CNS2025 Boston

March 29–April 1 | 2025

ABSTRACT BOOK

Cognitive Neuroscience Society

32nd Annual Meeting, March 28 - April 1, 2025
Sheraton Boston Hotel, Boston, MA, USA

2025 Annual Meeting Abstract Book

Contents

Cognitive Neuroscience Society
c/o Center for the Mind and Brain
267 Cousteau Place, Davis, CA 95616
www.cogneurosociety.org

Poster Session A

Saturday, March 29, 2025, 3:00 – 5:00 pm, Back Bay Ballroom/Republic Ballroom

A1 - The impact of realistic background noises on neurophysiological responses to speech, in a Virtual-Reality classroom

Orel Levy[1], Shirley Hackmon[1], Yair Zvilichovsky[1], Adi Korisky[1], Elana Zion-Golumbic[1]; [1]Bar-Ilan University

Speech comprehension in real-life situations can be challenging due to the presence of irrelevant sounds or background noise. Here, Using Virtual Reality (VR), we studied how different types of realistic sounds and background noises affect neural processing of speech and ongoing ocular and physiological responses in an ecologically relevant audiovisual setting: the classroom. We measured neural activity (EEG), eye-gaze patterns, and galvanic skin response (GSR) while participants listened to mini-lectures in a VR-classroom. We examined the impact of continuous versus intermittent construction noise (Exp.1) and occasional transient sounds like phone ringtones (Exp.2), comparing responses in adults with ADHD and controls. Our findings indicate that intermittent noise reduced neural speech tracking accuracy, increased physiological arousal, and lowered behavioral performance, while continuous noise did not affect these measures (Exp.1). Transient sounds (Exp.2) elicited neural ERPs and increased physiological arousal in both groups, with the ADHD group showing larger early N1 neural responses and reduced neural tracking of speech. Spontaneous eye-gaze patterns and neural alpha-power were unaffected by experimental conditions but explained some variance in ADHD symptoms. The novel VR experimental platform contributes to our understanding of how noise influences speech processing in realistic settings, showing that not all types of background noise disrupt equally and emphasizing the increased sensitivity to distraction in ADHD. While far from exhaustive, this work demonstrates the importance of studying speech-in-noise processing in increasingly real-life contexts, integrating neural, ocular, and physiological measures to create a more well-rounded description of listeners multifaceted response profile to speech in noisy environments.

Topic Area: ATTENTION: Auditory

A2 - Investigating the Ventral Attention Network, Vigilance, and Cognitive Fatigue Using EEG, Listening Effort, and tACS Neurostimulation Methods

Corrin Stines[1] (corrin.stines@utsa.edu), Edward Golob[1], Linda Calderon[1], Ricardo Castañeda[1], Jeffrey Mock[1], Juan Fernandez[1], Alyssa Randez[1]; [1]The University of Texas at San Antonio

Prior research has implicated a cortical network in the right hemisphere for maintaining attention on vigilance tasks, termed the ventral attention network (VAN). Vigilance tasks typically last 10s of minutes, induce a high mental workload, increase mental fatigue, and influence mood. Coordination between the two key areas of the VAN, the temporoparietal junction (TPJ) and inferior frontal gyrus (IFG), likely involves cortical oscillations, which can be non-invasively measured with EEG, but this had not been tested. Experiment 1 utilized EEG to identify oscillations between the TPJ and IFG, revealing theta-band activity (4–8 Hz) as the dominant frequency. Experiment 2 used transcranial AC stimulation (tACS) at the identified theta frequency to determine if performance can be enhanced during an auditory spatial attention task and found that reaction times significantly improved in the tACS group compared to the sham group, though accuracy did not differ. Building on these findings, Experiment 3 is currently testing whether stimulating the VAN with tACS at the theta frequency can also reduce mental workload and cognitive fatigue during a sustained auditory spatial attention task. This study is among the first to explore the relationship between tACS and cognitive fatigue, addressing a significant gap in the literature. Collectively, these findings suggest that theta oscillations play a critical role in VAN activity and may be causally related to attentional vigilance. Real-world applications include non-invasive interventions for mitigating fatigue-related impairments in high-stakes professions, such as healthcare and military operations, as well as therapeutic approaches for neurological and psychological disorders.

Topic Area: ATTENTION: Auditory

A3 - Dynamic Attenuation of Task-Irrelevant Auditory Processing During Numerical Tasks

Artturi Ylinen[1] (artturi.ylinen@helsinki.fi), Patrik Wikman[1], Jake McMullen[2], Erno Lehtinen[2,3], Minna Hannula-Sormunen[2], Kimmo Alho[1,4]; [1]University of Helsinki, Helsinki, Finland, [2]University of Turku, Turku, Finland, [3]Vytautas Magnus University, Kaunas, Lithuania, [4]Advanced Magnetic Imaging Centre, Aalto NeuroImaging, Aalto University, Espoo, Finland

In everyday life, cognitive tasks are often performed amid various auditory distractions, making the suppression of task-irrelevant auditory processing an important cognitive control mechanism. In this fMRI study, we investigated neural activations related to task-irrelevant meaningful speech, as participants (n=208, age range 12-14) performed three numerical tasks of varying difficulty: solving arithmetic equations, a more demanding task where equations are created to add up to a given target answer, and an easy control task requiring no calculation. The tasks were factorially combined with meaningful speech and noise-vocoded unintelligible speech as auditory distractors. The data were analyzed with 2×2 repeated-measures ANOVAs performed separately for each task pair. The analyses focused most importantly on interactions between task and auditory distractor type. Results were corrected using permutation inference (cluster-defining threshold p=10^-5, cluster-wise p<0.01, 10000 permutations). Our results replicate earlier findings showing that task-irrelevant speech processing in the auditory regions is attenuated as task demands increase. We also extend previous findings by showing that in bilateral prefrontal and parietal regions, the effects of auditory stimulus type differed by task: as task demands increased, activity during the meaningful speech distractor increased more than activity during the noise-vocoded distractor. This suggests that these control networks may participate in controlling task-irrelevant auditory processing during more demanding tasks. In all, our findings underscore the dynamic nature of the control of task-irrelevant auditory processing, as it is influenced by both task characteristics and the type of auditory stimulus. Further analyses will examine individual variability in these mechanisms.

Topic Area: ATTENTION: Auditory

A4 - Variations in alpha oscillations and speech evoked responses with different background sound types during performance on a speech-in-noise task

Heather L. Read[1] (heather.read@uconn.edu), Tylor J. Harlow[2], Laila Almotwaly[3]; [1]University of Connecticut

In healthy individuals, cyclic inhibition associated with alpha oscillations serves to suppress cortical processing of task-irrelevant and ignored sensory stimuli (Bonnefond et al., 2017; Foxe et al., 2011). Accordingly, electroencephalogram (EEG) recordings find an anticipatory increase in alpha levels with onset of ignored background sounds followed by a subsequent decrease in alpha with onset of attended foreground speech sounds (Dimitrijevic et al., 2017). Other studies find the speech evoked response potential (ERP) and temporal response function (TRF) amplitudes are predictive of speech-in-noise task performance (Kim et al., 2021; Muncke et al., 2022). Here, we quantify changes in alpha and evoked responses associated with performance of a speech-in-noise task that includes six variations in background sound type. As in prior studies, we find alpha power increases with onset of the to-be-ignored background sounds and decreases with onset of to-be-attended foreground speech. However, we find alpha power increase with background “white noise” is significantly higher than with background “speech babble” (permutation testing; p-value = 0.003). Topographic maps find alpha power levels and evoked potential amplitudes associated with onset of background sounds are maximal in central and temporal locations. In contrast, topographic maps find the more posterior temporal locations have maximal foreground speech-evoked responses. These findings support a mechanism where both alpha and evoked responses are potential biomarkers of performance on speech-in-noise tasks.

Topic Area: ATTENTION: Auditory

A5 - Cortical and Subcortical aging in the Attention System of Adults Engaged in Musical and Non-Musical Activities

Alexandre Sicard[1,2] (alexandre.sicard.1@ulaval.ca), Pascale Tremblay[1,2]; [1]Université Laval, Quebec City, Canada, [2]CERVO Brain Research Center, Quebec City, Canada

Attention and inhibition are interrelated cognitive abilities that decline with aging. Musical activities have been proposed as a potential means of mitigating cognitive decline through brain reorganization. According to the Scaffolding Theory of Aging and Cognition (STAC-r), positive life experiences, such as musical practice, can influence brain structure and expand functional networks to preserve cognitive performance. However, it remains unclear whether different types of musical activities, such as singing and playing instruments, have distinct effects on brain and cognition. The objective of this study was to investigate the aging of attention and inhibition in singers, instrumentalists and active non-musicians and its relationship with brain structure within attentional networks. We hypothesized that singers and instrumentalists would show reduced cognitive decline (attention and inhibition) and that these differences would be mediated by the structural properties of attentional networks. A total of 109 adults aged 20-88 were recruited: 34 singers, 38 instrumentalists, and 37 people engaged in non-musical activities. Participant completed attention and inhibition tasks, and T1-weighted MRI images were collected. Analyses examined associations between cortical thickness, subcortical volume, age, musical practice, and cognitive performance. Our results revealed that singers exhibited the least age-related decline in cortical thickness, employing with distinct mechanisms compared to instrumentalists for maintaining cognitive abilities. Both musical groups showed similar relationships between subcortical volume and inhibition. These findings highlight the unique and overlapping effects of different musical activities on brain plasticity and cognitive aging.

Topic Area: ATTENTION: Auditory

A6 - Attention or prediction? Characterizing the top-down influence of predictive context on speech encoding.

Alyssa Horng[1] (ahorng2@u.rochester.edu), Ilaria Benciolini[1], Aaron R Nidiffer[1,2], Edmund C Lalor[1,2,3]; [1]University of Rochester, [2]Del Monte Institute for Neuroscience, Rochester, New York, [3]Center for Visual Science, Rochester, New York

Theories of predictive perception posit that perception is the process of inferring the causes of our sensory input by combining that input with predictions derived from our learned and evolved model of the world. It has been suggested that such predictions play a key role in language processing. However, robust neurophysiological evidence of such processes remains elusive – particularly in the context of natural, continuous speech perception. Previous research has suggested that the auditory encoding of words in natural speech is influenced by how semantically related those words are to their preceding context. However, it is unclear whether this effect is driven by predictions per se rather than dynamic modulations of attention. The present study aims to adjudicate between these two alternatives by recording EEG from healthy, neurotypical adults (N=4, so far) as they listen to naturalistic audiobook stimuli. Crucially, specific words within the audiobook were modified to alter their surprisal, while preserving the level of constraint provided by their preceding context. This allows us to disambiguate between attention and prediction error (as indexed by surprisal) as the driving influence on the lower-level sensory encoding. Our preliminary results suggest that dynamic word-to-word fluctuations in top-down attention influence the sensory encoding of natural speech. While these findings do not rule out a parallel role for prediction in natural language comprehension, they do suggest a need to be careful in distinguishing between the influence of top-down attention and top-down prediction in the prelexical perception of speech.

Topic Area: ATTENTION: Auditory

A7 - Cueing vs. Distracting Effects of Attentional Orienting on Auditory Spatial Discrimination

Norbert Kopco[1] (nkopco@gmail.com), Yeganeh Modaresnia[1], Udbhav Singhal[1], Rene Sebena[1]; [1]P J Safarik University, Kosice, Slovakia

A previous study examining whether directing automatic attention affects listeners' performance in a fine-grained auditory spatial discrimination task found a predominantly distracting effect of invalid cues compared to the enhancing effect of the valid cues (Kopco and Sebena, 2020, Cognitive Neuroscience Society Poster D1). In that study, identical buzz sounds were used for both cues and targets. Here, a follow-up experiment investigated whether the distracting effect was mainly due to the cue-target similarity, or whether it was driven by interference caused by the large spatial shifts from the cue to the target. A setup similar to the previous study was used, except that 1) cue type varied (same as target or different), 2) cue/target stimuli could come from 3 locations in a left-right symmetrical spatial setup, and 3) blocks of trials kept the cue type either fixed or random. Ten participants performed a task that involved judging the direction of an auditory target's spatial shift following either a valid or invalid auditory cue, while maintaining the gaze fixation at a central location. The results revealed that: 1) participants performed better with valid vs. invalid cues; 2) responses were biased away from the gaze fixation point as well as away from the cue; 3) cue type and blocking had a small effect on performance. Overall, these results are consistent with interference of preceding stimulus location, rather than target-cue similarity, driving automatic attentional orienting in spatial auditory discrimination.[Work supported by EU Horizon Europe HORIZON-MSCA-2022-SE-01 grant N° 101129903 and APVV-23-0054]

Topic Area: ATTENTION: Auditory

A8 - Selective auditory attention in college students with ADHD: Development of an ERP study and preliminary data

Courtney Stevens[1] (cstevens@willamette.edu), Shane Barbour[1], Amanda Hampton Wray[2], Elif Isbell[3]; [1]Willamette University, [2]University of Pittsburgh, School of Health and Rehabilitation Sciences Communication Science & Disorders, [3]University of California, Merced

Event-related brain potentials (ERPs) indicate that early neural processing is modulated by selective attention. This effect is observed in neurotypical adults as well as neurotypical children as young as three years (Sanders et al., 2006). However, the magnitude of the effect of attention on early neural processing is reduced in some clinical populations (Stevens et al., 2006) and also correlates positively with nonverbal intelligence (Isbell et al., 2015). Limited prior research suggests reduced effects of selective auditory attention on early neural processing in children and adolescents with ADHD, however differences in nonverbal intelligence between the groups presents a confound (e.g., Gomes et al., 2012). The proposed study aims to address this confound by comparing the effects of selective attention on neural processing in adult college students, matched for nonverbal intelligence, both with and without an ADHD diagnosis. Using an established ERP dichotic listening task, participants will be cued to attend selectively to one of two simultaneously presented narratives differing in location (left/right speaker), narration voice (male/female), and content. Event-related potentials (ERPs) will be recorded to 100 msec probe stimuli embedded in the attended versus unattended story. Preliminary data from 10 college students with ADHD suggest reduced effects of selective auditory attention on neural processing relative to students without ADHD, even when matched for nonverbal intelligence. Data collection is ongoing and will assess whether this pattern holds, which will help clarify whether ADHD, independent of nonverbal intelligence, is associated with reduced effects of selective attention on early stages of neural processing.

Topic Area: ATTENTION: Auditory

A9 - Attention to hedonic stimuli in problematic alcohol consumption: a pilot study in a non-clinical population.

Lucia Alba-Ferrara[1] (lucia.alba@fultra.org), Juan Ignacio Segura, Guillermina Alvarez, Bautista Elizalde Acevedo, Ana Paula Colombini; [1]ENyS-CONICET, [2]Facultad de Ciencias Biomédicas, Universidad Austral

Objective: Identify the neural basis of inhibitory control in response to hedonic stimuli in problem drinkers, which may underlie mechanisms of problematic alcohol consumption. Methodology: 24 participants underwent an fMRI scan during a dichotic listening task. During the scanning session, two stimuli were presented simultaneously on each ear; one alcohol-related (I.e. uncorking a bottle) and one unrelated (I.e. hoovering). Participants were asked to focus their attention on one ear and respond whether the attended sound was alcohol related. We considered two trial types: Bottom-Up (alcohol related stimulus in the attended ear) and Top-Down (alcohol-related stimulus in the ignored ear). We measured alcohol consumption with the AUDIT scale. Results: All participants performed above chance level. Response times for Bottom-up trials were significantly shorter that Top-down trials. Bottom-up trials activated the Right Angular Gyrus, Right Precentral Gyrus, Left Middle Frontal Gyrus and Right Superior Parietal Gyrus; while Top-down trials activated the Left Postcentral Gyrus, Right Parahippocampal Gyrus, Right Cerebellum, Dorsolateral Prefrontal Cortex (DLPFC), Right Superior and Left Inferior Temporal Gyrus, and Right Precentral Gyrus. Discussion: Top-down trials possess higher cognitive demand, as they require

the subject to ignore the distracting hedonic stimulus. This explains the activation of the DLPFC. The absence of this activation in Bottom-up trials suggests a decrease in cognitive demand and control, provoked by the involuntary capture of attention by the hedonic stimulus. The DLPFC may underlie a necessary control mechanism that inhibits behaviour directed to alcohol search.

Topic Area: ATTENTION: Auditory

A10 - Attention modulates sound-generated negative emotions and their neural correlates: insights from misophonia

Marie-Anick Savard[1], Mickael Deroche[1], Emily Coffey[1]; [1]Concordia University

Misophonia is a condition characterized by strong negative emotional responses to specific trigger sounds. Although prior research has identified the involvement of higher-level cognitive processes in misophonia, their role in modulating these responses remains insufficiently explored. Reports from individuals with misophonia indicate that coping strategies, such as listening to music or focusing on alternative activities, may mitigate distress by engaging attentional networks and executive functions. These observations suggest that attentional mechanisms play a crucial role in managing misophonic reactions, offering a promising avenue for further investigation into the condition's neural underpinnings. The current study used functional magnetic resonance imaging (fMRI) to investigate brain activity during an auditory selective attention task in individuals with and without misophonia. Participants with (N=50) and without (N=50) misophonia listened to two simultaneous auditory streams presented through ear inserts: one comprising trigger or neutral sounds, and the other unfamiliar instrumental musical excerpts. Participants were instructed to selectively attend to one stream (sound or music) during each trial. Comparisons between the groups reveal differential patterns of brain activity associated with selective attention to neutral and misophonic trigger sounds. Furthermore, our results demonstrate that attentional control - a higher-level cognitive process that can be improved with training - can reduce hyperactivation of limbic networks in people suffering from misophonia. This work could inform interventions aimed at reducing misophonic distress, ultimately improving quality of life for those affected.

Topic Area: ATTENTION: Auditory

A11 - Attentional Dynamics Drive Narrative Lingering Under Effortful Listening Conditions

Ryan Panela[1,2] (ryan.panela@utoronto.ca), Alexander Barnett[2,3], Björn Herrmann[1,2]; [1]Rotman Research Institute, Baycrest Academy for Research and Education, [2]Department of Psychology, University of Toronto, [3]Department of Neurology and Neurosurgery, Montreal Neurological Institute and Hospital, McGill University

Investigations into speech-comprehension difficulties often focus on intelligibility of short, disconnected sentences, limiting generalization to real-life listening. Novel approaches to understanding naturalistic speech listening are critical for insight into impaired speech processing. Research has demonstrated that experiences linger in our minds, spontaneously returning to thought after their conclusion. This phenomenon, driven by attention, is more likely to persist when situational meaning is extracted rather than low-level semantics; however, this has not yet been investigated in the auditory domain under challenging listening conditions. In the current study, participants (N=40, 18-38 years) listened to three 5-minute stories overlaid with twelve-talker babble in three conditions, ranging from easy to difficult speech intelligibility: clear, +4dB SNR, and -2dB SNR. Before and after each story, participants completed a free association task, freely typing words for three minutes. Semantic similarity analyses quantified how narrative themes and direct words appeared in participants' associations. Results showed decreased intelligibility with more challenging listening conditions. Narrative lingering occurred across all conditions, with greater semantic similarity for direct narrative words than themes. Challenging listening conditions resulted in a decrease in lingering of direct narrative words, but theme words presented similarly across all SNRs. The results suggest that theme words, which encapsulate narrative meaning, are less dependent on precise language and may be retrieved through generalized representation, making them more robust to noise-related disruptions. These results reveal a link between background noise and auditory memory as cognitive load and reduced intelligibility may disrupt narrative lingering, accelerating decay in representations of speech content.

Topic Area: ATTENTION: Auditory

A12 - Beyond masking release: Differences in voice pitch and spatial location freeing up cognitive resources

Rebekah Adams[1] (rebekah.adams@mail.mcgill.ca), Mickael Deroche[1]; [1]Concordia University

The ability of the human brain to extract a voice from a background of competing speakers is a complex process that we struggle to understand. However, people use distinctions in voice pitch (harmonic cues) and spatial location (binaural cues) between two speakers to separate them perceptually. While the mechanisms behind this perceptual separation are unclear, it effectively makes the background quieter, resulting in better speech recognition. We know that quieter backgrounds are generally favourable to attentional and memory systems because they free up cognitive resources previously spent decoding speech. Therefore, we hypothesize that harmonic and binaural cues have benefits beyond their known contribution to auditory masking release to higher-level cognitive processes, namely short-term memory. To test this, fifty 10-word lists were presented to normally hearing adult participants in their first language in the presence of a non-linguistic masker. Experiment 1 examines the use of a pitch cue where words either share the same fundamental frequency (F0) or have different F0 by 3-semitones from the masking tone. Experiment 2 examines the use of a spatial cue where words come from either the same location or differ by 120 degrees from the location of the masking noise. The target and masker are presented at 5 different target-to-masker ratios (TMRs) to capture the whole psychometric function. Preliminary data suggests that the benefits of harmonic and binaural cues transfer to the recall task only to a small degree, which cannot simply be explained by the increases in intelligibility.

Topic Area: ATTENTION: Auditory

A13 - Representing rhythm in the Parkinson's brain: Evidence from EEG

Hannah Guglin[1], Emma Cozzi[1], Josh Keough[1], David DiStefano[1], Elizabeth Race[1]; [1]Tufts University

Accurate temporal processing plays a critical role in both cognition and action. Yet, how the brain codes time and uses temporal signals to guide adaptive behavior remains an open question. The basal ganglia has been proposed to play a key role in the coding of rhythmic temporal information, particularly when internal generation of the beat is required (Grahn, 2009; Nozaradan et al., 2017). Yet, patients with Parkinson's Disease (PD) with basal ganglia dysfunction can still leverage external rhythmic cues to benefit motor action, as demonstrated in rhythmic auditory stimulation therapies (Koshimori & Thaut, 2023). The current study tested the hypothesis that the processing of external rhythms does not critically depend on the basal ganglia and can be supported by the alignment of cortical activity to the temporal structure of the beat (neural tracking of rhythm). Electroencephalography was recorded while patients with Parkinson's Disease and healthy controls listened to three rhythmic sequences with a steady 1.25Hz beat: an unsyncopated rhythm, a syncopated rhythm, and a more complex instrumental music clip. Both patients and controls demonstrated significant neural tracking, evident in increased power at the beat frequency (1.25Hz), and the magnitude of neural tracking did not differ across groups. Interestingly, this cortical tracking response did not differ within or across groups according to the complexity of the auditory stimulus or the degree to which the rhythm required more internal generation of the beat. These results suggest that cortical tracking of rhythm does not critically depend on the basal ganglia.

Topic Area: ATTENTION: Auditory

A14 - Neural evidence supports the attention-invariant effects of phonetic categorical boundary adaptation

Evan Hare[1,2] (evan.hare@duke.edu), Mary Kate Merenich[1], Jamie Kurzer[1], Tobias Overath[1,2,3]; [1]Department of Psychology and Neuroscience, Duke University, [2]Center for Cognitive Neuroscience, Duke University, [3]Duke Institute for Brain Sciences, Duke University

The auditory system addresses the problem of invariance by implementing approximate categorical boundaries around spectrotemporal features, such as the average ratio of prominent frequency bands within vowels. These boundaries can also quickly adapt to new information when contextually labeled as part of an existing category. However, the role of attention in this process remains unclear. While previous research indicates that basic features at the phonemic level can be processed pre-attentively, it is uncertain whether shifting categorical boundaries in response to contextual information requires focused attention on the speech signal. We conducted an experiment with three groups of Native English speakers. Participants performed a phoneme identification task both before and after a 1-back audio-visual attention task in which they either attended to an auditory stream of words containing ambiguous phonemes meant to induce a lexically cued category shift (Attend Auditory Ambiguous (AAA)), or to a concurrent visual stream of grid-like patterns (Attend Visual Ambiguous (AVA)). A control group attended to a different auditory stream of words containing unambiguous vowels to prevent category shifts (Attend Auditory Prototypical (AAP)). While no differences were found between the AAA and AVA groups at the second identification task, they showed robust response differences when compared against the AAP group. Further, early ERP responses to previously ambiguous phonemes showed no difference between the AAA and AVA groups, but their responses were significantly different from the unshifting AAP group. These findings suggest that pre-attentive perception of phonemic information influences phonetic categorical boundaries in response to changing speech properties.

Topic Area: ATTENTION: Auditory

A16 - Sleep's impact on music processing in the developing brain

Rigel Baron[1] (rigel.baron22@stjohns.edu), Yan Yu[1]; [1]St. John's University

Sleep is a critical function of the human body, playing a significant role in the developing brain. Despite what is known about the value of sleep, there is currently a lack of understanding regarding the relationship between sleepiness and music processing in the developing brain. The purpose of the present study is to examine the potential link between subjective measures of sleepiness and objective measures of cortical function in children. As a refined measure of brain function, the present study utilized a six feature passive listening music oddball paradigm with deviant stimuli altering intensity, location, pitch, rhythm, slide, and timbre. Children aged five to 10 were presented with the paradigm, then asked to rate their level of wakefulness on a scale of one (fully alert) to five (exhausted) using a pictorial sleepiness scale. Children's responses varied between one, two, and three, with no children answering four or five. Children were partitioned into three groups based on their responses, with group one being the most wakeful and group three being the least wakeful. Preliminary results suggest the least wakeful group (group three) had more positive event-related potential (ERP) responses across hemispheres in all six conditions, possibly indicating a lack of focus or attention on the stimuli. Groups one and two displayed more negative ERP amplitudes than group three. Group one presented intermediate ERP amplitudes under intensity and pitch change conditions. Overall, preliminary data suggests there is a relationship between subjective sleepiness and ERP responses to music changes in children.

Topic Area: ATTENTION: Auditory

A17 - Development of neural mechanisms underlying joint attention during infancy using live-interaction electroencephalography (EEG).

Ana Badal[1] (anabadal@yorku.ca), Lara Pierce[1]; [1]York University

Understanding how socioeconomic disparities affect infants is crucial for optimizing long-term development. While prior research has explored the effects of low socioeconomic status (SES) and caregiver stress on developmental outcomes, less is known about how SES influences neural processes critical for social cognition and language through the infant's interactions with their caregivers. Joint attention (JA), the shared focus between caregiver and infant, plays a key role in these neural pathways and serves as a valuable measure of interaction quality. This study examines whether JA engagement mediates the relationship between socioeconomic stress (SE-Stress) and infant neural activity during JA, and whether JA can buffer the negative effects of SE-Stress on neurodevelopment. Data from an ongoing longitudinal study of 6- to 12-month-old infants will be analyzed. Electroencephalography (EEG) will be recorded at baseline and during a novel live JA task, where caregivers and infants share attention over a picture book. Relative frontal alpha and theta power will be extracted. JA behaviors will be coded during a 10-minute free-play session. SE-Stress will be assessed via parent-report scales. Path analyses will test whether SE-Stress predicts changes in EEG power during JA, with JA engagement as a potential mediator. Associations between high SE-Stress and less and lower-quality JA, leading to altered neural activity in infants are predicted. However, higher-quality JA may buffer the impact of SE-Stress, preserving typical neural patterns. This study aims to clarify how early SE-stress affects early neural development to inform policies which aim to support families from underserved communities.

Topic Area: ATTENTION: Development & aging

A18 - Changes in Alpha Spectral Events with Age and Prenatal Exposure to Alcohol

Donovan Roberts[1] (droberts@mrn.org), Falicha Candelaria-Cook[2], Debora Mun[3], Orin Myers[4], Megan Schendel[5], Maryam Alsameen[6], Pilar Sanjuan[7], Cassandra Cerros[8], Dina Hill[9], Julia Stephen[10]; [1]The Mind Research Network

This poster covers how age and prenatal alcohol exposure affect alpha spectral events. Prior studies on alpha oscillations focused on mean power, which inherently neglects the transient, rhythmic nature of oscillatory activity. Our study characterized alpha events using four constituent variables: amplitude of event, frequency span of the event, duration of the event, and number of events. We measured resting-state magnetoencephalography in 135 participants aged 4 to 12 years. The resting-state data from the 82 typically developing controls and 53 children exposed to alcohol prenatally were analyzed to find which of the four variables of alpha events was correlated most strongly with mean power between groups and how these parameters might change with age and by group. Investigating at age effects, discovered that both groups have a decrease in mean event duration as they age, and increased correlation between mean power and mean event frequency span with increasing age, but the exposed group had a negative correlation between mean event duration and increasing age. When examining group differences, we found a positive correlation between mean event duration and mean alpha power in the control group and a negative correlation between mean event frequency span and mean alpha power in the exposed group. These results reveal a complex interplay between the constituent variables associated with alpha events and mean alpha power that change with age and prenatal exposure to alcohol. Examining alpha spectral events is critical to understanding the underlying mechanisms related to neural oscillations in typical and atypical child development.

Topic Area: ATTENTION: Development & aging

A19 - Understanding ADHD through naturalistic fMRI data: symptoms & whole-brain connectivity

Ash Chinta[1] (ash.chinta.24@dartmouth.edu), Jean Ye[2], Matthew Rosenblatt[2], Link Tejavibulya[2], Dustin Scheinost[3]; [1]Dartmouth College, [2]Yale University, [3]Yale School of Medicine

Existing attempts to develop classifier models for Attention-Deficit/Hyperactivity Disorder (ADHD) based on neural data have largely been unsuccessful, with the most effective models often relying on non-neural information. This study explored the potential of integrating naturalistic data to reduce neural heterogeneity within ADHD populations. Using fMRI and behavioral assessment data from the Healthy Brain Network, ADHD was identified through clinician diagnoses and behavioral cutoff scores. Attention values were calculated based on a previously defined sustained attention network, and overlap between between-group network differences and the sustained attention network was evaluated using hypergeometric distribution. A classifier model was constructed using connectivity data to distinguish ADHD from controls. Results showed that between-group differences in sustained attention values were larger when ADHD was defined by behavioral scores ($t(665) = 0.878$, $p = 0.380$) compared to clinician diagnoses ($t(655) = 0.447$, $p = 0.655$), with no significant correlation between ADHD assessments and attention values. Classifier accuracy was slightly higher when ADHD was defined by behavioral scores (60%) versus clinician diagnoses (55%). Furthermore, the networks identified from the task data did not significantly overlap with the sustained attention network ($p = 0.859$ for ADHD > control; $p = 0.449$ for ADHD < control). These findings suggest that differences in network connectivity associated with ADHD may not be explained by sustained attention capabilities. These results underscore the necessity for a reevaluation of diagnostic and support strategies for ADHD and other heterogeneous disorders.

Topic Area: ATTENTION: Development & aging

A20 - Investigating the Development of Attention Networks in Preterm Infants at Preschool Age

Florian Ph.S Fischmeister[1] (florian.fischmeister@meduniwien.ac.at), Nadine Pointner[1], Sophie Weinmüller[2], Galatee Reme[1], Alfredo Spagna[1], Vito Giordano[1], Karin Pichler[1], Gregor Kasprian[1], Kathrin Kollndorfer; [1]Medical University of Vienna, Vienna, Austria, [2]Columbia University, New York, NY

Attention is an essential neuropsychological component crucial for effective cognitive functioning. According to Posner and Petersen (1990), attention comprises three distinct instances: the alerting network, which represents changes in the internal state; the orienting network, which is involved in selecting information; and the executive control network, which monitors conflicting information. These networks develop during infancy and are related to individual self-regulation differences. Here, we present data that evaluates these networks at a neuronal and behavioral level for both term-born and very preterm-born children at preschool age. Preschoolers (19 term/ 10 preterm, mean age 5.7y) underwent a comprehensive assessment that included clinical, behavioral, and socio-demographic evaluations. Functional images were acquired for a resting condition and a child-friendly version of the Attentional Network Test for Interaction. Task- and rest-based data were preprocessed using age-specific templates and then modeled using fixed-effect modeling. At a behavioral level, preterm and term-born performed equally, with only marginal differences. fMRI results indicate that all three attention networks are consistently found across both groups. Contrary to the behavioral data, a marked difference in specific networks within preterm-born children was observed. While the executive control network revealed increased activation in prefrontal regions, indicating a higher demand for cognitive resources in preterm, the alerting network showed the opposite pattern. This study is one of the first to show that aspects of attention are independent and linked to separate brain regions in preschoolers. Variations observed may indicate differences in processing style and/or developmental levels within subcomponents of the attention network.

Topic Area: ATTENTION: Development & aging

A21 - Developmental changes in neural dynamics serving fluid reasoning.

Sarah Hunter[1] (sarah.hunter@boystown.org), Haley Pulliam[2], Monica Clarke-Smith[3], OgheneTejiri Smith[4], Brittany Taylor[5]; [1]Institute for Human Neuroscience, [2]Boys Town National Research Hospital

Fluid intelligence (Gf) is the ability to problem solve when faced with unfamiliar circumstances or concepts. Gf and its underlying neural substrates rapidly mature during childhood and adolescence, though the maturation of the neural dynamics underpinning Gf have seldom been studied. Therefore, the present study investigated the development of these oscillatory dynamics in 104 youth ages 8-to-15 years old ($M = 12.34$ years $\pm$ 2.23; 53 males) who completed an abstract reasoning task during magnetoencephalography. Time-frequency spectrograms indicated significant theta (4-8 Hz, 0-250ms), alpha/beta (10-16 Hz, 450-1000ms), and gamma (80-96 Hz, 100-475ms) activity during the task. Significant windows underwent source reconstruction with a beamformer yielding whole-brain maps of oscillatory activity. These maps were subject to whole-brain regressions to determine the interactive effects of sex and age on neural dynamics serving abstract reasoning. We detected multispectral age- and sex-specific effects across the cortex. Youth exhibited stronger oscillatory responses as a function of age in the bilateral superior parietal lobules (alpha/beta, gamma), right dorsolateral prefrontal cortex (gamma), superior insula (alpha/beta), and lingual gyrus (theta), and weaker oscillatory responses in the left superior temporal gyrus (alpha/beta), ($\beta s= -.39 - .55$). We also detected sexually-dimorphic patterns of development in the left inferior frontal gyrus ($\beta= -.49$), such that females exhibited a weaker theta response with increasing age, whereas males showed stronger theta activity across development. These data suggest that there is robust maturation of the neural dynamics serving Gf well into adolescence, with key differences in development between biologically male and female youth.

Topic Area: ATTENTION: Development & aging

A22 - Differential Effects of tDCS on Working and Long-term Memory During Visual Search

Poopa Kaewbuapan[1,2] (poopa1111@gmail.com), Duanghathai Wiwatratana[2], Sirawaj Itthipuripat[2]; [1]School of Information Technology, King Mongkut's University of Technology Thonburi, Bangkok, Thailand, [2]Neuroscience Center for Research and Innovation, Learning Institute, King Mongkut's University of Technology Thonburi, Bangkok, Thailand

Visual search efficiency improves with repetition as target templates shift from working to long-term memory. The anodal transcranial direct current stimulation (tDCS) over the right posterior parietal cortex was reported to enhance working memory. However, the tDCS-stimulating effect of different cortical sites on the interaction between memory systems and attention during visual search remains unexplored. This study examines how tDCS influences the interaction between working memory, long-term memory, and attention during visual search. Nineteen participants (aged 18–35) completed a visual search task requiring memory of colored cues (red or green) and Landolt-C shapes, repeated across trials. Participants received

20 minutes of 2.0 mA anodal tDCS over the left or right posterior parietal cortex (PPC), right dorsolateral prefrontal cortex (DLPFC), or sham stimulation, with sessions separated by at least 48 hours. Behavioral results showed no significant difference in hit rates between real and sham stimulation, though left PPC stimulation modestly reduced reaction times. EEG data revealed that the right DLPFC stimulation enhanced contralateral delay activity in early trial repetitions, supporting improved visual working memory capacity. Both right DLPFC and left PPC amplified the N2pc component in mid-sequence trials, indicating enhanced attention guided by memory templates. Uniquely, the right PPC stimulation increased late positive complex activity during early and mid-repetition phases, suggesting facilitation of working-to-long-term memory transfer and highlighting functional lateralization within PPC. These findings underscore anatomically specific roles of PPC and DLPFC in modulating memory and attention processes during visual search.

Topic Area: ATTENTION: Development & aging

A23 - Are Children 'Stickier' Than We Think? How Novelty Shapes Developmental Differences in Visual Attention

Aarthi Ravi[1] (aarthi.ravi@mail.utoronto.ca), Josie Davies[1], Shelby Suhan[1], Amy Finn[1]; [1]University of Toronto

Children explore the world differently than adults, using broad attentional strategies that narrow with age. However, conflicting findings suggest children may not be as exploratory as assumed. While eye-tracking research shows younger children exhibit less exploration during scene viewing, these results may be influenced by task demands or the novelty of stimuli. Novelty, which increases exploratory eye movements in adults, has yet to be examined in children. This study investigates eye movements in 4–to 6-year-olds and adults viewing novel and familiar scenes. By analyzing fixation duration, fixation count, saccade count, and saccade amplitude, we aim to clarify developmental differences in visual exploration and whether novelty enhances or reduces exploration across development. Following the viewing task, participants completed a surprise memory test to assess recognition performance. Preliminary results suggest that children are 'stickier' than adults, with fewer saccades, fewer fixations, and longer fixation durations. Unexpectedly, children exhibited larger saccade amplitudes compared to adults, contradicting previous findings. This may indicate that while children's attention is more anchored when they do shift their gaze, they cover greater distances across a scene. Repetition effects were less pronounced than predicted. In terms of memory, children were less sensitive in detecting old from new images and were less able to discriminate lures than adults. Both groups showed better memory for repeated scenes compared to those viewed once. The next steps include collecting more data to confirm these findings and including 8– to 10-year-olds to explore developmental trends in scene exploration.

Topic Area: ATTENTION: Development & aging

A24 - Building multimodal classification of attentional states in the laboratory

John Thorp[1] (john.n.thorp@gmail.com), Joshua Friedman[1], Hengbo Tong[1,2], Helin Wang[2], Ruoxuan Li[1], Lily Penn[1], Emile Al-Billeh[1], Alfredo Spagna[1], Xiaofu He[1,2]; [1]Columbia University, [2]New York State Psychiatric Institute

As our student body and general populace becomes ever more quantified and evaluated, it is increasingly relevant to better understand what information on attentional states can be validly gleaned from observational data. We were therefore interested in the degree to which observational data collected from three separate modalities (brain activity collected via mobile EEG headsets, facial action amplitudes, and posture) during video lectures could be used to classify attentional states that predict subsequent learning of material. Here, we define subsequent learning as meeting three conditions: 1) a correct response on a multiple choice basic definition question, 2) a correct response on a multiple choice generalized application question, and 3) reporting not knowing these answers before the lecture. For each of the three modalities, we trained unimodal classifiers to predict the probability that participants were attending. Of these, facial action amplitudes provided the most reliable classification of attentional states. Analyses are currently focused on fusing each of these data streams into one multimodal classifier that can outperform unimodal approaches and better contextualize which features are necessary for insight into attention states. In the future, these models can be implemented in a neurofeedback framework intended to improve volitional attention regulation in the classroom.

Topic Area: ATTENTION: Multisensory

A25 - Attentional inhibition by alpha power is modulated by faster theta rhythm and audio-visual congruency during natural speech perception

Hyojin Park[1] (h.park@bham.ac.uk), Gabriel Byczynski[2]; [1]University of Birmingham, [2]Trinity College Dublin

Audio-visual speech processing is a fundamental aspect of human communication; however, the neural oscillatory mechanisms, particularly those involving alpha rhythms, that underlie attention in tasks requiring attention and suppression remain unclear. To investigate this, we employed a complex audio-visual paradigm designed to explore how alpha rhythms, along with slower frequencies, monitor and integrate audio-visual information under congruent and incongruent conditions. Participants were presented with a TED Talk video while listening to auditory stimuli under three conditions: (1) congruent audio delivered to both ears, (2) congruent audio in one ear and incongruent audio in the other, with attention directed toward the congruent audio, and (3) congruent audio in one ear and incongruent audio in the other, with attention directed toward the incongruent audio. To examine lateralized attention effects, participants were divided into left-attending and right-attending groups across individuals. By analyzing fluctuations in alpha power with regards to audio-visual congruency and the side of attention, we observed a notable finding: First, alpha power fluctuations, falling within the faster theta range. Second, this emerged exclusively in the left-attending group. This result indicates a lateralized relationship between low-frequency rhythms and alpha-band activity, highlighting the role of alpha rhythms as a mediator of attention in audio-visual speech processing. Also, these findings underscore the importance of lateralized neural dynamics in tasks involving selective attention and suppression, providing new insights into the oscillatory mechanisms underlying audio-visual integration in human communication.

Topic Area: ATTENTION: Multisensory

A26 - Selective attention directed to audiovisual and audio-only continuous speech

Yimeng Wang[1] (yimengw@umass.edu), Alexandra Jesse[1], Lisa D. Sanders[1]; [1]University of Massachusetts Amherst

Both selective attention and seeing the speaker's face improve speech processing. However, the effects of attention and visual speech on event-related potentials (ERPs) appear to be in opposition; directing attention to speech elicits larger auditory ERPs (additional neural resources for attended stimuli), whereas visual speech results in smaller auditory ERPs (fewer resources needed for partially redundant information). This apparent contradiction may be explained by differences in listening conditions (e.g., syllables/sentences, presence/absence of competing talker). In the current study, we employed EEG and ERP analyses to directly compare the effects of attention, visual speech, and competing speech while participants listened to stories for comprehension. Specifically, a female talker was presented as audiovisual or audio-only, with or without a concurrent audio-only male talker, when listeners were instructed to attend to the female talker or the male talker. Cross-correlations between EEG and speech amplitude envelopes indicate a stronger correspondence with attended speech, as well as with audiovisual speech. Similarities in the effects of selective attention and visual speech on the patterns of cross-correlation values across speech-to-EEG lags suggest the mechanisms by which visual speech affects processing of continuous auditory speech in multi-talker environments overlap with those of attention; seeing a talker facilitates attending and hinders ignoring their speech. Further, ERPs elicited by the naturally occurring acoustic onsets in speech provided the opportunity to compare the cross-correlation results with typical ERP effects. Each approach provides additional information about the relative contributions and interactions of selective attention and visual speech under realistic listening conditions.

Topic Area: ATTENTION: Multisensory

A27 - Examining the iEEG correlates of internal vs. external attentional states during movie-watching from eye movements

Christine Chesebrough[1] (christinechesebrough@gmail.com), Maximilian Nentwich[1], Ashesh Mehta[1,2], Stephan Bickel[1,2]; [1]Feinstein Institutes for Medical Research, [2]Zucker School of Medicine at Hofstra University

Whereas much previous research on mind wandering requires subjects to self-report their attentional state, here we explored whether simple eye movement measures could reveal signatures of distinct attention states in the brain, without self-reports. We examined intracranial EEG recordings and eye-tracking data from N = 11 subjects as they watched two types of movies (narrative and ambient). Eye behaviors including gaze position, saccade rate, and angle of eye vergence were used to detect periods during movie watching when their attention was likely engaged or disengaged from the movie. Using these states, we compared neural activity during periods of relative internal compared to external attention, which revealed patterns characteristic of mind-wandering. Results differed depending on movie type. Comparison of internal - external attention states during narrative movies were associated with significantly higher alpha power in the DMN, DAN, limbic, and visual networks, and lower HFA in DAN and visual networks, suggesting attenuation of external sensory inputs. By contrast, internal-external attention states during the ambient movie revealed significantly higher alpha power and lower HFA in VAN, DAN, and visual networks, but significantly lower alpha power and higher HFA power in the DMN, suggesting a cognitive state characterized by dampened visual processing coupled with active ongoing thought. These findings suggest that eye movements alone may reveal meaningful differences in neurophysiological states related to attention, and that the nature of lapses in external attention captured by eye movements differ depending on task demands.

Topic Area: ATTENTION: Multisensory

A28 - The effect of attentional locus on multisensory congruence in aging: neurophysiological evidence

Edwin Roberto Ramírez Benítez[1,2] (10081996edwin@gmail.com), Rodolfo Solís-Vivanco[1,2]; [1]National Institute of Neurology and Neurosurgery "Manuel Velasco Suárez", Mexico, [2]Faculty of Psychology, National Autonomous University of Mexico, UNAM

The congruence effect represents a remarkable index of audiovisual integration, which can be enhanced during healthy aging. However, the impact of attending to only one sensory modality (locus of attention) on this process in older adults remains unclear. This study aimed to compare the temporal and topographic changes in event-related potentials (ERPs) associated with the congruence effect evoked by synchronous targets and distractors during a crossmodal attention task in cognitively preserved young and older adults. The congruence effect (ERPce) was derived by subtracting the ERPs of incongruent conditions from the ones of congruent conditions for each sensory modality. Non-parametric permutation analyses were conducted for each modality in occipito-parietal and fronto-central channels including -0.2 to 1.1 seconds relative to the presentation of stimuli and distractors. Behaviorally, older adults exhibited a stronger congruence effect during auditory attention, whereas younger participants demonstrated a greater effect during visual attention. During visual attention, the ERPce revealed increased P50ec amplitudes over occipito-parietal regions in the older adults. In contrast, during auditory attention, older adults exhibited heightened P2ce and P7ec amplitudes with a fronto-central distribution, which were associated with stronger behavioral congruence effects. These findings suggest that focusing on a specific sensory modality modulates audiovisual integration differentially across age groups, with aging promoting reduced visual inhibition and delayed audiovisual integration in high-level association regions during auditory attention. Our results provide a foundation for further exploring the role of aging on multisensory integration and attentional performance

Topic Area: ATTENTION: Multisensory

A29 - Exploring the role of selective attention in decision rule representation

Liam P. McMahon[1], Jared Newell[1], Lauren Wolters[1], James D. Howard[1]; [1]Brandeis University

Adaptive behavior requires the ability to selectively attend to relevant information in complex environments and use this information to guide optimal decisions. Animal studies suggest that the mediodorsal thalamus (MDT) is a critical region for facilitating attention-guided rule representation in prefrontal cortex. Human neuroimaging studies point to a role for connectivity between MDT and both olfactory sensory cortex and prefrontal cortex in selective attention to odor stimuli. However, the relationship between attention-modulated MDT connectivity and neural representation of task rules in prefrontal cortex has not been established in humans. Here we aim to shed light on this process using an attention-guided two-alternative forced choice task. On each trial, participants are first cued to attend to either olfactory or auditory information, and then are simultaneously delivered one of two distinct odors and one of two distinct tones. The identity of the attended stimulus determines which of two subsequently presented choice options leads to a monetary reward. Behavioral results indicate that participants are able to make correct choices throughout the task and selectively attend to the cued stimulus. We aim to explore the mechanisms underlying this process by having participants perform this task while undergoing high-field fMRI scanning. We plan to implement a combination of multivariate pattern analysis techniques and functional connectivity analyses to test the hypothesis that coupling between MDT and prefrontal cortex facilitates representation of decision rules in distributed patterns of prefrontal cortex activity. Findings from this study may reveal a novel role for MDT in selective attention in humans.

Topic Area: ATTENTION: Multisensory

A30 - Investigating the mechanisms of multisensory divided attention in humans

Samara Glazer[1] (samara.glazer10@gmail.com), Jared Newell[1], Lauren Wolters[1], James Howard[1]; [1]Brandeis University

In complex natural environments, the ability to simultaneously attend to multiple sensory modalities and distinguish relevant information from irrelevant is essential for adaptive behavior. For example, making a decision about what to eat in a crowded street market may require attending to the sights, sounds, and smells of potential options. Divided attention tasks are an effective experimental model of multisensory processing. However, these tasks tend to utilize two modalities, and are almost exclusively limited to auditory and visual domains. The olfactory modality has received less focus in previous research despite being a significant part of daily sensory experience. Here we designed a study in which participants (n = 50) experienced simultaneous presentation of odors, visual images, and sounds in a multisensory divided attention task. On each trial, prior to stimulus presentation participants were cued to attend to one, two, or all three modalities, and then after stimulation probed on the specific identity of one of the attended modalities. We hypothesized that response time would increase and identification accuracy would decrease with an increasing number of attended sensory modalities in this task. Interestingly, we found that performance was significantly above chance in all attention conditions, with significantly decreased accuracy in any condition with olfactory attention. Additionally, the number of modalities attended did not have an impact on performance. These results indicate that humans have the capacity to simultaneously attend to auditory, visual, and olfactory information in multisensory conditions, with decreased accuracy for olfactory stimuli.

Topic Area: ATTENTION: Multisensory

A31 - The Path of Attention: Automaticity and Effort, Concept and Percept in Multimodal Visual Search Tasks

Alessandra Sardina[1]; [1]Edgewood College

Numerous studies have shown that cues from multiple sensory modalities can facilitate attention. The purpose of this study is to explore the dynamics of visual attention during a multimodal visual search task that differs based on the type of association (automatic or effortful) and type of object-location pairing (conceptual or perceptual). In the automatic association condition, the target audiovisual objects were paired to location based on conceptual features, for example, the sound and image of a bird at the top of the screen, or perceptual features, for example, a circle and an upward swoop sound on the top of the screen. For the effortful association condition, the object-location pairs were trained. This is a 2 x 2 within-groups design in which we used eye tracking to measure visual path and reaction time to find the target audiovisual object among other visual objects. Automatic associations resulted in a longer reaction time and a longer average visual path (mean = 2.2 fixations) than the effortful associations (mean = 1.85 fixations) (F =

212.34, p<0.001). Conceptual pairs resulted in longer reaction time and a longer average visual path (mean = 2.74 fixations) than perceptual pairs (mean = 1.3 fixations) (F = 49.64, p< 0.01), especially during the effortful association condition (F = 9.64, p < 0.001). Overall, these findings contribute to the understanding of how different kinds of multi-modal information can shape attention and highlight the idea that effortful training can be an effective strategy to modify attention.

Topic Area: ATTENTION: Multisensory

A32 - Multisensory integration and awareness in hemispatial neglect

Kun Dong[1] (kun.dong@donders.ru.nl), Arianna Zuanazzi[2,3], Valentina Varalta[4,5], Giorgia Rotundo[4], Cristina Fonte[4], Nicola Smania[4,5], Uta Noppeney[1,2]; [1]Donders Institute, [2]University of Birmingham, [3]New York University, [4]University of Verona, [5]Neurorehabilitation Unit, AOUI Verona

Hemispatial neglect which is characterized by impaired awareness for signals in the contralesional hemifield often arises after right hemispheric stroke. Although hemispatial neglect has primarily been studied in the visual domain, it is inherently a multisensory phenomenon. This study explores the complex interplay between visual and auditory processing in patients with hemispatial neglect. Twenty patients with right sided lesions and contralesional neglect (N = 20; 14 males, mean age 63.75, ranging from 33 to 83 years) and 16 control subjects (N = 16; 6 males, mean age 70.81 years, ranging from 62 to 83 years) participated in this audiovisual ventriloquist paradigm. On each trial, a flash appeared in the left or right hemifield or was absent. In synchrony with the flash, a white noise was played from the left, middle, or right side. Participants answered three questions: 1) “Where was the sound: left, middle or right?”; 2) “Did you see a flash?”; and 3) “Where was the flash; up or down?”. Results showed that auditory stimuli significantly improved visual detection, with perceptual gains correlating with neglect severity measured via the Catherine Bergego Scale scores. Visual stimuli also influenced where observers perceived the sound, but this effect did not correlate with neglect severity. These findings unravel the intricate interplay between multisensory integration and awareness of hemispatial neglect and suggest that multisensory integration may reduce attentional deficits in neglect.

Topic Area: ATTENTION: Multisensory

A33 - Perceptual Load Effects in Rejection Sensitivity Across Facial and Non-Facial Stimuli

Bradley E. Buchanan[1] (buchanan12@usf.edu), Rachel Gaynor[1], Harold A. Rocha[1], Ashlee Ross[1], Sofia Laporte[1], Emma Sonenblum[1], Emily A. Rancorn[1], Geoffrey F. Potts[1]; [1]University of South Florida

Attention and visual selection are integral aspects in the rapid processing of social cues when informing our behaviors. Understanding how deficits in attention across psychological disorders impact this rapid processing can lead to more sound theoretical frameworks for treatments. Rejection Sensitivity (RS) is a personality trait characterized by maladaptive responses to rejection. RS has been shown to be a direct and indirect predictor of Social Anxiety Disorder (SAD). Both RS and SAD have been shown to display similar attentional biases (hypervigilance) toward social feedback cues (such as faces). However perceptual load, or the complexity of features within a given perceptual field, has been shown to absorb the attentional resources needed for this attentional bias. While this has held true for SAD, some associated traits of SAD, such as trait anxiety, show a resilience toward these load effects. A sample of 66 undergraduate students were examined utilizing a visual search task to explore behavioral and neural correlates of perceptual load effects in the attentional biases toward facial distractors within those who self-reported highly RS traits. Overall, findings suggest that attentional differences were found between low and high RS groups. With the addition of RS and distractor interactions in behavioral data it is possible this difference could be considered evidence of hypervigilance. Additionally, perceptual load appeared to modulate performance and later attentional resource allocation, as indexed by P3 amplitudes, in both RS groups regardless of distractor. Limitations and implications of these findings are discussed for future works.

Topic Area: ATTENTION: Nonspatial

A35 - How States of Attention Are Represented by EEG Microstate Temporal Dynamics

David DiStefano[1] (david.distefano@tufts.edu); [1]Tufts University

Our ability to focus attention can change over short periods of time, where one moment may be characterized as an “in-the-zone” state of attention that is passive yet efficient, and the next moment may be characterized as “out-of-the-zone” where focus lapses and attentional control must be re-exerted back to a task at hand. However, it is not well understood how the brain exhibits neural markers of these attentional states at fast time scales. The present work analyzes EEG microstates as a robust, and promising way of understanding the spatial-temporal neural dynamics of attentional states in the context of a continuous performance task in which participants promptly press a button in response to target images in a visual detection task. To identify epochs of these attentional states, a well-validated measure of response time variability is used as an objective marker of behavioral attention. Microstate topographies are discovered using a spatialized k-means algorithm which converges to seven representative microstate maps (A through G). The microstate analyses presented focus on quantitative differences in classical univariate measures and first-order transition probabilities compared between the two states of attention. Results reveal that univariate measures of global field power, duration, and proportion of microstate C are more prevalent during the "out-of-the-zone" periods. Transition probabilities also differed between attentional states, with more frequent transitions from microstate C to D, and G to D during "out-of-the-zone" compared to "in-the-zone" periods. These results indicate that momentary attentional states are well represented by patterns of short-lived (~100 msec) spatial-temporal microstates.

Topic Area: ATTENTION: Nonspatial

A36 - Pupil Size as a Marker of Attentional Effort Across Suboptimal Attention States

Agnieszka Zuberer[1] (azuberer@gmail.com), Ziheng Wang[1*], Melanni Nanni-Zepeda[1], Michael Esterman[2,3,4], Flavio Frohlich[1]; [1]Department of Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, USA, [2]Department of Psychiatry, University of Tübignen, Tübignen, Germany, [3]National Center for PTSD, VA Boston Healthcare System, United States, [4]Boston Attention and Learning Laboratory, VA Boston Healthcare System, Boston, MA, 02130, USA, [5]Department of Psychiatry, Boston University School of Medicine, Boston, MA, USA*

Sustained attention (SA) is not sustained but instead fluctuates from moment to moment over seconds to minutes. Previous work has shown that SA alternates between optimal and suboptimal attention states, so called "in-zone" states of stable focus and "out-zone" states of attention lapses and variable behavior. While these fluctuations are linked to brain activity and connectivity, little research has examined their relationship with attentional effort and its role in attentional optimality. To address this, 25 healthy adults underwent 4 sessions of the gradual onset continuous performance task (~8min each) with concurrent pupil size (PS) recordings. We tested the association between PS and attentional optimality, measured by reaction time variance, finding a mean Spearman correlation of $r = .11 \pm .15$. The mean within-subject correlation was significantly greater than zero ($P < 0.001$, two-tailed Wilcoxon signed rank test). A linear mixed-effects model predicting commission error rate by PS level (high/low) and attentional optimality (in-the-zone/out-of-the-zone) revealed that higher PS during suboptimal attention states to be associated with higher commission error rate compared to low PS in this suboptimal attention state (interaction pupil state x attention state: $\beta=0.102$, 95% CI [0.011, 0.193], $p=0.028$). This suggests that greater PS may reflect the mobilization of additional attentional resources in response to poorer task performance. In contrast, commission error rates did not differ with PS during optimal attention, implying effective resource allocation without extra effort. These findings highlight PS as a potential marker for dissociating performance from resource mobilization, warranting further research in varying cognitive contexts.

Topic Area: ATTENTION: Nonspatial

A37 - Differential Neural Correlates of EEG Mediate the Impact of Internally and Externally Directed Attention in a Dual-task Working Memory Paradigm

Ankit Yadav[1] (yadavankit99@gmail.com), Arpan Banerjee[1], Dipanjan Roy[2]; [1]National Brain Research Centre, India, [2]Indian Institute of Technology Jodhpur, India

Spontaneous internally directed attention, such as mind-wandering, often impairs performance in cognitive tasks. However, the effect of intentional internally directed attention (IDA)—for example, purposefully reflecting on past or future events—on task performance remains poorly understood. In this study, we utilized a dual-task paradigm incorporating self-referential stimuli within a color-recall visual working memory task. Our findings indicate that intentional IDA exerts a more pronounced effect on performance compared to intentional externally directed attention (EDA). Specifically, IDA elicited larger late positive potentials (LPP) over medial frontal sensors, suggesting sustained stimulus processing in these regions. Furthermore, neural activity associated with internal attention showed a distinct pattern: event-related desynchronization (ERD) in the alpha band (8–12 Hz) during the encoding phase, followed by event-related synchronization (ERS) in the delay phase. Conversely, the EDA condition was characterized by theta band (4–8 Hz) ERS during the delay period. These results underscore the differential behavioral and neural signatures of internally versus externally directed attention in dual-task contexts.

Topic Area: ATTENTION: Other

A38 - Focus and Flight: How focus of attention impacts muscle recruitment and performance in a skills learning task

Evan Rufer[1] (erufer@edgewood.edu), Ferrinne Spector[1]; [1]Edgewood College

Focus of attention is a component of cognition that has implications for physical performance (Hitchcock & Sherwood, 2018). The purpose of this study is to understand how focus of attention (FOA) influences rate of learning and muscle recruitment during a skills learning task. Using a within groups design, we measured muscle recruitment using continuous Electromyography (EMG) on the flexor carpi ulnaris (wrist) during a dart throwing task across two counterbalanced conditions: internal FOA and external FOA. Each condition included 20 throws towards a target, participants rated each throw on a visual analog scale that was based on dart flight (external FOA) or elbow angle at release (internal FOA). We predicted that accuracy across trials will be higher with an external FOA compared to an internal FOA and that muscle recruitment would be different across the conditions. Accuracy was significantly higher in the external FOA condition ($p <.05$, $\eta 2p= .163$) and it improved across learning phase (beginning, middle end), regardless of condition ($p<.01$, $\eta 2p= .180$). Additionally, although the baseline throws resulted in the highest EMG frequency and amplitude, the external FOA resulted in significantly higher frequency ($p<01$, $\eta 2p = .031$) and amplitude ($p<.001$, $\eta 2p= .060$) than that of the internal FOA condition. These results underscore the idea that an external focus is a more efficient strategy for an external target. Additionally, this external advantage coincides with differential muscle recruitment. These findings have implications for optimizing performance by utilizing cognitive and attentional factors along with physical components during skills training.

Topic Area: ATTENTION: Other

A39 - Attention induces a left hemispheric lateralization for three-dimensional shape from shading: an ERP study

Joshua Matthews[1] (jsm22cvd@bangor.ac.uk), Paloma Marí-Beffa[1], Debra Mills[1], Ayelet Sapir[1]; [1]Bangor University

Despite retinal input providing only two-dimensional (2D) information, three-dimensional (3D) shape can be inferred from depth cues in the environment. For instance, the shading pattern across an object can be used to derive 3D shape in a process termed shape from shading. Early evidence suggested that shape from shading is a pre-attentive process, however recent findings imply that attention is necessary to perceive 3D shape from shading. Here, we explore this notion using event-related potentials (ERPs), specifically by examining the N2pc (posterior contralateral) component as a measure of attentional resources. We hypothesised that 3D stimuli would evoke a larger N2pc amplitude than 2D stimuli. Furthermore, in line with evidence suggesting a right hemispheric dominance in 3D perception, we predicted that this effect would be lateralized to the right hemisphere. Participants were presented with 2D and 3D stimuli in the left and right visual field. At the beginning of each experimental block, a target shape was defined, and participants were asked to indicate the location of the target stimulus. We found that N2pc amplitude was greater for 3D targets compared to 2D targets, but this effect was only significant over the left hemisphere. Thus, the current study demonstrates that increased attentional resources are necessary to identify 3D shapes defined by shading cues. Interestingly, as we also found that this effect was lateralized to the left hemisphere, it supports alternative suggestions that the ventral visual pathway in the left hemisphere is involved in processing 3D shape.

Topic Area: ATTENTION: Other

A40 - The impact of prefrontal tDCS on periodic and aperiodic contributions to resting-state EEG

Ashley R. Rosenfeld[1] (asrrosen@ucsc.edu), Cameron S. Carter[2], Megan A. Boudewyn[1]; [1]University of California Santa Cruz, [2]University of California Irvine

Studies exploring the effects of transcranial direct current stimulation (tDCS), a non-invasive neurostimulation technique, on cognitive performance have increased exponentially over the last decade. However, the mechanism by which tDCS modulates the underlying neural circuits is not yet understood. There is evidence that, rather than influencing neural spiking directly, tDCS modulates neural oscillations (Chase et al., 2020), and may also impact excitatory/inhibitory balance in cortex (Bunai et al., 2021). Interestingly, recent methodological advances have highlighted the contributions of periodic (rhythmic oscillatory activity) and aperiodic activity to the EEG signal, with aperiodic activity thought to be related to cortical excitatory/inhibitory balance (Gao et al., 2018). Thus, the goal of the current study is to examine tDCS-related changes in aperiodic contributions to the EEG signal and periodic oscillatory activity across several frequency bands of interest. We will examine resting-state EEG collected after a 20-minute tDCS protocol was administered in three conditions using a within-subjects design: PFC-targeted active stimulation, active control stimulation, and sham stimulation. Data collection is already complete (N=75). We will parameterize neural power spectra into periodic and aperiodic components using the spec-param method (Donoghue et al., 2020) for eyes-open and eyes-closed resting state EEG data separately. Of particular interest will be the slope of the aperiodic signal, which we hypothesize will vary as a function of tDCS protocol condition. This analysis is expected to provide new insights into the impact of tDCS on oscillatory dynamics in key neural circuits underlying higher-order cognition.

Topic Area: ATTENTION: Other

A41 - Long-term memory under uncertainty: the impact of cue reliability in attentional prioritization of long-term memory representations

Melinda Sabo[1] (sabo@ifado.de), Kia Nobre[1]; [1]Wu Tsai Institute | Yale University

Attentional prioritization is well-established in the perceptual and working memory domains, yet its role in long-term memory retrieval remains underexplored. This study aims to address this gap by characterizing attentional prioritization during long-term memory retrieval under varying cue reliability. Using an episodic learning paradigm, participants encode associations between scenes and two objects. In a subsequent retrieval phase, participants are presented with a scene and asked to report the color of the indicated object. Before revealing the to-be-tested object, participants are presented with a retro-cue, which probabilistically indicates the target object. Three cue-reliability levels are introduced: 90%, 70%, and 50% (uninformative). Behavioral benefits reflected in valid trials and behavioral costs captured in invalid trials are assessed. Two scenarios are hypothesized: (1) behavioral benefits and costs mirror working memory patterns, with greater benefits and costs in the 90% condition compared to 70%; (2) all objects are robustly represented regardless of the cue, leading to high benefits and minimal costs across conditions. Magnetoencephalogram decoding analyses will examine whether neural representations scale with cue reliability or display comparable above-chance decoding performance across conditions. These findings aim to clarify the interplay between attentional prioritization and long-term memory under uncertainty.

Topic Area: ATTENTION: Other

A42 - Closed-loop neuromodulation of anticorrelated spontaneous activity between default and dorsal attention networks

Janet Li[1] (jl4646@drexel.edu), Tiara Bounyarith[1], Lotus Shareef-Trudeau[1], David Braun[1], Aaron Kucyi[1]; [1]Drexel University

The dynamic interplay between the default mode (DMN) and the dorsal attention (DAN) networks is thought to underpin mind-wandering and attention. DMN activity, implicated in mind-wandering, is typically anticorrelated with DAN activity, implicated in goal-directed attention. Despite DMN-DAN anticorrelation being well-established association, the causal relationship with behavior remains untested, in part, due to limitations in network-based neuromodulation techniques. We will explore the possibility of direct modulation of DMN-DAN anticorrelation through covert real-time fMRI neurofeedback (rt-fMRI-NF), or directly manipulating spontaneous brain activity without awareness using implicit learning. Thirty healthy adults will be divided into 2 groups, each comprised of fifteen participants who will either upregulate DMN relative to DAN activity (DMN>DAN group) or DAN relative to DMN activity (DAN>DMN group). Runs of rt-fMRI-NF will include implicit rewards and intermittent experience sampling to assess mind-wandering. Measures of attentional task performance will be collected prior to and after rt-fMRI-NF training. We hypothesize that (1) covert rt-fMRI-NF will modulate DMN-DAN anticorrelation in both groups, (2) that modulation success will correspond to increased or decreased mind-wandering, respectfully, depending on modulation direction, and (3) that post-training attentional task performance will reflect these changes. Analyses will examine changes in DMN-DAN activation differences over time across rt-fMRI-NF runs, correlate trial-wise mind-wandering ratings with DMN-DAN activation differences during rt-fMRI-NF, and measure pre- relative to post-training changes in attentional performance. If hypotheses are supported, we will demonstrate that covert neuromodulation of DMN-DAN anticorrelation can alter mind-wandering and attention, offering insights into their causal roles and future interventions targeting these networks.

Topic Area: ATTENTION: Other

A43 - Examining EEG Microstate Dynamics as a Function of Time-on-Task

Brooke Schwartzman[1] (bes171@miami.edu), Anthony P. Zanesco[2], Jason S. Tsukahara[1], Ekaterina Denkova[1], Amishi P. Jha[1]; [1]University of Miami, [2]University of Kentucky

The vigilance decrement, characterized by worsening attentional performance with greater time-on-task, has been linked to within-task increases in response time variability (RT ICV) and mind wandering. Yet, its neural dynamics remain underexplored. EEG microstates are transient brain states of large-scale neural activity that offer millisecond-level insight into brain dynamics. Prior research has associated specific microstate configurations with cognitive states, linking microstate C to mind wandering and microstate E to on-task focus. Examining how these microstate configurations change as a function of time-on-task can provide insight into the brain dynamics contributing to the vigilance decrement. Herein, RT ICV, mind wandering, and microstate dynamics were evaluated as a function of time-on-task through secondary analysis of data previously reported by Zanesco et al. (2021). Participants (N = 34) completed a modified version of the Sustained Attention to Response Task with task-embedded mind wandering probes. EEG microstates were analyzed in the pre-stimulus period of trials preceding probes. Growth curve modeling revealed that RT ICV and mind wandering increased with greater time-on-task. The dynamics of microstates also changed with time-on-task. Microstate C explained more topographic variance, occupied more of the time series, and occurred more frequently with greater time-on-task. Additionally, microstate E was shorter in duration with greater time-on-task. These results demonstrate dynamic changes in objective performance, subjective ratings, and brain microstates as a function of time-on-task, expanding our understanding of the mechanisms underlying the vigilance decrement.

Topic Area: ATTENTION: Other

A44 - A school-based neuroscience study on student engagement with intelligent tutoring systems

Yushuang Liu[1] (yushuang.liu@bc.edu), Ido Davidesco[1], Bruce McLaren[2], J Elizabeth Richey[3], Xiaorui Xue[1], Leah Teffera[2], Hayden Stec[2], Joyce Zhang[4], Elana Golumbic[5]; [1]Boston College, [2]Carnegie Mellon University, [3]University of Pittsburgh, [4]University of Pennsylvania, [5]Bar-Ilan University

Computer-based intelligent tutoring systems (ITSs) are increasingly becoming an integrated component of both in-person and online learning. Even though ITSs are inherently interactive, not all students engage effectively with these platforms. Student engagement with ITSs is typically assessed using behavioral markers (e.g., how long it takes students to solve a problem), which do not completely capture the multidimensional nature of engagement. Therefore, in the current project, we studied how students engage with intelligent tutors using a combination of behavioral, EEG, and eye-tracking measures. A total of 56 high school students participated in the study at a neuroscience lab, which was set up in two high schools. The study adopted a pretest-intervention-posttest design. During the intervention, students watched short instructional videos and solved a series of chemistry problems with the help of a computerized tutor. Students were able to request hints and received feedback from the tutor. In addition to logging student responses, we operationalized engagement as EEG power in the Alpha band (8-12 Hz) and as fixation duration in pre-defined regions of interest (ROIs). Overall, students demonstrated significant pre-to-post test improvement. Preliminary EEG results suggest that students showed lower alpha power during problem solving compared to instructional videos, suggesting that students were more engaged while interacting with the tutor. Preliminary eye-tracking analysis showed that students had longer fixation duration when reading hints compared to other ROIs, suggesting that hints provided by the tutor effectively captured student attention. These preliminary results highlight the potential value of neuroscience methods in educational research.

Topic Area: ATTENTION: Other

A45 - The impact of emotional item memorability on the attentional blink

Amy MacGlashing[1] (amacglashing@worcester.edu), Brittany M. Jeye; [1]Worcester State University

Previous research has found that individuals are less likely to perceive a target item when it directly follows an emotionally evoking one (i.e., "emotion-induced blindness", similar to the attentional blink). In the current study, we examined whether the memorability of an emotional item induces an attentional blink. Participants were asked to identify a target image (i.e., a rotated image) within a rapid serial visual presentation of images. Emotional distractor images were shown either two or eight images (e.g., lag 2 or lag 8) before the targets and were varied in their memorability (e.g., high memorability, low memorability, or neutral memorability). Analyses investigated whether the memorability level (high, low, or neutral) of the emotional distractor impacted participants' abilities to find the target at either the lag 2 (i.e., the attentional blink) or lag 8 position. We found no difference between the mean response accuracies for high or low memorability emotional stimuli at either lag 2 or lag 8 in either experiment. Our results suggest that emotional item memorability may not impact participants' responses and that memorability does not influence the attentional blink.

Topic Area: ATTENTION: Other

A46 - Exploring the Relationship Between Critical Brain Dynamics and Reaction Time Variability in ADHD

Alessandra DallaVecchia[1] (adallave@ucla.edu), Nicolas Zink[1], Sarah L. Karalunas[2], Greg V. Simpson[3], Agatha Lenartowicz[1]; [1]University of California, Los Angeles, [2]Purdue University, [3]ThinkNowInc, San Francisco, CA

Elevated reaction time (RT) variability during sustained attention tasks is a robust correlate of attention deficit hyperactivity disorder (ADHD). This variability reflects more frequent slow RTs and has been linked to increased neural variability, though underlying mechanisms are not fully known. The Critical Brain Hypothesis provides a possible control mechanism for neural variability and posits that the brain operates near "criticality", a state poised between stability and flexibility. During task, the brain has been found to shift slightly towards stability, so a deviation back towards criticality could mechanistically explain increased neural variability and increased slow RTs. In this study, we investigated how a family of measures that capture criticality-associated phenomena (spectral slope, long-range temporal correlations [LRTC], low-frequency [LF] power and variability), derived from EEG signals, change prior to slow reaction times in an audio-visual task in 138 adults with (n=103) and without ADHD (n=32). Effects in the LRTC and slope indicated that dynamics shifted closer to criticality prior to slow RTs compared to average and fast RTs for all subjects. The same effects (stepper slopes & higher LRTC) were found in the ADHD group consistent with brain dynamics closer to criticality overall. While LF power did not show a significant effect related to performance, LF variability increased prior to slow RTs and during passive viewing, but only for the ADHD group. In conclusion, EEG brain dynamics shift toward criticality before slow responses, with ADHD individuals exhibiting dynamics closer to criticality than controls, potentially contributing to increased LF variability.

Topic Area: ATTENTION: Other

A47 - The Role of the Temporoparietal Junction in Theory of Mind: Evidence from Intracranial EEG

Shweta Soni[1] (shwetanbrc@gmail.com), Julia WY Kam[1], Fady Girgis[1]; [1]University of Calgary

Theory of Mind (ToM), a core mental process of human social cognition, is the ability to attribute thoughts, beliefs and intentions to oneself and others, and to understand that these mental states can differ from others. While neuroimaging techniques suggest the involvement of a variety of brain areas within the default mode network in ToM, comprehensive investigations of the neurophysiological basis of ToM remain limited. To address this, we examined intracranial EEG (iEEG) in 13 pharmacoresistant epileptic patients during a ToM task. We recorded brain responses from electrodes implanted over the temporoparietal junction (TPJ) and other areas while participants read ToM stories and responded via keyboard to associated ToM and control questions. Our results revealed significantly greater high-frequency broadband activity (70–170 Hz) in the TPJ in response to ToM questions compared to control questions. Moreover, TPJ electrodes showed significantly more power in higher frequencies during ToM than non-TPJ (i.e., insula as the control region) electrodes, suggesting a key role of the TPJ in supporting ToM processes. Leveraging the millimeter-scale spatial and millisecond-scale temporal resolution of iEEG, this study provides crucial insights into the spatiotemporal dynamics of ToM processes and holds significant implications for understanding psychiatric and neurological disorders like autism spectrum disorder, schizophrenia, and social anxiety disorder that are characterized by challenges in ToM processes. Keywords: Neuroimaging; Intracranial EEG; Theory of Mind; Social cognition; Neurophysiology

Topic Area: ATTENTION: Other

A48 - Reading with intent: Phonological processing not always automatic

Niki Sinha[1] (nsinha7@uwo.ca), Marc Joanisse[1]; [1]Western University

This study tested the automaticity of accessing sound-spelling pairings during reading in adults using event-related potentials in EEG. We focus on whether goal-driven attention exerts a top-down influence on automatic word recognition and minimizes interference from sound-spelling conflict. We recorded EEG in 37 English adult readers as they made quick judgements of visually presented word-pairs. Tasks directed attention to different aspects of word information by asking participants to judge word-pairs on spelling or colour. Orthographic and phonological conflict was manipulated by presenting word-pairs that shared both (cool/pool) or neither (boat/fair), versus conflict trials which were mismatched in orthography (cane/rain) or phonology (most/cost). Participants had slower reaction times to conflict trials when making spelling judgments, but not colour judgements. EEG analysis found enhanced N400 negativity when comparing conflict trials to their non-conflict counterparts, suggesting both orthographic and phonological differences between word-pairs were recognized when participants made spelling judgements. This effect was attenuated in the colour judgement task where comparison of conflict and non-conflict trials revealed N400 differences only in trials with orthographic mismatch. Results show automatic orthographic effects regardless of task; however sound-spelling conflict did not occur when participant attention was directed to non-word information, highlighting the role of attention in what we might think of as automatization during reading.

Topic Area: ATTENTION: Other

A49 - Prioritizing Structure: Statistical Regularities Gate Sustained Attention on a Concurrent Task

Elena Greatti[1,2] (egreatti@sissa.it), Davide Crepaldi[1,3], Amy Sue Finn[4]; [1]International School for Advanced Studies (SISSA), [2]University of Camerino, [3]University of Pavia, [4]University of Toronto

There is ongoing debate about the role of attention, if any, in statistical learning – the detection of structural regularities in our environment. Evidence suggests that statistical regularities capture attention (Zhao et al., 2013), but it is unclear whether this effect persists when the regularities are task-irrelevant (Alamia & Zénon, 2016) or how attention directly influences statistical learning (Toro et al., 2005; Batterink & Paller, 2019). To address these questions, a measure of sustained attention is needed. The present study explores the relationship between fluctuations in sustained attention and statistical learning by examining implicit neural entrainment and explicit recall of statistical patterns. Participants were exposed to two syllable streams containing statistical patterns (based on frequency groupings and transitional probabilities) and one control stream, with syllables presented at 4Hz. During exposure, participants performed a categorization task, identifying whether the displayed syllable was red or blue. Response times on this categorization task were used to measure fluctuations in sustained attention—lapse rates (Decker et al., 2020). Behavioral results revealed that statistical regularities influenced attention even when task-irrelevant: lapse rates were higher in both statistical conditions compared to the control. Neural entrainment was also observed in both statistical conditions, indicating a clear sensitivity to attention-attracting structure. After exposure, participants completed two behavioral tasks which evaluated how attention and neural entrainment to statistical regularities influenced their explicit recall. Results highlight the dynamic interaction between attention and statistical learning, advancing our understanding of how attentional states shape the detection, storage, and recall of regularities in memory.

Topic Area: ATTENTION: Other

A50 - Patterns of low-frequency signals across brain networks reflect differences in attention control

Ms Dolly Seeburger[1] (dseeburger3@gatech.edu), Jason Tsukahara[2], Nan Xu[3], Shella Keilholz[1], Randall Engle[1]; [1]Georgia Institute of Technology, [2]University of Miami, [3]University of Maryland

Patterns of low-frequency signals across functional brain networks are relatively stable (Yousefi & Keilholz, 2021). This reflects a possible trait-level signal. In this individual differences study, participants completed 2 days of a battery of cognitive tasks to assess attention control, working memory, and fluid intelligence as a latent factor. We then obtained fMRI scans during rest, 1-back and 3-back task. Attention control latent factor, and not working memory or fluid intelligence, significantly predicted differences in the connectivity between fronto-parietal and dorsal attention network as well as fronto-parietal and the default mode network. Moreoever, the locus coeruleus, a region thought to be the nexus of attention control (Tsukahara & Engle 2021), was positively correlated with the activity in the fronto-parietal control network in high attention individuals but negatively correlated in low attention control individuals. This suggests that high attention control individuals have better network switching of the fronto parietal to the dorsal attention from the default mode network, when cognitive load increase possibly influenced by the locus coeruleus. Furthermore, we investigate the activity of the locus coeruleus and how it relates with trait level attention control.

Topic Area: ATTENTION: Other

A51 - Choose Your Own Attention: Does PFC Resting State Determine Selective Attention Ability?

Madison Gaugler[1], A'maya Tatum, Chase Elliott, Kayla Challacombe, Carole Scherling; [1]Belmont University

A resting brain exhibits patterns that closely resemble task-related attention networks (Park & Madden, 2013). Particularly, executive functions recruit the prefrontal cortex (PFC; Rossi, 2008; Racz, 2017) and higher rest activity associates with higher executive task performance (Jia, 2016). Hence, investigating PFC resting-state can elucidate active state and task performance outcomes. Selective attention, an executive domain, has been mostly investigated using EEG and fMRI. The current fNIRS study probed PFC resting-state as a predictor of selective attention performance. Forty-six undergraduates [29F, age (SD)= 20 (1.39)] completed eyes-open/-closed resting sessions (8-minutes each; 8x8 PFC montage). Participants engaged with an Attentional Bias Cueing Task, with accuracy and reaction times as performance outcomes (accuracy rates (%)= 93.2 (3.1); average latency (msec)= 451 (87.51)). We hypothesized that higher eyes-open and -closed PFC rest activity would associate with a) higher task accuracy and b) faster reaction times. Results did not reveal significant correlations between PFC resting-states and selective attention performance ($p > 0.05$), potentially indicating that resting-state PFC is not modulatory for selective-attention performance. With few imaging studies systematically investigating resting-state and this attentional domain, we are limited to discuss alignment with field findings. We suggest the application of a more complex selective-attention task to increase performance variability, as well as to shift attention away from global PFC activity and more on localized ventromedial and dorsolateral PFC involvement. Overall, the current findings support the use of fNIRS to probe resting-state activity and brain lateralization, and additionally promote its flexible applications for executive functioning studies,

Topic Area: ATTENTION: Other

A52 - Attentional dysfunction in post-9/11 veterans with suicidal thoughts and behaviors

Jessica Sullivan[1,2], Jaiden Huang[1,6], Audreyana Jagger-Rickels[1,2,3], Catherine Fortier[4,5], William Milberg[4,5], Jaclyn Kearns[2,3], Joseph DeGutis[1,4,5], Michael Esterman[1,2,3,4]; [1]Boston Attention and Learning Lab (BALLAB), VA Boston Healthcare System, Boston, MA, USA, [2]Boston University Chobanian and Avedisian School of Medicine, Boston, MA, USA, [3]National Center for PTSD (NCPTSD), VA Boston Healthcare System, Boston, MA, USA, [4]Translational Research Center for TBI and Stress Disorders (TRACTS), VA Boston Healthcare System, Boston, MA, USA, [5]Harvard Medical School, Boston, MA, USA, [6]University of California, Los Angeles, CA, USA

Although neuropsychological deficits in attentional control have been shown to contribute to or underlie numerous psychiatric disorders, markedly less work has examined whether such deficits contribute to suicide risk. This is especially challenging given the high levels of comorbidities in individuals with suicide risk, such as depression and posttraumatic stress disorder (PTSD). Investigating the cognitive correlates of suicide risk (e.g., suicide attempt) may help identify underlying mechanisms of suicidal thoughts and behaviors, as well as better predict those at greatest risk. To address this question, 332 trauma-exposed post-9/11 veterans participated in this study as a part of a broader ongoing longitudinal study. Participants completed the gradual-onset continuous performance task (gradCPT), a well-validated measure of sustained attentional control, alongside a battery of neuropsychological tests of attention, executive functioning, and memory. We compared performance on these tests between those with and without a suicide attempt (SA) history. We also characterized their current suicidal ideation (SI) and their PTSD and depression symptoms. We observed that veterans with SA had impaired performance, marked by greater response variability on the gradCPT, compared to those without SA ($p<0.01$). Although depression and PTSD were also associated with increased variability on the gradCPT, the effect of SA remained significant after controlling for current PTSD and depression symptoms ($p<0.05$), as well as when controlling for current SI ($p<0.01$). These effects were not observed during standard neuropsychological tests, indicating that deficits in sustained attention may represent a distinct cognitive mechanism linked to an increased risk of suicide.

Topic Area: ATTENTION: Other

A53 - Disentangling the neural responses to overlapping visual streams of task stimuli and emotional distractors in a sustained attention task

David Rothlein[1,2], Samuel Agnoli[2], Travis Evans[1,2,4], Carrie Hughes[1,2], Audreyana Jagger-Rickels[1,2,3], Joseph DeGutis[2,6], Michael Esterman[1,2,3]; [1]National Center for PTSD, VA Boston Healthcare System, [2]Boston Attention and Learning Lab (BALLAB), VA Boston Healthcare System, [3]Department of Psychiatry, Boston University Chobanian and Avedisian School of Medicine, [4]Department of Psychological Sciences, Auburn University, [5]Department of Psychiatry, Harvard Medical School

In real-world settings, attention balances competing information streams, suppressing distractions to complete goal-directed tasks while remaining sensitive to potential task-irrelevant surprises. How does the brain allocate resources to simultaneously monitor goal-directed information and background distractions? In this fMRI experiment, we used a novel sustained attention task, emogradCPT, where participants responded to a sequence of digit stimuli fading in and out, pressing a button for most digits and withholding for 3 (10% of trials). The digits were overlaid on emotionally positive (e.g., puppies) or negative (e.g., roadkill) backgrounds. We sought to distinguish neural signals from task-relevant digits vs. distracting backgrounds and track their neural pathways. We developed a design leveraging shared inter-subject neural responses exposed to identical stimuli to estimate predicted neural responses specific to the foreground digits or background images. Participants completed two runs: one with a fixed sequence of backgrounds behind a randomized digits, and another with fixed sequences digits and random backgrounds. By By averaging across participants to estimate predicted responses to the fixed sequences of digits and backgrounds. In a third run where both trial orders were fixed, we used these predictors to quantify the brain activity driven by digits versus backgrounds. We found that while sensitivity to backgrounds and digits was widespread, backgrounds dominated the visual cortex and dorsal attention network, and digits dominated the ventral attention and motor networks. This approach demonstrates the value of leveraging shared inter-subject responses in disentangling competing visual streams, providing a framework for studying attentional control dynamics amid emotional distraction.

Topic Area: ATTENTION: Other

A54 - Subcortical dynamics during failures in maintaining alertness after sleep restriction in the human brain.

Ewa Beldzik[1,2] (ewa.beldzik@gmail.com), Daniel Gomez[2], Nicholas Cicero[1,2,3], Zinong Yang[1,3], Juan Eugenio Iglesias[1,2], Brian Edlow[2,4], Laura Lewis[1,2,3]; [1]Massachusetts Institute of Technology, [2]Massachusetts General Hospital, [3]Boston University, [4]Harvard Medical School

Sleep restriction can severely impair alertness, resulting in delayed responses, omissions, or microsleeps. The neural dynamics underlying these drowsy periods and subsequent recovery to alertness are not well understood. Previous fMRI studies have focused on cortical and thalamic regions, which likely reflect downstream effects of dysregulated arousal mechanisms originating in the brainstem and hypothalamus, as shown in animal research. However, high-resolution imaging of these structures in humans is limited due to their small size and deep location. This study aimed to overcome these challenges using ultra-high-field (7T) fMRI to measure activity in brain regions critical for sleep-wake regulation during a simple attention task (psychomotor vigilance task) in sleep-restricted subjects (n=25). We applied advanced subcortical segmentation tools to analyze hemodynamic activity linked to the first omission trial (entering drowsiness) or the first alert trial after an omission (regaining alertness), across all nuclei of the ascending arousal network (AAN). We found that at the onset of drowsiness, activity decreased across all AAN regions, except for the tuberomammillary nucleus, which increased. Regaining alertness was marked by a strong increase in AAN activity, except in the hypothalamic preoptic area, which decreased, consistent with its sleep-promoting function. These patterns were influenced by the duration of the drowsiness period. Further, distinct temporal characteristics (e.g., number, latency, and width of peaks/troughs) in the hemodynamic activity across AAN regions suggested local neuromodulatory effects on the fMRI signal. Our findings shed light on the complex interactions between subcortical circuits that mediate attentional lapses after sleep restriction.

Topic Area: ATTENTION: Other

A55 - Brain waves during deep meditative absorption: alpha suppression as a marker for meditation depth

Lionel A. Newman[1] (lionel.newman@allhere.org), Christoph M. Michel[1,2], Monika Stasytyte[1], Erkin Bek[1], Chuong Ngo[1,3]; [1]All Here SA, Geneva, Switzerland, [2]University of Geneva, Switzerland, [3]Swiss Federal Institute of Technology Lausanne, Switzerland

Meditation has long been associated with profound changes in brain structure and function, yet the neural dynamics underlying these effects remain incompletely understood. While previous research has focused on trait-level changes in novice practitioners—often reporting enhanced alpha and theta activity during cognitive and social tasks—the role of alpha dynamics during meditation itself has been less clear. A review of 40 studies revealed inconsistent findings during Focused Attention Meditation (FA-M): 16 studies reported increased alpha power, 8 observed decreases, and 16 found no significant changes (Lieberman, 2024). State-level changes during meditation, particularly in advanced practitioners, hold the potential to shed light on these inconsistencies. However, such research is limited by the challenge of recruiting meditators with extensive experience in comparable practices. To address this gap, we analyzed EEG data from an advanced yogic Samadhi practitioner, 11 Theravada Jhana experts, and 10 less experienced meditators practicing FA-M. Across all groups, meditation was marked by significant alpha suppression compared to baseline, with the degree of suppression strongly correlating with the level of expertise. Notably, expert practitioners also exhibited increased infraslow, delta, and gamma activity during meditation. These findings suggest that alpha suppression may be a defining feature of meditative expertise, providing a potential resolution to the inconsistencies reported in the literature. Furthermore, they indicate that changes in alpha and other brain dynamics evolve with meditative practice, offering valuable insights into the neural mechanisms underlying meditation's transformative effects.

Topic Area: ATTENTION: Other

A56 - Microsaccades strongly modulate but do not necessarily cause the N2pc EEG marker of spatial attention shifts in perception and working memory

Freek van Ede[1] (freek.van.ede@vu.nl), Siyang Kong[1], Baiwei Liu[1]; [1]Vrije Universiteit Amsterdam

The N2pc is a popular human-neuroscience marker of covert and internal spatial attention that occurs 200-300 ms after being prompted to shift attention – a time window also characterised by the spatial biasing of small fixational eye-movements known as microsaccades. To delineate the relation between these co-occurring spatial modulations, we conducted a combined EEG-eyetracking study where a central colour cue prompted covert or internal selection of a left/right visual target that was either visible (selection from perception) or held in working memory (selection from memory). We show how co-occurring microsaccades profoundly modulate N2pc amplitude during top-down shifts of spatial attention in both perception and

working memory. At the same time, we show that a significant – albeit severely weakened – N2pc can still be established in the absence of co-occurring microsaccades. Thus, while microsaccade presence and direction strongly modulate N2pc amplitude, microsaccades are not strictly a prerequisite for the N2pc to be observed. Moreover, this relation holds no matter whether microsaccades also bring attended visual targets closer to the fovea (in perception) or not (in working memory).

Topic Area: ATTENTION: Spatial

A57 - Gray matter volume correlates of Visual-spatial Attention Gradient in Trait Anxiety

Mrinmoy CHAKRABARTY[1,2] (mrinmoy@iiitd.ac.in), Suhail Rafiq Mir[1,2], Varsha Singh[2]; [1]Indraprastha Institute of Information Technology Delhi (IIITD), India, [2]Centre for Design and New Media, IIITD, India, [3]Indian Institute of Technology Delhi, India

Flexible allocation of visual attention to different spatial loci is crucial for optimizing visually guided cognition. Failure to adaptively redistribute spatial attention may compromise the attentional field. This is relevant in anxious individuals, known to have biases of visual attention. We used an affect-primed, visual-spatial attention task with structural magnetic resonance imaging (sMRI) in healthy young adults with varying degrees of trait anxiety (n = 60; 23 females; age [mean ± s.d.] = 22.8 ± 3.8 years). Using a behavioural task and sMRI, we explored if a) Fear and Neutral affect from image primes differed relative to No affect in modulating the distribution of visual-spatial attention; b) an association existed between the gray matter volume (GMV) of any region(s) of the whole brain and a measure of the spatial distribution of visual attention by individual valences of affect and overall. We calculated the spatial gradient of visual attention (metric for tunnel vision) using measures of attentional efficiency at two spatial locations. There was no effect of emotional valences on attentional distribution but the average gradient (across emotional valences), correlated negatively with the GMV of right cerebellum lobule VI. Further, this correlation within bilateral cerebellar lobule VI was moderated by inter-individual differences of trait anxiety, that conspicuously varied between females and males. Summarily, individuals with lesser GMV of cerebellar lobule VI manifested greater individual severity of tunnel vision, differing by trait anxiety and gender. The results suggest a non-classical role of cerebellar lobule VI in tuning fine-grained visual-spatial attention in anxiety.

Topic Area: ATTENTION: Spatial

A58 - Parallel, not Serial processes underpin detection of a Stare in the Crowd

Lynne Ling[1], Gregory Davis; [1]University of Cambridge

Previous research has reported a robust Stare-In-The-Crowd effect – a search asymmetry characterised by faster detection of direct gazing eyes than averted gazing ones. The attentional mechanisms underpinning the SITCE remain controversial, largely due to a paucity of behavioural measures capable of distinguishing noisy, parallel processes from serial ones. In the current study, we applied a new method, the Attention Location and Size (ATLAS) Task, designed to distinguish between candidate search processes. In this task, observers begin each trial by searching for a target stimulus. To profile attention and its guidance, search is sometimes interrupted, with memory probes replacing each search stimulus. Participants choose just one memory probe they wish to report from those available; the number and spatial arrangement of available items is then manipulated to profile attention's breadth and changing proximity to search targets' locations across time. In two search experiments, each with additional 'calibration' conditions to establish expected serial and parallel attention patterns, plus acuity changes due to eye movements, it was found that the breadths of attention when searching for direct- vs. averted-gaze targets were comparable. Changes in target proximity were also inconsistent with any unguided serial process. Instead, a stronger and potentially earlier-emerging attentional guidance process towards direct-gaze targets in comparison to averted-gaze targets was found, likely explaining the search asymmetry.

Topic Area: ATTENTION: Spatial

A59 - Choosing When and Where to Attend: Decoding the Electrophysiological Correlates of Self-Paced Willed Attention

John Nadra[1] (jnadra@ucdavis.edu), Ava Hutchins[1], Grace Sullivan[1], Sofia Fischel[1], Sreenivasan Meyyappan[1], Mingzhou Ding[2], George Mangun[1]; [1]University of California, Davis, [2]University of Florida

Studies of voluntary visual-spatial attention have used attention-directing cues, such as arrows, to instruct observers to focus selective attention on relevant locations in visual space in order to detect subsequent target stimuli. In real-life scenarios, however, voluntary attention is influenced by a host of factors, most of which are quite different from the laboratory paradigms that utilize attention-directing cues. These factors include priming, experience, reward, meaning, motivations, and high-level behavioral goals. Attention that is endogenously directed in the absence of external attention-directing cues has been referred to as willed attention (for a review, see Nadra & Mangun, 2023), where volunteers decide where to attend in response to a prompt to do so. Here, we used a novel paradigm that eliminated external influences (i.e., attention-directing cues and prompts) about where and when spatial attention should be directed. Using machine learning decoding methods, we showed that the well-known lateralization of EEG alpha power during spatial attention was also present during purely self-generated attention. In contrast to prior work on self-paced willed attention (Nadra et al., 2023), the novel paradigm employed here allows for the use of decoding methods to analyze the time course of shifts of self-paced willed attention.

By eliminating explicit cues or prompts that affect the allocation of voluntary attention, this work advances our understanding of the neural correlates of attentional control and provides steps toward the development of EEG-based brain-computer interfaces that tap into human intentions.

Topic Area: ATTENTION: Spatial

A60 - Pinging the Hidden Attentional Priority Map: Suppression Needs Attention

Changrun Huang[1,2,3] (changrun.huang@duke.edu), Dirk van Moorselaar[2,3], Joshua Foster[5], Mieke Donk[2,3], Jan Theeuwes[2,3,4]; [1]Duke University, [2]Vrije Universiteit Amsterdam, [3]Institute Brain and Behavior (iBBA), Amsterdam, the Netherlands, [4]ISPA-Instituto Universitario, Lisbon, Portugal, [5]Boston University

Attentional capture by an irrelevant salient distractor can be mitigated when it frequently appears in a specific location, suggesting learned suppression of that location. However, it remains unclear whether this suppression is proactive—occurring before attention is directed to the distractor—or reactive, occurring after attention has been engaged. To address this, we utilized the pinging technique, which visualizes the attentional priority map prior to the search display. In an EEG experiment, participants performed a visual search task (additional singleton paradigm) during the maintenance period of a continuous recall spatial memory task. A neutral placeholder display was introduced after the memory cue and before the search display. The visual search task included a regularity: a singleton distractor was more likely to appear in one location. Behaviorally, suppression of the high-probability distractor location was evident, as search efficiency increased when the distractor appeared there. Using a forward encoding approach, we reconstructed the spatial tuning profile of the memorized position. Results revealed reliable tuning profiles during memory maintenance, which decayed over time but reemerged with the placeholder display preceding search. Critically, the revived tuning profile exhibited a spatial gradient centered on the high-probability location, with pronounced tuning at the to-be-suppressed location. These findings support a reactive suppression account, where learned suppression is preceded by an initial phase of spatial selection. This study advances our understanding of spatial distractor suppression mechanisms.

Topic Area: ATTENTION: Spatial

A61 - Wholehead HD fNIRS for Selective Attention Analysis

Sudan Duwadi[1] (sudan@bu.edu), De'Ja Rogers[1], Alex D. Boyd[1], Laura Carlton[1], Yiwen Zhang[1], Anna Kawai Gaona[1], Grace Magee[1], Bernhard Zimmermann[1], W.Joe O'Brien[1], Alexander von Luhmann[2,3], David A. Boas[1], Meryem A. Yucel[1], Kamal Sen[1]; [1]Neurophotonics Center, Department of Biomedical Engineering, Boston University, USA, [2]Intelligent Biomedical Sensing (IBS) Lab, Machine Learning Department, Technical University of Berlin, 10587 Berlin, Germany, [3]BIFOLD – Berlin Institute for the Foundations of Learning and Data, 10587 Berlin, Germany

Complex Scene Analysis (CSA) enables the brain to focus on a single auditory or visual object in crowded environments. While this occurs effortlessly in a healthy brain, many hearing-impaired individuals and those with neurodivergent conditions such as ADHD and autism experience difficulty in CSA, impacting speech intelligibility (Dunlop et al., 2016). We propose using high-density (HD) functional Near-Infrared Spectroscopy (fNIRS) for whole-head brain imaging during complex scene analysis (CSA) in naturalistic settings. This approach allows analysis of cortical activity patterns, with potential applications in enhancing brain-computer interface technologies. Our experimental design mimics an ecologically valid cocktail party scenario in both overt and covert contexts. In the overt scenario, 3-second audiovisual movie clips are presented simultaneously at 30 degrees to the left and right. Prior to each clip, a 2-second spatialized white noise cue is paired with a white crosshair on the corresponding screen, guiding subjects on which direction to focus, with eye movements allowed. In the covert scenario, subjects are exposed solely to spatialized audio from the same set of movies. Here, the 2-second spatialized white noise serves as the cue, directing their attention, while they maintain a gaze on a central screen displaying a static white crosshair. fNIRS data were collected from 9 subjects with a whole head, high density cap layout. Our results show evoked responses in somatosensory association, primary motor, premotor and supp' motor, left primary somatosensory, right dorsolateral prefrontal cortex, and right visuomotor areas in both overt and covert conditions but not in control condition.

Topic Area: ATTENTION: Spatial

A62 - Impacts of Mental Imagery Vividness on Adolescents' Eye Movements During an Encoding and Recall Science Learning Task

Sarah Wene[1] (sw0661a@american.edu), Cassandra Ivie[1], Elshadai Melkam[1], Sophia Stull[1], Emily Peterson[1]; [1]American University, Washington D.C.

Greater similarity in eye movements during image viewing and recall (gaze reinstatement) is suggestive of higher mental imagery, which is an important aspect in STEM learning. However, most gaze reinstatement research has looked at adults' memory for decontextualized images. Therefore, whether vividness of mental imagery impacts adolescents' eye movements in an authentic learning task was the focus of this investigation. Participants enrolled in a geospatial science course completed the Vividness of Visual Imagery Questionnaire (VVIQ) to measure general levels of self-reported mental vividness and had their eyes tracked during a science learning task. Students were presented with maps of scientific phenomena as visual stimuli and asked to generate statements of "I notice" or "I wonder" based on what they saw while encoding the image. During recall they were asked to state everything they could remember about each map while looking at a blank screen and to rate the vividness of their mental imagery. Positive correlations between the encoding and recall trial fixation count support gaze reinstatement. Adolescents with higher VVIQ scores made more fixations during encoding and recall, and viewed a greater diversity of areas during recall. However, state mental vividness only correlated with fixation count during encoding. These results support previous gaze reinstatement findings when applied to an ecologically valid learning task. Further, results indicate that in addition to recall, mental vividness may be relevant during encoding, which could potentially lead to interventions that support students' visual attention during learning to enhance memory performance.

Topic Area: ATTENTION: Spatial

A63 - Investigating the effect of background images on spatial working memory representations

Nicholas Schmitz[1] (nschmitz@vols.utk.edu), Sage Bendickson[1], David Sutterer[1]; [1]University of Tennessee, Knoxville

Recent work finds that the location of remembered stimuli can be reconstructed from patterns of EEG alpha-band activity throughout a 1 to 2 second memory delay (Foster et al., 2016; Sutterer et al., 2021). This foundational work involved objects being presented on a blank background. However, an open question is whether this is the way we use spatial working memory in the real world, where many background cues are present in addition to the target object. To answer this question, we used a delayed spatial estimation task in which participants remembered the location of a target dot presented around fixation while the background alternated block-by-block between a conventional blank background and an image of a real-world setting. We hypothesized that background cues could affect spatial memory representations in opposing ways. Background cues could enhance spatial memory representations by providing a physical cue that can be attended during the memory delay. Alternatively, background cues could serve as a placeholder that can be used in lieu of maintaining the target location throughout the delay. To test between these alternatives, we applied an Inverted Encoding Model (IEM) to the topography of EEG alpha-band power to measure the spatial selectivity for the target location for each background condition. We observed higher spatial selectivity throughout the trial for blank background compared to scene background trials. Participants in the image condition were also slower and more accurate. These observations are consistent with the idea that the presence of background information reduces demands on spatial working memory.

Topic Area: ATTENTION: Spatial

A64 - Testing the duration of spontaneous spatial representation in working memory when items can be differentiated by temporal-order

Sage Bendickson[1] (sbendic1@gmail.com), Nicholas Schmitz[1], David Sutterer[1]; [1]University of Tennessee Knoxville

Space and time are proposed to play a critical role in working memory formation and maintenance relative to other object features. Prior work shows that alpha-band EEG activity spontaneously carries information about an object's location when location is task-irrelevant (Foster et al., 2017). Recent work finds that observers make microsaccades towards an objects encoded hemifield during the maintenance of non-spatial features when responses are tested by ordinal position (de Vries et al., 2023), suggesting that space maintains its prioritized role at a hemifield specific level when temporal information can be used for individuation. However, an open question is whether objects' precise locations are maintained throughout a memory delay when ordinal individuation is possible. To answer this question, we used a sequential two-item delayed color estimation task in which each stimulus presentation was followed by a 1-second delay. Observers were cued to report the color of one of the two circles based on its ordinal position (first or second). This ensured that the objects could be individuated without relying on location. We applied an Inverted Encoding Model to the topography of EEG alpha-band power to measure the spatial representation of each item in the sequence. We found a robust representation of each item's location during the delay immediately following encoding, and the spatial representation of item one did not sustain following the presentation of the second item. Thus, our results indicate that spatial locations are spontaneously maintained after initial encoding but can be discarded after new information is presented.

Topic Area: ATTENTION: Spatial

A65 - Alpha Lateralization from Distractors: Suppression-Specific and Domain-General

Joshua Seewald[1] (jseewal1@jh.edu), Natalia Khodayari[1], Howard Egeth[1], Susan Courtney[1]; [1]Johns Hopkins University

It has been widely contested whether alpha oscillations, which have been shown to index selective spatial attention, reflect target enhancement, distractor suppression, or a combination of enhancement and suppression. Recent EEG findings in auditory selective attention by Wöstmann et al (2019) showed suppression-specific neural oscillations in the alpha band independent of target enhancement effects. These results suggest that the neural processes underlying alpha lateralization in auditory selective attention include both target enhancement and distractor suppression. It is unclear, however, whether these findings are specific to auditory selective attention or are instead domain-general. Here, we examined whether Wöstmann and colleagues' alpha lateralization results are domain-general by adapting their study to a selective visual attention task using EEG. Analogous to Wöstmann's design, in our task the location of a target shape singleton was cued with 100% validity. The location of a distractor color singleton (present in all trials) was associated, with 100% validity, with the target location; when the target was lateral the distractor was midline, and vice versa. This allowed us to examine lateral enhancement effects independently from lateral suppression effects. The topography of lateral suppression effects found during our visual attention task replicated those found in Wöstmann's auditory attention task. Combined, these results validate Wöstmann's previous findings that alpha lateralization reflects a combination of neural processes of both enhancement and suppression. These results also suggest that these suppression-specific alpha oscillations are domain-general and not specific to auditory selective attention.

Topic Area: ATTENTION: Spatial

A66 - The Role of Visual Noise Complexity in Attentional Capture and Hold

Sepideh Hedayati[1] (sepidehh@unc.edu), Hannah L. Morgan[2], Joseph B. Hopfinger[1]; [1]University of North Carolina at Chapel Hill, [2]Duke University School of Medicine

The transition from the initial, automatic orienting of attention (i.e., "capture") to the more sustained holding of attention, and the influence of stimuli characteristics on these processes, remains unclear. We investigated these dynamics across four experiments with different types of neutral ("noise") stimuli and varying stimulus-onset asynchronies. Participants completed dot-probe tasks, across four different experiments in which pictures of faces or places were paired with visual noise images created by scrambling the face and place pictures. Results revealed that measures of attentional capture and hold were significantly influenced by characteristics of the noise stimuli. Specifically, the typical finding of attentional capture to faces or places was dependent upon the pixelation size of the scrambled noise images. Attention was captured to place stimuli when the noise stimuli were less pixelated, but the noise stimuli captured attention, over the place stimuli, at higher levels of pixelation. These findings provide new insights that subtle variations in the neutral stimuli significantly affect measures of attentional focus. These results challenge the assumption that faces automatically capture attention and may be more consistent with contingent capture theories (Folk et al., 1994), since the match between low-level features of the distractor and target affected measures of capture. The present results also provide evidence that the involuntary holding of attention by faces versus places follows a different time course. These results further our understanding of how 'neutral' stimuli, as well as meaningful stimuli such as faces and places, significantly shape the involuntary dynamics of attentional capture and hold.

Topic Area: ATTENTION: Spatial

A67 - Independent effects of Surveillance Attention and Spatial Attention on touch: An ERP investigation

Elena Gherri[1] (elena.gherri@unibo.it), Elisabetta Ambron[2], Gioacchino Garofalo[1], Giulia Titone[1], Branch Coslett[2]; [1]University of Bologna, [2]University of Pennsylvania

Recent evidence suggests that a low-level "early warning system" is constantly operating in the background to protect the organism from threats in the environment (Surveillance Attention, SA). SA is more prominent in the space behind the body as compared to peripersonal space directly in front. Furthermore, SA is assumed to operate at a low, bottom-up level and should be independent of other top-down spatial attention mechanisms. To investigate this possibility, SA and sustained tactile attention (STA) were orthogonally manipulated in the present event-related potential (ERP) study. On different blocks of trials, participants covertly attended to one hand (STA+) to perform a tactile target-nontarget discrimination while ignoring non-target stimuli to the unattended hand (STA-). Because SA is more strongly engaged when stimuli are presented to the hand placed in rear than in front space, posture was manipulated across blocks with participants placing one hand in front (SA-) and the other behind them, in rear space (SA+). In line with existing literature, sensory-specific ERP components elicited by tactile stimuli were strongly modulated by STA, with enhanced positivities for STA+ compared to STA-. Crucially, the same early ERP components were also modulated by SA. However, the effect of SA on touch showed an opposite pattern, with enhanced negativities for SA+ compared to SA-. This dissociation in the pattern of the effects of SA and STA on somatosensory processing reveals that these processes can be simultaneously engaged, are mediated by independent mechanisms and have different effects on touch.

Topic Area: ATTENTION: Spatial

A68 - Rhythmic and Aperiodic Activity jointly guide the allocation of selective spatial attention

Isabel Raposo[1] (isabel.raposo@student.uni-tuebingen.de), Randolph F. Helfrich[1]; [1]Hertie Institute for Clinical Brain Research

Attention samples visual space sequentially to enhance behaviorally-relevant sensory representations. While traditionally conceptualized as a static continuous spotlight, contemporary models of attention suggest that the environment is sampled in a discrete manner at a theta rhythm (3-8 Hz). But which other neural mechanisms govern the temporally precise allocation of attention? Periodic brain activity as exemplified by neuronal oscillations as well as aperiodic temporal structure in the form of timescales have been suggested to orchestrate the attentional sampling process in space and time. However, both mechanisms have been largely studied in isolation. To date it remains unclear how periodic and aperiodic temporal structures interact to give rise to multiple attention phenomena, such as the inhibition of return (IOR). Here, we simultaneously investigate these processes and their contributions to attention dynamics, using a temporally fine-grained adaptation of the Posner paradigm, designed to quantify multiple temporal regularities. The behavioral results from 22 patients who underwent intracranial EEG monitoring revealed two overlapping, yet dissociable temporal dynamics: an aperiodic decay function and theta-band modulation of reaction times. Neurophysiologically, we observe that intrinsic timescales and theta oscillations index these two distinct temporal profiles of attention. By integrating behavioral and neural data, we disentangle the rhythmic and aperiodic processes and show their interplay in shaping spatio-temporal attention dynamics in large-scale neocortical circuits centered on the fronto-parietal attention network.

Topic Area: ATTENTION: Spatial

A69 - Target Enhancement Is Not Simply One Process: Different Factors for Explicit Cueing Effects and Statistical Learning Effects on Attention

Natalia Khodayari[1] (nkhodayari@jhu.edu), Howard Egeth[1], Susan Courtney[1]; [1]Johns Hopkins University

It is unclear the extent to which the neural mechanisms of attention underlying target enhancement by top-down explicit cueing and by statistical learning are the same. In previous experiments, we examined the sensitivity to state factors of mechanisms of explicit cueing and statistical learning. In those experiments, a six-item visual array was briefly presented. During explicit cueing blocks, a letter cue informed participants of the likely target location. During statistical learning blocks, a ready signal was presented without target information, and the target was most likely to appear in one of six locations. The results showed a contrast: whereas attention driven by explicit cueing is trait-like and more stable in the face of state changes, attention driven by statistical learning is more sensitive to state changes across days. To verify replicability of these results, we conducted a within-subjects test-retest study, where each participant (N = 85) completed both tasks in each of two sessions, 3-8 days apart. We replicated our original findings, showing that individual difference measures of target cueing (invalid – valid target cue) and target frequency (infrequent – frequent target location) yielded internally-reliable measures within each session. This replicates our findings that both tasks yield stable, trait-like, behaviors within each session. Measures for statistical learning, however, did not correlate across sessions, suggesting these measures are reliable within days but not across days (i.e., they are sensitive to long-term changes). These results demonstrate a clear contrast between the factors underlying mechanisms of attention for top-down and statistical attentional control.

Topic Area: ATTENTION: Spatial

A70 - A Neuroinformatics-Computational Approach to the Assessment of Visuospatial Neglect

Vinoth Jagaroo[1,2] (jagaroo@bu.edu), Woo Zhong Han[3], Kiran Jagaroo[4], Sophia Andrienko[3], Annie Chen[3], Darian Cheung[3], Daniel Doh[3], Zekai Wu[3], Joshua Yip[3], Justin Zheng[3]; [1]Boston Univ. School of Medicine (Behavioral Neuroscience), [2]Emerson College, [3]Boston University Center for Computing & Data Sciences and SPARK! Program, [4]University of Massachusetts-Boston, College of Science & Mathematics

Hemispatial neglect, a complex neurocognitive disorder with differential neural mechanisms, manifests in 30% of stoke patients. Neuropsychological assessment of neglect is hindered by outmoded 'paper-and-pencil' tests, ill-suited to complex cognitive and neural dynamics of neglect. There is pressing need for computational methods in the assessment of neglect. We describe the successful development of an informatics platform for the analysis of neglect. Theoretical impetus for the platform stems from the spatiotopic model of neglect, centered on Brodmann's area 7 (posterior parietal) – representational neglect is function of spatiotopic compression that can be mathematically described. The platform uses a scalable grid -- array of cells of a computer screen that record the coordinates of content displayed. Grid-based mapping applies Manhattan Distance -- coordinate translations with the center (0,0 coordinate) as the reference point. Two visuospatial tests, Letter Cancellation and the Boston Visuospatial Battery (BVB), were digitized. The clinician selects the letter cancellation task or an image from the BVB. Selected test is displayed on the grid matrix. Patient uses a mouse or touchpad to trace the image. Based on neglect gradient extracted by the software, the image can be incrementally moved. Patient then retraces the image, and the process is repeated until no neglect is recorded. A mathematical rendering of the gradient of neglect is generated. With further data acquisition, we aim to (a) apply machine learning methods to combine several predictive models to make predictions about patients' visuospatial prognosis, and (b) tie their computational patterns of neglect to fMRI imaging data.

Topic Area: ATTENTION: Spatial

A71 - Can 3D shape-from shading be a marker of post-stroke recovery?

Marjola Peca[1] (mrp18fqc@bangor.ac.uk), Ayelet Sapir[1], Giovanni d'Avossa[1]; [1]Bangor University

To perceive depth in 2D images, the visual system relies on monocular cues such as shape-from-shading, where shading is interpreted relative to an assumed light source. Typically, objects with brighter tops are perceived as convex and those with darker tops as concave, reflecting the assumption that light comes from above. Research consistently shows a leftward bias in the assumed lighting direction, possibly linked to right-hemisphere dominance in shape-from-shading processing. Interestingly, post-stroke survivors with left spatial neglect exhibit a different bias in the acute stage compared to age-matched healthy individuals, suggesting that shape-from-shading perception may be influenced by spatial attention. This study investigates whether a simple 3D shape-from-shading task can serve as a marker of spatial neglect recovery in post-stroke survivors. We are conducting a longitudinal study on individuals with right-hemisphere strokes and left-sided neglect, assessing them at two time points: upon admission to a rehabilitation clinic and before discharge. Participants complete the Montreal Cognitive Assessment (MoCA), a bell cancellation task, and a 3D shape-from-shading judgment task. To evaluate whether performance on the 3D task reflects recovery, we compare bias differences between sessions. We then examine associations between the 3D task, MoCA, and the bell cancellation task to determine whether changes are specific to spatial attention or broader cognitive function. Our findings will show whether perceptual biases in shape-from-shading can serve as markers of visuospatial recovery in stroke patients, potentially informing future diagnostic and rehabilitative strategies.

Topic Area: ATTENTION: Spatial

A72 - The Relation of Early Adversity to Language Processing, Emotion Reactivity, and Working Memory

Emily R. Drucker[1] (emilyrosadrucker@gmail.com), Alisha B. Compton[2], Claire M. Tate[3], James R. Booth[4]; [1]Hunter College, [2]Vanderbilt Brain Institute, [3]Baylor College of Medicine, [4]Vanderbilt Psychology and Human Development

Early adversity is known to affect emotion and cognition, but more research is needed on distinct effects of varying types of adversity. The dimensional model of adversity groups experiences postulated to have similar consequences and includes the dimensions of threat and deprivation. This project aims to examine deprivation as a unique factor underlying language skill, threat as a unique factor underlying emotion reactivity, and the relation of both to working memory, but perhaps more for deprivation. 48 children, 7-12 years (Mage=10.11), completed an experimental rhyming task that manipulates lexical processing (low- vs. high-frequency words), affective valence (negative vs. neutral images), and working memory (2- vs. 1-back load). Parents completed surveys on the child's threat (VEX-R) and deprivation (ECLS) experiences. Using hierarchical regressions, we examined variance explained by threat and deprivation, above and beyond age and the other, in lexical processing, affective valence, and working memory performance. Trends suggest a unique relation of deprivation to lexical processing accuracy ($\Delta R2=7.44\%$, $F(1,44)=3.91$, $p=0.054$), and working memory reaction time variability (RTV; $\Delta R2=6.74\%$, $F(1,44)=3.89$, $p=0.055$), in line with a dimensional model. We also see a significant unique relation of threat to lexical processing RTV ($\Delta R2=9.28\%$, $F(1,44)=6.08$, $p=0.018$) and a trend with reaction time ($\Delta R2=4.87\%$, $F(1,44)=2.96$, $p=0.09$). Prior literature suggests threat, but not deprivation, relates to processing speed and response caution. Yet other studies have found an association between deprivation and response inhibition. To further examine associations of the dimensional model with RTV we will analyze a larger sample and examine relevant neural correlates with fMRI.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A73 - Does the neural representation of symbolic magnitude task predict future mathematical ability in young children?

Amanda Martinez-Lincoln[1] (amanda.martinez-lincoln@vanderbilt.edu), Gavin Price[2], Laurie Cutting[1]; [1]Vanderbilt University, [2]University of Exeter

Children's behavioral performance on symbolic comparison tasks is robustly correlated with their concurrent and future mathematical ability [1]. Parallel to behavior findings, brain imaging data indicates that the left and the right intraparietal sulci (IPS) are important brain regions associated with symbolic comparison tasks [2] and individual differences in IPS activation are correlated with mathematic skills [3]. In addition to the IPS, the arithmetic network also includes auxiliary brain areas, including the prefrontal cortex, which supports executive functioning (EF) processes [4]. Activity in these auxiliary prefrontal brain regions typically increases during the early stages of learning math [5]. While brain findings support the idea of a developmental shift in reliance on ancillary EF brain regions [6-8], how this shift relates to future mathematical ability is unclear. The current study will examine whether the neural representation in math and auxiliary EF brain regions predicts future mathematic skills in children. 94 kindergarten children completed behavioral mathematical measures and neuroimaging, which they completed a symbolic comparison task. Children returned in first grade for behavioral testing (time 2). Behavioral findings indicate that mathematical ability at time 2 was positively correlated with early symbolic numeracy ($r = 0.49$, $p = 0.01$) at time 1. Data will be analyzed to examine if the neural representation of the symbolic magnitude task in kindergarten predicts first-grade mathematic skills. This study's findings will provide a greater understanding of the development of math skills and the relationship between executive function and math.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A74 - Exploring the Eye Dynamics of People with bvFTD and Apathy in Ecological Settings

Claire Berner[1] (clairelisebernen@gmail.com), Elena Karpinski[1], Julie Behenská[1], Richard Levy[1], Karim N'Diaye[1], Monica N. Toba[1,2], Bénédicte Batrancourt[1]; [1]Paris Brain Institute (ICM)Sorbonne Université, Institut du Cerveau - Paris Brain Institute – ICM, Inserm, CNRS AP-HP, Hôpital de la Pitié Salpêtrière, Paris, France., [2]Laboratory of Functional Neurosciences (UR UPJV 4559), University Hospital of Amiens and University of Picardie Jules Verne, Amiens, France

Introduction: The behavioral variant of frontotemporal dementia (bvFTD) impairs social, emotional, cognitive, and behavioral functioning, with apathy—a core symptom—leading to diminished motivation and purposeful behaviors (Rascovsky et al., 2011; Levy and Dubois, 2006). The ECOCAPTURE initiative at the ICM studies apathy's pathophysiology and digital biomarkers, previously demonstrating (ECOCAPTURE@LAB, Clinicaltrials.gov: NCT03272230) that apathy in bvFTD impairs exploratory and goal-directed behaviors, through reduced exploration in a waiting room with cameras and sensors (Batrancourt et al., 2019). Methods: Building on these findings, this study uses eye-tracking to refine the apathy signature in bvFTD, assessing visual exploration in ECOCAPTURE@LAB. We hypothesized that higher apathy correlates with reduced visual exploration and engagement, and examined the relationship between gaze dynamics, the Starkstein Apathy Scale, and structural MRI analyses linking ocular dynamics to frontal eye fields (FEF), a key region for saccadic movements. Results: bvFTD patients exhibited an overall lower saccade frequency and reduced gaze efficiency than controls, suggesting impaired visual exploration linked to FEF atrophy. Greater variability in saccade frequency among bvFTD participants indicated inefficient exploration that may superficially appear as high exploration but lacks goal intent. Correlation analyses revealed contrasting trends: controls had a non-significant negative correlation between apathy and saccade frequency, while bvFTD patients exhibited a significant positive correlation, potentially reflecting self-report biases from anosognosia or inefficient visual exploration. Conclusion: This study highlights eye-tracking as an objective and quantitative tool for investigating apathy and its behavioral impacts, offering deeper insights when paired with neuroimaging.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A75 - Neurocognitive development in adolescence: The importance of age versus pubertal stage

Erynn Christensen[1] (erynnchristensen@gmail.com), Katharina Brosch[1], Elvisha Dhamala[1]; [1]Institute of Behavioral Science, Feinstein Institutes for Medical Research, Manhasset, NY, USA

Puberty involves physiological and neuroanatomical developments supporting cognitive functions that influence decision-making. Typically, research looking at neurocognitive development in adolescence is focussed on age-related relationships. However, with puberty starting at younger ages, it raises the question of whether age-related benchmarks are the most effective way to understand this developmental period. Using a large longitudinal dataset (ABCD Study), the present study investigated the extent to which age and pubertal stage influence cognitive development across adolescence (9-15yrs). Data from the Flanker, Pattern Comparison Task (PCT), and the Little Man Task (LMT), age, and the Pubertal Development Scale (PDS) were collected at baseline (N=9766, 48% females), and 2- (N=7520, 47% females) and 4- (N=2818, 48% females) year follow-ups. Linear mixed effects models found that Flanker and LMT performance was significantly positively predicted by age but not pubertal stage (β=2.04, p<.001 for Flanker; β=236, p<.001 for LMT). For PCT, age (β=5.50, p<.001) and pubertal stage (β=0.32, p=0.02) significantly positively predicted task performance, with age having a larger effect. The interaction between age and pubertal stage did not predict Flanker performance, but did predict PCT (β=-0.22, p<.001) and LMT (β=6.11, p=.002) performance. Findings indicate that age is the best predictor of cognitive development across all domains. However, pubertal development independently, and through its interaction with age, influences development within specific cognitive domains. Thus pubertal maturation could serve as an important factor in refining our understanding of cognitive changes during adolescence.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A76 - Changes In Error-Related Theta Oscillations and Post-Error Behavior Across Adolescence

Felix Zakirov[1,2] (fzaki001@fiu.edu), Kianoosh Hosseini[1,2], Ana Garcia-Morazzani[1,2], Lillian LaPlace[1,2], Jeremy W. Pettit[1,2], George A. Buzzell[1,2]; [1]Center for Children and Families, Florida International University, Miami, USA, [2]Department of Psychology, Florida International University, Miami, USA

Error monitoring, which allows for detecting mistakes and adapting behavior, is associated with increased theta (4-7 Hz) activity over the medial frontal cortex (MFC). These neural changes are typically followed by post-error adjustments of performance at the behavioral level. However, few studies have investigated developmental patterns in these processes across adolescence and the potential impact of social observation. To close these gaps, we analyzed 64-channel EEG and behavioral data from adolescents aged 11-14 (n=158) who performed a flanker task twice: once while alone and once while observed by a peer. To assess error monitoring processes, we computed measures of response-locked (0-250 ms) theta power, inter-trial phase synchrony (ITPS), and inter-channel phase synchrony (ICPS). For each neural measure of interest, we fit mixed-effects regression models to assess the potential effects of accuracy, social observation, and age. Regardless of social observation, we identified significant accuracy X age interactions for both power (p< .001) and ITPS (p = .004); age-related increases were most prominent for error-related responses. These neural effects were mirrored by similar age-related improvements in post-error behavior (post-error accuracy and post-error reduction in interference). Only ICPS between the MFC and visual regions exhibited interactions with social context (p = .038). Specifically, age-related increases in synchrony between MFC and visual regions were most pronounced for error-related responses in the alone condition. The results suggest selective influence of social observation on error monitoring across age. More broadly, these data provide evidence for age-related improvements in error monitoring at the neural and behavioral levels.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A77 - White matter tract development may reflect cognitive development in the context of executive functioning

Emily M Harriott[1] (emily.m.harriott@vanderbilt.edu), Tin Q Nguyen[1], Kellam Schmudde[1], Chenglin Lou[1], Bennett A Landman[1], Laura A Barquero[1], Laurie E Cutting[1]; [1]Vanderbilt University, Nashville, TN, USA

Functional neuroimaging studies provide evidence to suggest that executive functioning (EF) relies on a network of distinct and largely bilateral frontal brain regions. These regions are thought to be connected by white matter tracts, pathways by which neural signals are transmitted. Emerging evidence suggests that the microstructure of these tracts, measured using diffusion weighted imaging (DWI), influences performance on EF tasks. However, little is known not only about which tracts influence EF performance, but also how those tracts develop across childhood. In a sample of children assessed at two timepoints (N=89, M=5.77 +/- 0.37 years at timepoint 1; N=59, M=6.79 +/- 0.37 years at timepoint 2), we investigated relationships between fractional anisotropy (FA), a DWI metric quantifying the direction of water molecule movement along white matter tracts (thought to reflect tract "integrity"), and performance on three EF tasks (working memory, cognitive flexibility, inhibition). We used FreeSurfer's TRACULA to reconstruct 42 white matter tracts and calculate their FA values. Exploratory regression analyses were run at each timepoint, using each tract's FA to predict each concurrent EF outcome. A comparison of the regression models from timepoint 1 to those from timepoint 2 suggests development in relationships between performance on EF measures and FA in the prefrontal and premotor portions of the corpus callosum, in addition to the bilateral cingulum bundles and superior longitudinal fasciculus 1. From these preliminary results, we hypothesize that, similar to the cognitive development of EF, the white matter tracts underlying EF may also form and specialize over time.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A78 - Gender Insights on 24-hour Movement Behaviors and Cognitive Function among the ABCD Cohort: a Compositional Data Analysis
Michelle Lim[1] (michelle.lim@uri.edu), William W. Lewis-de los Angeles[2,3], Nicole E. Logan[1]; [1]University of Rhode Island, [2]Warren Alpert Medical School of Brown University, [3]Emma Pendleton Bradley Hospital

INTRODUCTION: The cognitive benefits of physical activity (PA) are well-documented. Yet, boys typically spend more time in PA during adolescence than girls, and the gender differences concerning cognitive benefits associated with PA remain elusive. Compositional data analysis (CoDA) is the statistical tool that assesses the interaction between time spent in PA and other movement behaviors that make up the 24-hour day in a single statistical model. We investigated how 24-hour movement behaviors are associated with cognitive function in boys and girls using CoDA. METHODS: Early adolescents (N=4082; F=1997; aged 11.97 ± 0.65 years) from the Adolescent Brain Cognitive Development (ABCD) study at Year 2 were analyzed. CoDA was used to explore predicted changes in cognitive function (NIH Toolbox) with 60-min time reallocations between sleep, sedentary behaviors, light PA, and moderate-to-vigorous PA (MVPA), obtained by wrist-worn accelerometer. Estimated cognitive function response curves were based on significant regressions from isometric log-ratio coordinates of time spent in movement behaviors, adjusted for covariates (age, puberty, household income, BMI). RESULT: Significant R2 changes were observed for picture vocabulary (girls: adj-R2=0.24,p<0.001; boys: adj-R2=0.19,p<0.001), flanker (girls: adj-R2=0.05,p<0.001; boys: adj-R2=0.04,p<0.001), and oral reading tasks (girls: adj-R2=0.14,p<0.001; boys: adj-R2=0.13,p<0.001). CoDA with 95% CI revealed that a 60-min increase in MVPA among girls, but not boys, was significantly associated with improved picture vocabulary (0.10, 6.33), flanker (1.03, 7.05), and oral language performance (0.04, 5.01). CONCLUSION: CoDA reveals that increasing MVPA by 60 minutes a day in early adolescent girls is associated with improved cognitive functioning.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A79 - Divergent aging trajectories of aperiodic neural activity between neurotypical adults and those with autism spectrum disorder
Christian Cazares[1] (cazares@ucsd.edu), Anet Estrada[1], Bradley Voytek[1]; [1]University of California, San Diego

Previous studies have identified several candidate electrophysiological biomarkers for cognitive aging in adults, with one emerging biomarker being aperiodic (1/f-like) neural activity measures. However, how these age-related changes in aperiodic neural activity differentially manifest in autism spectrum disorder (ASD) remains unknown. Here, we analyzed an open, resting-state EEG dataset from 56 participants (ASD and age-matched neurotypical controls, aged 20-70 years, sourced from Dickinson et al., 2022) using mixed-effects models to characterize non-linear age relationships while controlling for aperiodic-adjusted oscillatory power (theta, alpha, beta), social responsiveness scale scores, and sex. All regions showed negative associations between aperiodic neural activity measures and aging (p<0.001), replicating prior work showing that older adults tend to have "flatter" spectra than younger adults. For the aperiodic exponent, we found group differences in how aging was associated with activity in central (β=0.786, p<0.001) and temporal regions (β=0.821, p=0.015), where people with ASD had lower exponents with increasing age. We found similar age-related group differences in aperiodic offset across central (β=1.019, p=0.011), temporal (β=1.053, p=0.036), and occipital regions (β=1.146, p=0.037). Our findings suggest fundamentally different aging trajectories in aperiodic neural activity between ASD and healthy individuals. Specifically, while neurotypical controls showed negatively-tilted, U-shaped trajectories across age, individuals with ASD showed continuous decline in both aperiodic neural activity measures. Given higher rates of cognitive and neurodegenerative conditions in aging adults with ASD, these findings support the inclusion of resting-state aperiodic features as candidate biomarkers for tracking aging trajectories in ASD, potentially informing targeted interventions for this highly heterogeneous population.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A80 - Set-shifting in older age: Insights from of a large cohort.

Margarita Darna[1] (margarita.darna@lin-magdeburg.de), Constanze I. Seidenbecher[1,2,3,4], Björn H. Schott[1,2,5,6], Anni Richter[1,3,4]; [1]Leibniz Institute for Neurobiology (LIN), Magdeburg, Germany, [2]Center for Behavioral Brain Sciences (CBBS), Magdeburg, Germany, [3]German Center for Mental Health (DZPG), partner site Halle-Jena-Magdeburg, [4]Center for Intervention and Research on adaptive and maladaptive brain Circuits underlying mental health (C-I-R-C), Halle-Jena-Magdeburg, [5]German Center for Neurodegenerative Diseases (DZNE), Göttingen, Germany, [6]Department of Psychiatry and Psychotherapy, University Medical Center Göttingen, Göttingen, Germany

With aging, the brain undergoes structural and functional changes and many cognitive functions show both decline and adaptation. One such function is set-shifting, an executive function crucial for daily life. Previous studies on set-shifting in old age have reported somewhat inconclusive results on both behavioral changes and on the underlying neural mechanisms. Here, we aimed to elucidate neurocognitive correlates of set-shifting in older adults using behavioral, electrophysiological, and biochemical measures. To this end, we recruited a large cohort of 122 young (18 to 35 years) and 100 older participants (60 to 85 years), that was tested using in an EEG compatible set-shifting task. Our key findings are: 1) older adults showed increased switch costs in reaction times but reduced overall error rates compared to young adults , 2) older adults had overall lower midfrontal theta power which lacked modulation during set-shifting and 3) older adults lacked amplitude differences in the late posterior switch positivity across distinct set-shifting difficulty levels. Our findings suggest that theta modulation during cognitive control declines with age and that alternative neural resources might instead be recruited. Thus, older adults can still successfully set-shift, albeit without showing theta modulation as a function of varying set-shifting difficulty levels. We additionally plan to present preliminary results on age-related differences in gamma oscillations and biochemical measures of extracellular matrix integrity as a potential factor influencing set-shifting in older age.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A81 - Four Key Networks Across the Lifespan: A Precision fMRI Study

Ashley Jaimes[1] (ashley.jaimes@fsu.edu), Diana Perez[2], Gretchen Wulfekuhle[1,3], Ally Dworetsky[1,4], Nathan Labora[1,5], Zach Ladwig[2], Mackenzie Mitchell[1], Caterina Gratton[1,2,6]; [1]Florida State University, [2]Northwestern University, [3]University of North Carolina, [4]Washington University, [5]University of Minnesota, [6]University of Illinois Urbana-Champaign

Aging is a universal process, yet its impact varies across individuals. While some individuals experience significant decline, others maintain cognitive abilities comparable to younger individuals. Research shows that brain networks change as we age, with less connectivity within-networks, and more connectivity between networks, leading to reduced segregation. These changes are apparent in association networks critical to cognitive function. Precision fMRI shows that brain network features, including size, shape, and borders between network regions, differ significantly between people. This variability emphasizes the importance of individualized brain mapping to better understand age-related changes in brain networks. The current study uses precision fMRI to investigate resting-state functional connectivity across the adult lifespan (N = 159, ages 18-75) in four association networks: the Default Mode Network, Frontoparietal, Cingulo-Opercular, and Salience Network. We used three individual network mapping methods (MSHBM [Kong et al., 2019], template matching [Gordon et al., 2017], and Infomap [Rosvall and Bergstrom, 2008]). We found that the frontoparietal network is significantly smaller with age (MSHBM $p < 0.005$; template matching $p < 0.001$; Infomap $p < 0.005$). Results in other networks were less consistent across methods and individuals. These findings may contribute to the patterns of desegregation in association networks observed in previous studies. Finally, the results underscore the value of considering individual differences in brain network organization in aging.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A82 - Impact of non-verbal reasoning and baseline individual differences in cognitive training to enhance mathematical abilities

Nieves Ruiz Ibáñez[1] (nieves.ruiz.ibanes@ki.se), Julia Ericson[1], Torkel Klingberg[1]; [1]Karolinska Institutet

Enhancing spatial abilities has been suggested as a promising approach to improving mathematical skills. We hypothesized that training with non-verbal reasoning (NVR) tasks would positively influence mathematical learning and that the benefits of training would vary depending on individual differences. We included 1,028 children, aged 5–9 years, who used an adaptive mathematical and cognitive training program for 4 weeks. Participants were randomly assigned to training plans that varied in the proportions of NVR and visuospatial working memory (VSWM) tasks, with equal amounts of mathematical training. Data from the first week of training — including measures of reaction times, accuracy, and trial counts of all tasks — were input into a gradient boosting regressor that predicts the final performance on a number line task. This model was trained on an independent dataset of 33,000 children. Predicted performance (level) was included as a covariate for analyzing the new data. The amount of time spent on NVR tasks was generally associated with greater improvements in math performance. However, there was a negative interaction between the amount of NVR training and baseline performance, such that children with greater mathematical difficulties at baseline, as defined by the prediction algorithm, benefited more from NVR training, while children with higher performance at baseline showed greater improvements training on VSWM tasks instead of NVR. These findings highlight the importance of individualizing cognitive training. They also emphasize the potential of machine learning tools to optimize education, offering personalized strategies to meet each child's unique needs.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A83 - Synchronized music and rhythmic visual stimulation increases theta-gamma phase-amplitude coupling in Mild Cognitive Impairment

Arun Asthagiri[1], Benjamin M. Kubit[1], Xiaotong Wu[1], Ji Chul Kim[2], Edward W. Large[2], Psyche Loui[1]; [1]Northeastern University, [2]University of Connecticut

Gamma sensory stimulation has emerged as a promising non-invasive treatment for Alzheimer's Disease (AD), shown to mitigate neurodegeneration in mouse models (Iaccarino et al, 2016) and support cognition in older adults (Chan et al., 2022). Working memory decline in aging is causally related to decreased theta-gamma coupling (Reinhart & Nguyen, 2019), especially with AD (Goodman et al., 2018). While direct neural stimulation (for example, using transcranial alternating-current stimulation) has been shown to improve theta-gamma coupling (Reinhart & Nguyen, 2019), music provides an affordable, and typically more enjoyable, alternative for entraining theta-band brain activity at frequencies that reflect the perceived beat (Tichko et al., 2022). Here, we present results from an audiovisual intervention that uses musical rhythm to drive delta-theta frequencies and modulate visual gamma stimulation. We hypothesize that (1) music entrains neural oscillations in theta band, (2) entrained theta frequencies are coupled to gamma activity, and (3) theta-gamma coupling increases from pre to post intervention. In an ongoing clinical trial, 21 participants with mild cognitive impairment (scoring >=0.5 on Clinical Dementia Rating Scale) used the intervention at home for 8 weeks. Completion rates were high (87%) and preliminary results showed that the music and gamma light stimulation successfully entrained music-specific delta and theta frequencies. Furthermore, the intervention facilitated phase-amplitude coupling between the targeted theta and gamma frequencies, which increased from pre to post intervention in frontocentral electrodes. Overall, the results suggest that the gamma music-based intervention leverages musical rhythm to enhance cross-frequency coupling that is disrupted in AD patients.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A84 - Spindles in Patients with Dravet Syndrome

Joanne Hall[1] (hall.joa@northeastern.edu), Mathew Yarossi[2], Alexander Rotenberg[3]; [1]Northeastern University, [2]Harvard University

Introduction: Dravet Syndrome (DS) is an epileptic encephalopathy caused primarily by haploinsufficiency of the SCN1A gene, disrupting fast-firing GABAergic inhibitory interneuron signaling, potentially leading to seizures, cognitive delays, and motor impairments. Studying sleep microarchitecture (vital for neurodevelopment), offers potential for identifying early-life biomarkers. Sleep spindles - rhythmic bursts of activity during NREM sleep – may reflect sensory-motor integration (particularly fast spindles, ~12.5-16 Hz), memory consolidation, and neural plasticity. Methods: EEG data of patients with DS and age-matched controls were band-pass filtered in the sigma range from 9-16 Hz. Stage 2 NREM sleep was analyzed for spindle duration, Intrinsic spindle frequency (Hz) (via FFT), temporal overlap (spindle-event co-occurrence) and frontal hemispheric synchronization using the Phase Lag Index (PLI). Spearman correlations analyzed relationships to age, from 0-12 years. Results: Patients with DS showed faster frontal/central 10-15 Hz spindle frequencies than controls for the FFT ($p = .02$). For other metrics, controls showed significantly higher values; For frontal spindle-event temporal overlap, controls showed significantly more co-occurrence ($p = 0.001$) that strongly correlated with age ($r = .78$, $p = .02$), longer spindle duration ($p = .005$), and stronger frontal PLI values ($p = .004$). Conclusions: The results suggest N2 sleep spindle deficits may reflect impaired inhibitory signaling in networks crucial for synchronization and information processing during sleep. Full spindle activity supports higher-order integration of daily events, while deficient spindles links to cognitive and sensory disability. These metrics could serve as biomarkers for interventions targeting intellectual/cognitive function (slow spindles) and sensory-motor integration (fast spindles).

Topic Area: EXECUTIVE PROCESSES: Development &aging

A85 - Sound Minds: Testing a novel Cognitive Framework for Rhythm-focused MBIs to address age-related cognitive declines

Cloie Dobias[1] (dobias.c@northeastern.edu), Maruša Laure[1,2], Pierre-Valery Tchetgen[1], Susanne Jaeggi[1], Aaron Seitz[1]; [1]Northeastern University, [2]University of Maribor

This sketchpad proposes a feasibility study of rhythm-focused Music-based interventions (MBIs) within a cognitive framework. Rhythm-focused MBIs have shown promise to improve executive functions and other health-related outcomes among adults with Alzheimer's disease and related dementias (ADRD). However, extant studies lack mechanistic approaches, controls, power, and rigorous and replicable methods. These limitations are addressed by following NIH MBI Toolkit guidelines with a theory-based cognitive framework in a clinical trial testing how rhythm-focused MBIs can ameliorate age-related cognitive decline. The primary intervention is a cognitively complex rhythm-based MBI employing "naturalistic" conversational drumming approaches. Participants will learn probabilistic sequences based upon musical grammars, spatially map sounds on "virtual instruments", and practice call-response behaviors. The control is a standard rhythm-based MBI tapping game where participants follow the beat. These MBIs will be piloted in adults 60+ to test adherence, acceptability, and engagement. Potential findings will inform the extent to which these interventions are well-tolerated and effectively exercise the proposed cognitive constructs, as well as the feasibility of at-home implementation of the interventions and outcome measures. This research will provide fundamental information to motivate future studies addressing efficacy of rhythm-focused MBIs as tools for healthy cognitive aging, which is an important step towards the long-term goal of testing the extent to which rhythm-focused MBIs cognitively engage patients with mild cognitive impairment and ADRD.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A86 - Frontostriatal white matter connectivity: longitudinal development through adolescence and associations with reward and executive control processes

Vanessa Lozano Wun[1] (vlwun@umn.edu), Paul F. Collins[1], Samuel D. Klein[1], Monica Luciana[1]; [1]University of Minnesota

Adolescence is marked by significant change, including alterations in neural systems underpinning executive control and reward processes. Structural and functional variations in frontostriatal circuits are implicated in alterations of self-control, reward sensitivity, and sensation-seeking during adolescence. While seminal work in nonhuman primates has established that frontostriatal connections proceed along a ventromedial-dorsolateral gradient, this has only recently been validated in humans. Using resting-state functional connectivity (rsFC), work from our lab established that these gradients refine during adolescence, including a) developmental increases in ventral striatum (VS) rsFC with brain areas implicated in reward processing, b) concurrent VS rsFC decreases with areas implicated in executive function (EF), and c) the opposite patterns for dorsal striatum (DS) rsFC. Moreover, more rapid developmental increases in VS rsFC with reward areas were related to improvements in reward-based decision-making, whereas increases in DS rsFC with EF areas were related to improved EF (Klein et al., under review). However, it remains unclear if frontostriatal white matter (WM) connectivity exhibits the same ventromedial-to-dorsolateral gradient. Using data from 153 individuals with 360 total scans acquired across 4 waves and 8 years (ages 11-32 years), probabilistic tractography was performed for ventral (VS to medial orbitofrontal cortex) and dorsal (DS to dorsolateral prefrontal cortex) frontostriatal WM tracts. The longitudinal developmental trajectories of WM microstructure and associations with reward sensitivity (self-reported via the Behavioral Activation System Scales) and EF (composite index of Digit Span, CANTAB Spatial Working Memory, Tower of London, and spatial delayed response performance) will be assessed using hierarchical linear modeling.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A87 - Gamma Power is a Timescale-Dependent Biomarker for Cognition in Young Adults with Down Syndrome in a Clinical Trial of Transcranial Photobiomodulation

Lauren Sidelinger[1,2] (lsidelinger@mgh.harvard.edu), Maia Gersten[1,2], Puneet Velidi[1,2], Borja Ferreras[1,2], Katelyn Sylvester[1,2], Carlos Lohmann[1,2], Fabio Luchese[1,2], Paolo Cassano[1,2]; [1]Massachusetts General Hospital, [2]Harvard Medical School

Down syndrome (DS) is an intellectual disability characterized by alterations in brain oscillatory patterns and mitochondrial dysfunction. More specifically, in the gamma band (30Hz-100Hz), individuals with DS, and other neurodegenerative conditions like Alzheimer's disease, have less gamma power compared to age-matched controls. Gamma power has also been correlated with cognitive performance in an elderly healthy population, suggesting that gamma oscillations could make an effective neuromodulation target. The present analyses investigate whether changes in gamma power correlate with changes on neuropsychological test performance for young adults with DS (n=14) and take place in the context of a double-blind sham-controlled clinical trial for transcranial photobiomodulation (t-PBM) using near-infrared (NIR) light. Neuropsychological testing (such as the Kaufman Brief Intelligence Test-II (KBIT-2)) and an EEG were performed at baseline (BL), 6 weeks (6W) immediately following a treatment block, and 12 weeks. These preliminary analyses investigate whether changes in gamma power, either occurring naturally or induced by t-PBM potentially engaging neural oscillations of the gamma frequency band, correlated with changes in cognitive performance between sessions. We found that the KBIT-2 IQ Standard Score performance correlated with low gamma (31Hz-55Hz) power for baseline performance ($r=0.63$, $p=0.022$) and that changes in performance between BL and 6W correlated with changes in lower gamma power at these timepoints ($r=0.65$, $p=0.02$). However, changes from BL to 12W ($r=-0.14$, $p=0.66$) and 6W to 12W ($r=-0.07$, $p=0.82$) were insignificant. This raises interesting questions about the reliability and usability of gamma power as an indicator of cognitive performance and change.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A88 - Feedback sensitivity in younger and older adults: Effects of social content and valence on time estimation and event-related potentials

Lindsay A. Santacroce[1] (lsantacroce@torontomu.ca), Santhiya Purohit[1], Kieryn E. A. Carlse[1], Ben J. Dyson[2], Julia Spaniol[1]; [1]Toronto Metropolitan University, [2]University of Alberta

Navigating social environments requires attending to feedback, both positive and negative, and adjusting behaviour accordingly. Prior research in younger adults has found that negative and social feedback have stronger effects on brain and behaviour than positive and nonsocial feedback, respectively. However, little is known about age-related changes in feedback sensitivity, although theories of lifespan development might suggest reduced sensitivity to feedback overall and differential sensitivity to feedback valence and social content in older adults. The current study recorded electroencephalogram while younger and older adults completed a time estimation task in which they estimated the passing of one second and received positive or negative feedback from social or nonsocial sources. The behavioural results revealed greater estimation adjustments following negative vs.

positive feedback, suggesting greater sensitivity to negative stimuli, and overall better performance with social vs. nonsocial feedback. Surprisingly, there were no age differences in the behavioural results. Event-related potential results, however, revealed age-related differences in the neural processing of feedback. Younger, but not older, adults showed greater sensitivity to negative feedback, as reflected in a later P2 component for negative compared to positive feedback. Both age groups exhibited increased neural processing of social feedback, as indicated by a later P300 component for social compared to nonsocial feedback. These findings suggest that feedback processing may be sensitive to age-related change.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A89 - Title: Exploring Cognitive and Olfactory Differences in APOE e4 Carriers

Hector Reyes[1] (hreyes0762@sdsu.edu), Claire Murphy[1,2,3]; [1]San Diego State University, [2]SDSU/UCSD Joint Doctoral Program in Clinical Psychology, [3]University of California San Diego Department of Psychiatry

Objective: APOE e4 carriers are at heightened risk for Alzheimer's Disease (AD), exhibiting cognitive and olfactory deficits associated with AD pathology (Corder et al., 1993; Michaelson, 2014; Murphy, 2019; Saunders et al., 1993; Small et al., 2003). This study investigates whether APOE e4 carriers perform differently on cognitive and olfactory tests compared to non-carriers and explores potential moderating effects of tau and amyloid biomarkers. Participants and Methods: Sixty-five cognitively unimpaired adults completed the Alzheimer's Disease Assessment Scale Cognitive Subscale (ADAS-Cog) and olfactory assessments. All variables were converted to z-scores for comparability. Separate ANOVAs tested group differences for cognitive and olfactory assessments, while linear regressions examined biomarker moderation effects. Results: Results revealed significant group differences between e4 carriers and non-carriers in ratings of odor familiarity ($p = .0031$. Plasma biomarkers did not significantly moderate the relationship between APOE status and odor familiarity. However, exploratory plots revealed important trends. Familiarity ratings decreased as pTau 181 increased across groups, while AB42/AB40 ratio showed opposing trends for carriers and non-carriers. Conclusions: These findings reveal complex relationships between olfactory performance, APOE status, and AD biomarkers. The results may reflect underlying mechanisms not yet fully understood. Further investigation is needed to clarify the implications of these findings and the role of odor familiarity as a marker of olfactory performance in AD risk. Supported by NIH grant # R01AG062006 from the National Institute on Aging to CM. We thank Conner Frank, Abbey Albertazzi, Taline Bicakci, Aaron Jacobson and Drs. Jaime Mondragon and Douglas Galasko for their contributions.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A90 - The effects of aging on task representations during rapid instructed task learning

Kirsten L. Peterson[1] (klp173@newark.rutgers.edu), Luke J. Hearne[2], Ravi D. Mill[1], Michael W. Cole[1]; [1]Rutgers University, Newark, NJ, United States, [2]QIMR Berghofer Medical Research Institute, Brisbane, QLD, Australia

Normal aging is associated with declines in cognitive abilities, including the ability to learn new tasks from instructions. Rapid instructed task learning (RITL) enables humans to perform complex new tasks, often on the first attempt. It is theorized to depend on the frontoparietal control network (FPN) integrating task-relevant information from diverse regions. In previous fMRI studies, however, healthy older adults have shown less distinct task-related neural representations, perhaps from decreased gain and signal-to-noise ratios in neural populations. We therefore tested the effect of age on RITL task representations. We acquired fMRI scans of younger (18-35 years old, n=42) and older (>65 years old, n=34) adults while they performed a stimulus-response RITL task, which mapped specific visual stimuli to button press responses according to novel and previously practiced rules. For both conditions, we estimated cortical regions' total representational similarities during instructions, and stimulus and response category representations during rule implementation. In younger adults, representational similarities during instructions were highest in the visual, dorsal attention, and frontoparietal networks. Similarities increased for novel instructions, particularly in the FPN, with additional control regions also recruited. In older adults, representational similarities during practiced instructions were higher and spread across more regions, including those additional control areas. Age-related differences in novel instruction and practiced/novel stimulus representations were less pervasive, but all showed older adults to have weaker representations in mediotemporal cortex and stronger in precuneus (regions of the default mode network connected to the hippocampus) and weaker representations in ventral visual areas.

Topic Area: EXECUTIVE PROCESSES: Development &aging

A91 - Neural Correlates of Concurrent Demands on Cognitive Stability and Flexibility

Jinjiang Zhang[1] (jzhang7345@gmail.com), Raphael Geddert[1], Roshni Ammanamanchi[1], Michael Andrew[1], Tobias Egner[1]; [1]Duke University

Two core capacities of cognitive control are cognitive stability, the ability to focus attention on a current task while ignoring task-incongruent distracters; and cognitive flexibility, the ability to switch between different tasks. Whether stability and flexibility arise from distinct or overlapping neural mechanisms remains unclear as prior studies have typically investigated these capacities in isolation. We obtained functional magnetic resonance imaging data (fMRI) from 45 adult subjects while they completed a digit parity/magnitude task that independently manipulated trial-level (congruent vs. incongruent stimuli, repeat vs. switch trials) and block-level (low vs. high congruency proportion, low vs. high switch proportion) demands on stability and flexibility.

Behavioral results revealed significant main effects of congruency and switch type, as well as interactions between congruency and congruency proportion, and switch type and switch proportion, replicating well-known behavioral signatures of cognitive control over stability and flexibility. Univariate fMRI analyses revealed that switch vs. repeat trials and their interaction with low vs. high switch proportions, was associated with increased BOLD activity in lateral frontoparietal and cingulo-opercular networks, including the dorsolateral prefrontal cortex and anterior cingulate cortex. In contrast, incongruent vs. congruent trials and their interaction with low vs. high congruency proportions did not show significant univariate effects, highlighting the need for multivariate approaches. Multivariate representational similarity analysis identified neural patterns associated with congruency, switch type, and their interactions with congruency and switch proportions in lateral frontoparietal and cingulo-opercular networks. These results suggest concurrent demands on conflict-control and task-switching rely on both distinct and overlapping neural substrates.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A92 - Causal fractionation of the contribution of the prefrontal cortex to cognitive control

Jongmin Lee[1] (jongmin.lee.529@gmail.com), Alexandria Meyer[1], Keri Anne Gladhill[1], Anabel Dorfman[1], Sadie Gould[1], Derek Evan Nee[1]; [1]Florida State University

Cognitive control enables flexible and goal-directed behavior by overriding habitual responses. The prefrontal cortex (PFC) is crucial for cognitive control. Substantial research indicates that distinct cognitive control demands engage distinct PFC sub-regions supporting functional differentiation. However, causal, mechanistic evidence for the specific contribution of different PFC sub-regions to control processes remains limited. To resolve this issue, in different sessions, we separately targeted the dorsolateral prefrontal cortex (DLPFC), lateral frontopolar cortex (FPl), or a control site (primary somatosensory cortex; S1) with intermittent theta burst transcranial magnetic stimulation (iTBS), an excitatory stimulation protocol. The DLPFC and FPl were targeted due to their theoretical prominence for cognitive control and simultaneous engagement in the same cognitive control conditions. PFC targets were individually-localized based upon fMRI activations using the same task contrast. Following iTBS, participants were once again scanned with fMRI while performing a comprehensive control task that dissociates multiple forms of control. Among the control processes studied was contextual control, the ability to flexibly select context-appropriate task sets, which underlies multi-tasking and task-switching. We found that DLPFC-iTBS selectively enhanced contextual control compared to FPl-iTBS and control conditions (no-iTBS, S1-iTBS) evidenced by significantly reduced mixing costs and numerically reduced switching costs. These behavioral improvements were accompanied by reduced BOLD activation across the lateral PFC suggesting that DLPFC-iTBS improved neurocognitive efficiency. Taken together, the dissociation between the effects of DLPFC- and FPl-iTBS suggests that the DLPFC is particularly important for neurocognitive efficiency. Furthermore, these dissociations underscore the importance of pairing correlative techniques (fMRI) with causal techniques.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A93 - Latent structure inference supports behavioral flexibility

Tiffany A. Morton[1], Daniel Kimmel[1], Daphna Shohamy[1,2,3]; [1]Zuckerman Mind Brain Behavior Institute, Columbia University, [2]Kavli Institute for Brain Science, Columbia University, [3]Columbia University, NY, NY

For flexible behavior, agents must adapt their responses to stimuli based on features of the environment, which are often collectively referred to as "context". Yet, it remains unclear how one forms a mental representation of context that is abstracted away from its observable features. We hypothesized that, early in learning, agents represent conjunctions of observable features to support context-dependent behavior, but, with experience, gradually transition to an abstract representation of context. To investigate this, we developed a serial reversal learning task where the set of action and outcome contingencies for several stimuli changed in successive blocks of trials. Each set of contingencies corresponded to a latent context that subjects could exploit to infer optimal actions after a block change. Critically, throughout the course of learning, we systematically varied the number of features required to define the latent context, such that the benefit of a context-based representation increased with conjunction size. Preliminary results show that subjects utilize the latent structure to infer the optimal response. Early in learning, performance was greater on trials where the latent context was resolvable with fewer features (i.e., a simple conjunction). However, with experience, performance on trials requiring complex conjunctions improved. These results are consistent with our hypothesis that the representation of latent structure transitioned from the conjunction of observable features to an abstracted concept of context. These findings contribute to a deeper understanding of how abstracted representations of context are constructed and may inform predictions for the underlying neural representations.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A94 - Flexibility in FMRI Brain Dynamics Predicted Behavioral Stability and Flexibility

Jean Ye[1] (jean.ye@yale.edu), Saloni Mehta[1], Milana Khaitova[1], Jagriti Arora[1], Fuyuze Tokoglu[1], C. Alice Hahn[1], Cheryl Lacadie[1], Abigail S. Greene[2], R. Todd Constable[1], Dustin Scheinost[1]; [1]Yale University, [2]Brigham and Women's Hospital

Altered stability and flexibility appear transdiagnostically. How the brain dynamically supports these operations and how their disruptions are linked to psychopathology remain elusive. One possibility is that the ability to flexibly engage recurring brain states supports stability and flexibility. Here, we leveraged a multivariate computational framework and external validation to investigate whether flexibility in brain state engagement predicts individual differences in stability and flexibility in three transdiagnostic datasets. Resting-state data were collected in the Yale (N=237), Transdiagnostic Connectome Project (TCP; N=163), and Consortium for Neuropsychiatric Phenomics (CNP; N=225) datasets. Flexibility was assessed with the Behavioral Rating Inventory of Executive Function (shift; Yale) and the Rumination Response Scale (TCP). Stability was evaluated by response time during the incongruent condition of the color word task (Yale & CNP). To avoid circular analysis, we identified four recurring brain states in 390 Human Connectome Project participants. Non-negative least squares regression tracked their moment-to-moment engagement in all participants. Flexibility in brain state engagement was estimated by variability in engagement (SEV) over time. We studied if overall SEV correlated with behaviors within dataset before external validation. Lower SEV was linked to worse stability in patients (Yale: r=-0.18, p=0.03; CNP: r=-0.37, p<0.01) and more inflexibility in all participants (Yale: r=-0.15, p=0.02; TCP: r=-0.16, p=0.04). Regression models trained in one dataset successfully predicted stability in patients (Yale-to-CNP: r=0.33, p<0.01; CNP-to-Yale: r=0.20, p=0.02) and flexibility in all participants from another dataset (Yale-to-TCP: r=0.22, p<0.01; TCP-to-Yale: r=0.17, p<0.01). These results indicate flexibility in brain state engagement underpins stability and flexibility.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A95 - Decoding the Neural Generator of the Reward Positivity with simultaneous EEG-fMRI

Jaleesa S. Stringfellow[1] (jss388@newark.rutgers.edu), Malte R. Güth[2], Travis E. Baker[1]; [1]Rutgers Newark, [2]University of Minneapolis

The reward positivity (RewP) is an event-related brain elicited by reward feedback is used to study neural mechanisms of goal-directed behavior in typical and atypical populations. While the RewP is believed to originate from or near the anterior midcingulate cortex (MCC), its neural source remains a topic of debate. To resolve this issue, we utilize a new method based on simultaneous EEG-fMRI data and machine learning to decode the neural source of the RewP. We acquired EEG-fMRI data from twenty-eight healthy participants (Age: M = 23.5 years, SD = 4.24 years; 16 female) while they navigated a virtual T-maze to find rewards. We first performed a linear discriminant analysis (LDA) classification on single-trial EEG data to identify the peak temporal classification window. Next, the EEG-trained LDA classifier was then tested on the fMRI data sample set using single-trial conditions labeled as features. The EEG data accurately classified reward and no-reward conditions within a range of 250-350 ms, with a peak accuracy of 0.547 at 275 ms post-feedback. Within this time window, EEG information classified BOLD activity in the midcingulate cortex (Glasser Region a34prime, accuracy score t (21) = -2.97, p<0.01), as well as posterior cingulate (Glasser Region d23ab, accuracy score t (21) = -2.99, p<0.01). These results suggest that the neural source of the RewP comes, at least in part, from the MCC and algins with prior research and shows the feasibility of fusing EEG and fMRI data using machine learning techniques to compare neural activity across different modalities.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A96 - Impact of Task-Engaged PFC-Targeted tDCS on Neural Markers of Proactive Control in Schizophrenia

Megan A. Boudewyn[1] (mboudewyn@ucsc.edu), Ana-Maria M. Iosif[2], Cameron S. Carter[3]; [1]University of California, Santa Cruz, [2]University of California, Davis, [3]University of California, Irvine

INTRODUCTION: This study aimed to evaluate the hypothesis that transcranial direct current stimulation (tDCS) targeting the prefrontal cortex (PFC) enhances neural markers of proactive control in individuals with schizophrenia, and that tDCS effects will be maximal under conditions in which participants are performing a task engaging cognitive control neural circuitry, rather than when tDCS is delivered during rest. METHODS: We examined gamma-band power (30-50 Hz) while participants completed the Dot-Pattern Expectancy (DPX) task, after receiving 20 minutes of 2 mA PFC-targeted tDCS, compared to sham. Active or sham stimulation was administered while participants completed the N-back task or while resting in a within-participants design (4 experimental sessions; N=39). RESULTS: We observed a significant three-way interaction of tDCS, task-engagement and DPX trial type (easy versus hard) on gamma-band power (p=0.02). Follow-up analyses decomposing the three-way interaction showed that gamma power was significantly increased at right frontal electrodes following task-engaged PFC-targeted stimulation for difficult trial types (p=0.04). CONCLUSIONS: These findings are consistent with our hypothesis, suggesting that PFC-targeted tDCS can enhance neural correlates of goal maintenance in individuals with schizophrenia. The results also suggest there is value added in administering tDCS during the performance of a task designed to engage the targeted neural circuits (here, the PFC). These results contribute to the growing body of evidence indicating that PFC-tDCS enhances cognitive control processes such as proactive control in individuals with schizophrenia.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A97 - The functional organization of task-tailored neural representations for control in human neocortex

Haley Keglovits[1], Robert Zielinski[1], Apoorva Bhandari[1], David Badre[1]; [1]Brown University

Cognitive control underlies the adaptability of human behavior. The lateral prefrontal cortex (lPFC) is widely associated with cognitive control function and is thought to represent diverse task information flexibly for use as a top-down control signal. In our prior work (Bhandari et al., 2024), we found that control representations in lPFC are organized in a task tailored way to permit robust, efficient readout. For example, when the task required following a hierarchical rule – wherein a context stimulus feature conditioned which other stimulus feature was relevant to a response – the task representation was organized along an abstract context axis. Further, subspaces for each subtask compressed irrelevant inputs for that subtask and were rotated in order to minimize interference. However, this study left open how specialized such geometry is within lPFC and which of these characteristics are also found in broader cortical networks. To investigate, we measured neural responses while humans performed two categorization tasks: one with a flat, conjunctive rule structure and one with a hierarchical, context-dependent rule structure. Whole brain representational similarity analyses found widespread context sensitivity in the hierarchical task, such that stimulus features were differentially encoded based on context relevance, including in unimodal sensory cortex. This indicates that neural representation is shaped by task context broadly in the brain. Further, we employed dimensionality reduction techniques on patterns of neural activity to explore common organizing principles in task geometry. Our results provide a novel window into brain function and organization based on geometric features of task representations.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A98 - Decoding Cognitive Control Dynamics: Neural Evidence of Inertia in Cognitive Control Adjustments Following Goal Changes

Ivan Grahek[1] (ivan_grahek@brown.edu), Xiamin Leng[1], Atsushi Kikumoto[2], Ainsley Bonin[3], Amitai Shenhav[1]; [1]University of California, Berkeley, [2]Brown Univeristy, [3]University of Pennsylvania

As our goals change (e.g., transitioning from chatting with a colleague to attending a work meeting), we adjust how we process information and act. Such flexibility requires adjustments in cognitive control states that align our cognition with our current goals (e.g., adjusting attention and response caution). Here, we leverage computational modeling and EEG decoding to show that such control adjustments take time, leading to goal-suboptimal performance. Participants (N=41) performed the Random Dot Motion task under two goals: maximizing either speed or accuracy. They performed the task in blocks in which these goals were either fixed or varying. We fit drift diffusion models to the data to infer the control states corresponding to each of the goals. Drift rates (processing efficiency) and thresholds (caution) were higher for the accuracy versus speed goal. However, the differences between these control states were substantially reduced in varying blocks, suggestive of gradual movement between control states. Do test this hypothesis more directly, we sought to decode control states from EEG signals. We trained time-resolved decoders to distinguish between the speed and accuracy goals. The two control states were reliably decodable when goals were fixed, but decoding accuracy degraded substantially when goals varied. Critically, decoding accuracy in varying blocks increased with more repetitions of the same goal, evidencing gradual adjustments of control. These results reveal that once our goals change, the neural states corresponding to different control states gradually move from their current toward the new target state. The speed of this movement contrains goal flexibility.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A99 - Cognitive control networks direct brain flows underlying rapid instructed learning of stimulus-response tasks

Arun Aryal[1] (arun.aryal@rutgers.edu), Ravi D. Mill[1], Alexandros Tzalavras[1], Michael Cole[1], Nachshon Meiran[2], Inbar Amir[2]; [1]Rutgers University-Newark, [2]Ben-Gurion University of the Negev

Rapid Instructed Task Learning (RITL) enables humans to quickly learn and execute new tasks based solely on instructions, demonstrating unmatched cognitive flexibility. While RITL is well-established, the neural mechanisms supporting immediate task execution without prior practice remain unclear. To address this, we combined behavioral testing, functional magnetic resonance imaging (fMRI), and computational modeling (n=36) using the NEXT cognitive paradigm. Participants performed both practiced and novel tasks during fMRI scanning. We modeled the generation of neurocognitive processes and resulting behavior using a multi-step activity flow modeling method. The model was data-driven, with a simulated flow of activity inputs from a subset of regions to downstream regions via empirical functional connectivity routes. Functional connectivity was estimated with graphical lasso at the region level and principal component regression vertexwise on regions surviving lasso thresholding, and trial-wise betas were estimated using ridge regression. Univariate fMRI analyses revealed increased activation in cognitive control networks and decreased activation in the default-mode network during novel tasks. The generative model simulated motor output patterns in somatomotor network with above-chance classification accuracy. The stepwise region-level flow graph highlighted the critical role of dorsal attention network and front parietal network in processing inputs from VIS1/VIS2 to bias appropriate motor responses. These findings provide a mechanistic framework for understanding how cognitive control networks enable RITL. Future work will simulate lesions within the model to further explore specific network contributions.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A100 - Context-Dependent Statistical Learning: Bridging Human Cognition and Neural Network Dynamics

Fleming Peck[1] (fpeck@ucla.edu), Hongjing Lu[1], Jesse Rissman[1]; [1]UCLA

We aimed to test whether statistical learning can occur in a context-dependent fashion. Participants performed perceptual judgments on a continuous sequence of abstract visual objects. Unbeknownst to participants, the objects were organized in pairs, such that the first object in a given pair predicted the ensuing object. This temporal associative structure remained constant within a context, but periodically the context would change, and with this change came a new set of temporal associations. Regardless of whether context changes were signaled (via border color) or completely latent (n=50 participants for each condition), participants' response times for predictable versus unpredictable objects grew faster over time, revealing context-dependent learning. Moreover, a final two-alternative forced-choice (2AFC) test showcased above-chance predictions about which object would come next in a given sequence. To gain insight into the mechanisms supporting this learning, we trained neural network models to predict the next item in the sequence and to complete a final 2AFC task, much like the human participants. Despite no explicit coding of context, we found that gated recurrent units enabled networks to acquire and retain knowledge of both temporal associative structures, in contrast to simple recurrent and feedforward units. Additionally, we found a non-monotonic relationship between weight variance at initialization and task accuracy, with peak performance achieved with modest noise. By applying representational similarity analysis to hidden layer activity patterns, we track the emergence of context sensitivity and relate this to task performance. These results provide clues into how the human brain might achieve context-dependent learning.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A101 - Neurochemical and functional circuitry alterations underlying goal-directed and habitual behaviour in obsessive-compulsive disorder

Máiréad Healy[1] (mph58@cam.ac.uk), Yuanxi Li[1], Marjan Biria[2], Maité Crespo-García[1], Zoe Kourtzi[1], Trevor Robbins[1]; [1]University of Cambridge, [2]University College London

Introduction: Obsessive-compulsive disorder (OCD) involves an imbalance in frontal-striatal circuitry, favouring habitual behaviours over goal-directed actions. This imbalance may result from altered neurochemical regulation of excitatory and inhibitory processes in these systems. However, the interplay between neurochemical and functional brain mechanisms influencing compulsivity remains poorly understood. Methods: We conducted a multimodal imaging study with 20 OCD participants and 20 matched controls to explore structural-functional mechanisms underlying compulsive behaviour. Using 7-Tesla 1H-MRS and an optimised MRS sequence (semi-LASER), we quantified Glu, Gln, and GABA in the anterior cingulate cortex (ACC) and supplementary motor area (SMA) — regions strongly linked to OCD. Participants also completed an fMRI contingency degradation task to assess their habitual (stimulus-response) versus goal-directed (action-outcome) tendencies. Results: Preliminary findings suggest that compulsive behaviours correlate with neurochemical markers in the ACC and SMA, indicating a potential alteration in the excitatory/inhibitory (E/I) balance of neurometabolites such as Glu and GABA. Neurochemical imbalance was linked to increased habitual responding in the SMA across the entire sample (Pearson's $r = 0.26$, $p = 0.02$, p-FDR = 0.06). Participants with OCD showed a similar relationship within the ACC (Pearson's $r = 0.38$, $p = 0.02$, p-FDR = 0.04). Future analyses will examine how functional activation corresponds to neurochemical shifts to explain the imbalance between goal-directed and habitual behaviours. Conclusion: We hypothesize that E/I balance and functional activity interactions predict habitual versus goal-directed behaviour, offering insights into the mechanisms of behavioural flexibility.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A102 - Hippocampo-cortical contributions to the structured organization of task knowledge

Bettina Bustos[1], Jiefeng Jiang; [1]University of Iowa, Psychological and Brain Sciences, [2]Cogitive Control Collaborative

Successful task switching requires resolving interference from the previous task and reconfiguring the representation of the new task, both of which depend on how task representations are organized in the brain. Tasks may be encoded in orthogonal representations to minimize interference, though this would maximize reconfiguration demands. Alternatively, it is possible that task knowledge is organized within a common reference frame, balancing interference and reconfiguration costs by modulating the similarity between task representations. A potential candidate for this reference frame is a cognitive map, where task features are encoded as continuous parameters like coordinates on a map, with each point uniquely identifying a task. We test this hypothesis using a parametric task-switching paradigm with high-resolution 7T fMRI, focusing on the role of the hippocampus and cortex in constructing relational maps of task knowledge, such as stimulus, response, and rule representations. These regions are critical for forming relational cognitive maps. Preliminary data (N = 12) reveal significant regions of interest, including the posterior cingulate cortex, insula, and frontoparietal cortex, where task information is represented during execution. Moreover, we hypothesize that the strength of the correlation between task and pattern similarity in the frontoparietal cortex is linked to hippocampal activation. Understanding the organization of task rules will aid our understanding of how task knowledge organization supports cognitive flexibility.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A103 - Effects of repeated cranial electrotherapy stimulation on high-stress decision making

Marissa Lee[1] (marissa.lee@tufts.edu), Kana Okano[1], Hannah Hart-Pomerantz[1], Travis Harvey[2], Tad Brunyé[3,1]; [1]Tufts University, [2]United States Special Operations Command, [3]United States Army DEVCOM Soldier Center

Cranial electrotherapy stimulation (CES) is a low-intensity electrical neuromodulation technique that administers pulsed alternating microcurrent to electrodes typically placed on bilateral earlobes. CES may exert nonspecific effects on afferent projections of cranial nerves, increasing parasympathetic nervous system activity and ameliorating acute stress responses. If so, this may help support cognitive functions vulnerable to stress exposure such as memory, spatial orienting, and decision-making. A double-blind, randomized controlled trial investigated the effects of repeated CES stimulation in 40 neurotypical participants who received either active (n = 19) or sham (n = 21) CES across 20 daily sessions. During baseline and follow-up sessions, we measured performance on memory (MEM), spatial orienting (SO), and decision making (DM) while under threat of torso shock. We expected the active CES group would show reduced physiological and biochemical stress responses and improved task performance at follow-up compared to the sham CES group. General linear models analyzed the effect of CES group (active, sham) and time (baseline, follow-up) on physiological, biochemical, and cognitive outcomes. Threat of shock successfully modulated physiological responses and salivary alpha amylase and cortisol levels at baseline and follow-up but did not vary significantly by CES group (p's>0.05). Results also showed no effect of CES group on MEM, SO, or DM performance (p's>0.05). While CES did not significantly impact stress biomarkers or cognitive performance in the overall sample, we will discuss exploratory findings that individuals with high baseline trait anxiety may derive targeted benefits from active CES, suggesting potential for personalized interventions.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A104 - Enhanced P300 and pupil dilation differentiated high-impact from low-impact cognitive states

Ling-Yu Huang[1] (beryl.ly.huang@gmail.com), Victoria Lyons[2], Brett Clementz[3], Jennifer McDowell[3]; [1]Beth Israel Deaconess Medical Center, [2]Boston University, [3]The University of Georgia

To map the neural mechanisms underlying cognitive flexibility, multi-modal imaging and robust task designs together maximize internal validity of results. In this study, neurodynamics during different cognitive states were captured using EEG and pupillometry. The cognitive states examined were: 1) processing of high-impact vs. low-impact feedback, and 2) preparation to switch responses vs. repeat responses. We constructed set-shifting trials in which healthy participants (N = 25 mean age = 21.0 yrs, SD = 2.0 yrs) performed prosaccade, saccade inhibition, or antisaccade sets during simultaneous high-density EEG. Participants received visual post-trial feedback ("correct" or "incorrect") to determine whether to change or repeat the same type of eye movement in the next trial. Each set lasted 5-8 trials; 52 sets were administered over 4 task runs. P300, the saliency marker, was higher in response to the first positive feedback received after a set shift (high-impact input) compared to positive feedback repeatedly received during a set (low-impact) (Cohen's d = 1.1), though appearances of the feedback were identical. No feedback-related negativity (FRN) was predicted since positive feedback presented no conflict, and paired t-tests confirmed this hypothesis (d = 0.1). Greater pupil dilation was observed during fixation periods following negative feedback, compared to following positive feedback ($F(2,69) = 9.31$, $p < 0.001$). Current results indicate that despite identical sensory input, pupil and EEG could both differentiate scenarios when such input was more internally meaningful. Further analyses in-progress include calculating phase lag indices to discover directional connectivity during these cognitive states, and source analysis.

Topic Area: EXECUTIVE PROCESSES: Goal maintenance & switching

A105 - MEG Resting State Functional Connectivity Predicts Metacognition in Self-Control

Benjamin Kinder[1], Dong James Sung[1], Uri Maoz[2], Aaron Schurger[2], Mathieu Landry[3]; [1]Montreal Neurological Institute, McGill University, [2]Chapman University, [3]Université du Québec à Trois-Rivières

The ability to regulate one's actions is crucial for success in many aspects of life. A key component of developing and maintaining self-control is metacognition or thinking about one's capacity for self-regulation. We investigated the neural correlates of metacognition in self-control in a group of 60 (28 female) individuals using magnetoencephalography (MEG) resting state functional connectivity. Participants completed the Metacognition in Self-Control Scale (MISCS) (Bürgler et al., 2022) and 5 minutes of resting state in MEG. MEG data was pre-processed following best practices (Gross et al., 2013) and source localized using Brainstorm (Tadel et al., 2013). We computed connectivity using the weighted phase lag index (wPLI) for each of the canonical frequency bands (δ, θ, α, β, γ) within each voxel and derived clustering coefficients (Brain Connectivity Toolbox; Rubinov & Sporns, 2010) for each parcel of the Desikan-Killiany atlas. Using a Leave One Out paradigm, we trained a model to predict MISCS scores for each participant. Using this method, the model achieved a Spearman correlation of 0.339 ($p = 0.0129$) and a Pearson correlation of 0.328 ($p = 0.0144$). These findings show that resting-state MEG functional connectivity predicts metacognition in self-control scores.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A106 - Relations between conflict-related midfrontal theta and parent-reported self-regulation in preschool-aged children

Farnoosh Khandan[1] (fkhandan2@huskers.unl.edu), Carrie Clark[2]; [1]University of Nebraska-Lincoln

Background: Cognitive control, a core component of self-regulation, undergoes significant development during the preschool years, with children showing major improvements in inhibition and cognitive flexibility. Neural oscillatory activity in the theta frequency range (4–8 Hz) is critical in coordinating cognitive processes within neural circuits associated with self-regulation. Nonetheless, the underlying neural mechanisms contributing to cognitive control development in preschool-aged children remain poorly understood. This study investigates the relationship between conflict-related midfrontal theta power and parent-reported self-regulation in preschool-aged children. Methods: Our sample size is 80 children aged 3 to 5, with over-recruitment of 3-year-olds to ensure adequate data for this age group. Currently, we have collected data from 60 participants. Participants completed an Animals Stroop task while wearing an EEG cap. The task consisted of no-conflict trials (pictures of familiar animals) and conflict trials (chimera animals with mismatched heads), designed to generate cognitive conflict. Verbal responses were recorded for accuracy during 48 trials of each type, with a 500ms inter-trial interval and a break to check impedances. Parents also completed the Devereux Early Childhood Assessment (DECA) survey to report on their children's self-regulation and socio-emotional competencies. Results: Preliminary results will be presented in the poster. Results are pending at this stage. Discussion: The study anticipates finding a positive correlation between age and midfrontal theta power, reflecting increased cognitive control development. Higher midfrontal theta power is also expected to correlate with stronger self-regulation skills, enhancing understanding of brain development underlying cognitive control.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A107 - The Neural Correlates of Inhibitory Control in Children with developmental language disorder (DLD)

Asiya Gul[1] (agul@mghihp.edu), Annika L. Schafer[1], Yael Arbel[1]; [1]MGH Institute of Health Professions, Cognitive Neuroscience Group

Abstract Children with developmental language disorder (DLD) exhibit limited executive functions1–3 —critical cognitive skills for goal-directed behavior—particularly inhibitory control deficits that impair performance on inhibition tasks4,5. The neural mechanisms underlying these deficits remain unclear. This study investigated the role of midfrontal theta-band (4–8 Hz) oscillations—a marker of cognitive control and error monitoring6–8, in inhibitory control among children with DLD compared to typically developing (TD) peers. Electroencephalography (EEG) data were collected from 70 children (27 DLD, 43 TD), aged 8–13 years while performing a Flanker task. Theta-band inter-trial coherence (ITC) and phase-locking values (PLV) were analyzed to assess temporal coherence and neural connectivity within and between brain regions. Neural activity at midfrontal (FCz), lateral-frontal(F3/F4), and lateral-central(C3/C4) sites was analyzed during two time-windows: -100 to 100 ms (error-related negativity, ERN) and 200 to 400 ms (P300). Children with DLD showed lower accuracy and slower reaction times than TD peers. Group differences in theta ITC and PLV were observed at lateral-frontal and lateral-central sites during incongruent trials, regardless of accuracy. During incongruent correct trials, children with DLD exhibited reduced PLV, particularly in connectivity between midfrontal (FCz) and the right lateral-central site (C4). Atypical theta dynamics and reduced neural connectivity in children with DLD indicate disrupted coordination of cognitive control processes. These disruptions likely underlie deficits in inhibitory control and error monitoring9, emphasizing the need for targeted interventions to support EF development in this population.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A108 - Inhibition-related executive functioning in children during the Go/NoGo task: a fMRI study

Dania Javaid[1] (djavaid2@huskers.unl.edu), Danya Alderoubi[2], Yingying Wang[3]; [1]Department of Educational Psychology, University of Nebraska-Lincoln, Lincoln, NE, USA, [2]Department of Department of Nutrition and Health Sciences, University of Nebraska-Lincoln, Lincoln, NE, USA, [3]Neuroimaging for Language, Literacy and Learning, Department of Special Education and Communication Disorders, University of Nebraska-Lincoln, Lincoln, NE, USA

Executive functioning, particularly inhibition, plays a critical role in cognitive development and behavioral regulation. This study examined the inhibition-related executive functioning in children using functional magnetic resonance imaging (fMRI) and its relationship with phonological awareness. Specifically, we hypothesized that children with greater phonological awareness would have stronger inhibition-related executive functioning. This study included 33 children (mean age: 7.01 years, 14 boys, all right-handed). A block design Go/NoGo task was used to assess inhibitory control. Phonological awareness (PA) was evaluated using the Woodcock Reading Mastery Tests (WRMT-III) subtest. The fMRI protocol included 322 volumes (TR=1s), with blocks alternating between resting, Go-only, and Go/NoGo conditions. Preprocessing was conducted using SPM12, including motion correction, coregistration, normalization, and smoothing (Gaussian kernel with Full Width at half maximum (FWHM) = 6 mm). Second-level analyses revealed four significant clusters after Family-Wise Error correction ($p < 0.05$), including bilateral occipital poles, the right superior temporal gyrus (rSTG), and the right middle temporal gyrus (rMTG). Participants were categorized into low PA (raw score < 30, N=17) and high PA (raw score ≥ 30, N=16) groups. A two-sample t-test ($p < 0.001$ uncorrected) revealed stronger left hippocampal activation in the high PA group, whereas the low PA group exhibited greater activation in the right superior frontal gyrus (rSFG). These findings suggest distinct neural mechanisms underpinning inhibition and phonological awareness, with implications for understanding how executive functioning supports early literacy development. Interventions targeting PA and executive functioning may enhance cognitive and behavioral outcomes in young children.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A109 - Investigation of single- and multi-electrode anodal tDCS for enhancing executive function: Implications for simplified protocols

Megan O'Connor[1] (mboconnor@mgh.harvard.edu), Asif Jamil[1], Laura Dubreuil-Vall, Joan A. Camprodon[1]; [1]Massachusetts General Hospital and Harvard Medical School

While transcranial direct current stimulation (tDCS) shows promise for enhancing executive function, its outcomes vary due to differences in stimulation parameters. In motor studies, multi-site stimulation targeting broader networks proved more effective than single-site stimulation. However, it remains unclear whether a similar approach improves executive function over the traditional left dorsolateral prefrontal cortex (DLPFC) montage. In two randomized, placebo-controlled, cross-over studies, we first compared single-site versus multi-site tDCS on executive function. After finding that left DLPFC stimulation outperformed multi-site stimulation, we conducted a follow-up study to test whether this was due to differences in current intensity, modifying the multi-electrode montage to ensure both the left and right DLPFC received 2 mA each. In Study 1 (N=22), we applied 2 mA anodal tDCS targeting the left DLPFC using a standard bipolar montage vs. 2 mA anodal tDCS targeting the frontoparietal network (FPN) using a multi-electrode montage vs. sham. In Study 2 (N=22), we applied 2 mA anodal tDCS targeting the left DLPFC using a standard bipolar montage vs. 2 mA anodal tDCS targeting each the left and right DLPFC using a bilateral montage vs. sham. Subjects performed the Flanker Task before and after tDCS to assess reaction time and accuracy. In both studies, anodal tDCS targeting the left DLPFC with a standard bipolar montage significantly improved reaction time compared to both multi-electrode montages and sham. These findings suggest that a simpler, non-specific tDCS approach may be more effective than multi-site, current-intensity optimized models in improving reaction time on the Flanker Task.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A110 - Late speech error monitoring is impaired if one’s own voice cannot be accessed during vocal errors.

Marlene Buch[1] (marlene.buch@ku.de), Robert Steinhauser[1], Peter Löschner[1], Marco Steinhauser[1]; [1]Catholic University of Eichstätt-Ingolstadt

There is a consensus that a joint mechanism is responsible for monitoring both pre- and post-articulatory processes in speech production. Theories diverge, however, regarding the importance of processing one’s own vocal speech. The error-related negativity (Ne/ERN) is viewed as a correlate of early internal error monitoring that does not rely on sensory feedback. The error positivity (Pe), however, represents a later stage of error processing and results from an evidence accumulation process that leads to error awareness. The Pe could potentially be influenced by auditory feedback but has only sparsely been investigated in speech tasks, with contradictory results. We considered both the Ne/ERN and Pe following errors in overt speech production with a focus on the importance of auditory feedback, i.e., listening to one’s own voice for error monitoring. In a Stroop color-naming task, participants responded orally while their voices were masked by noise in half of the trials. Our results showed that errors were followed by both an Ne/ERN and a Pe. Importantly, the Pe was reduced for errors in noise-masked trials suggesting that late error monitoring is impaired when auditory feedback cannot be accessed. Exploratory analyses revealed distinct error types that differed regarding the Ne/ERN and Pe. Uncorrected errors elicited only a Pe but no Ne/ERN, whereas partial errors elicited only a Ne/ERN but no Pe. This finding supports the idea that the Ne/ERN and Pe reflect independent monitoring processes and furthermore implies that error corrections may be of particular importance in speech error processing.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A111 - Error-Related Memory Biases Are Specific To Social Stimuli For Socially Anxious Individuals

Kianoosh Hosseini[1] (khoss005@fiu.edu), Aaron T. Mattfeld[1], Jeremy W. Pettit[1], George A. Buzzell[1]; [1]Florida International University, Miami, FL

Social anxiety (SA) is associated with enhanced error monitoring, which refers to the ability to self-detect one’s own mistakes. However, the neurocognitive mechanisms underlying this relationship remain unclear. One hypothesis is that stronger error monitoring contributes to the maintenance/worsening of SA by strengthening the encoding of error events (including relevant social cues present when errors occur), negatively biasing what is remembered. Accordingly, we recently demonstrated that higher SA is associated with improved memory for social stimuli (faces) present on error (vs. correct) trials in a Flanker incidental memory paradigm. However, it is unknown whether these error-related memory biases for individuals high in SA are specific to social stimuli or instead reflect a general bias to encode any information present when errors occur. To examine this, we had two groups of participants (n = 140) perform a Flanker task when either trial-unique face (social) or object (non-social) images appeared behind Flanker stimuli followed by a surprise memory test for stimuli on error (vs. correct) trials. Notably, a significant interaction between SA symptoms and condition ($p = 0.01$) was found. Higher SA was associated with error-related memory biases only for social stimuli ($p = 0.03$), with no effect for non-social stimuli. Thus, we replicated the novel finding that individuals higher in SA exhibit a bias to remember more faces from error (vs. correct) trials. Moreover, the results demonstrate that SA-related memory biases for error events are specific to social stimuli, not a general bias to encode any information present on error trials.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A112 - Error monitoring for correct but unfavorable outcomes

Peter Löschner[1] (peter.loeschner@ku.de), Marco Steinhauser[1]; [1]Catholic University of Eichstätt-Ingolstadt

The error positivity (Pe) is an event-related potential observed following incorrect responses in choice tasks. Recent evidence suggests that the Pe does not only distinguish between incorrect and correct responses but represents a higher-order error signal reflecting an inference-based outcome evaluation. In the present study, we investigated the role of the Pe for outcome evaluation in a multistage task, in which the overall outcome depended on the correctness of responses at two individual stages. Crucially, an incorrect response at the first stage led to an unfavorable overall outcome even if the response at the second stage was correct. Our results replicated the general finding that a Pe occurs immediately after errors within each stage. In addition, a higher-order Pe occurred after correct responses at the second stage if this response was associated with an unfavorable overall outcome. A pattern classifier trained on the higher-order Pe was also able to decode the Pe immediately after incorrect responses, demonstrating that both types of Pe rely on the same neural activity. Our results suggest that the Pe reflects an evaluation process that infers the outcome by integrating multiple error signals while taking context into account.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A113 - Error precursors reflecting selective attention to distractors predict error-related brain activity.

Martin Maier[1], Marco Steinhauser[1]; [1]Catholic University of Eichstätt-Ingolstadt, Eichstätt, Germany

The error-related negativity (Ne/ERN), an electrophysiological correlate of error monitoring in choice tasks, is related to post-error adjustments of behavior indicating that it signals the need for behavioral adjustments following errors. This requires that the underlying error monitoring system takes possible error sources into account, for instance, by monitoring error precursors related to these error sources. Here, we aimed to isolate such an error precursor and to test whether it predicts the size of the Ne/ERN. In a selective attention task, participants had to classify a target letter in one hemifield but ignore a distractor letter in the opposite hemifield. Stimulus-related posterior alpha asymmetry was enhanced for errors compared to correct responses indicating increased attention to the distractors on error trials. This error precursor predicted the Ne/ERN amplitude on a single-trial level. Furthermore, the Ne/ERN on a given error trial predicted decreased stimulus-related alpha asymmetry on the next correct trial. Our results thus provide support for the idea that source-specific error precursors are monitored to appropriately signal the need for behavioral post-error adjustments.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A114 - Examining the Physiological and Cognitive Effects of Intermittent Hypoxia Training (IH) in Healthy Adults.

Denait Haile[1], Nasimi A. Guluzade[1], Antonio Mendes[1], Daniel A. Keir[1], Matthew Heath[1]; [1]Western University

Executive function (EF) is improved following a single bout of exercise, a benefit linked to an exercise-mediated increase in cerebral blood flow (CBF). A bi-directional relationship exists between EF and CBF, such that transient decreases in CBF negatively impact EF. Some evidence has reported that chronic exposure to a hypoxic environment (i.e., lower than atmospheric concentration of O_2) improves EF via enhanced cerebrovascular O_2 extraction. This study aimed to determine whether a single session of intermittent hypoxia (IH) benefits EF. Healthy young adults (N=24) participated in two 60-minute sessions: an IH condition involving alternating 5-minute intervals of hypoxic (FiO_2 = 10%) and normoxic breathing (FiO_2 = 20%), and a normoxic control condition of the equivalent duration. CO_2 levels were maintained at baseline for both conditions, and concurrent fNIRS and TCD were used to measure condition-based cortical hemodynamic changes. Additionally, EF was assessed via the antisaccade task (i.e., saccade mirror-symmetrical to exogenous target) at baseline (T0), immediately post-protocol (T1), and 30-min post-protocol (T2). As expected, arterial and cerebral O_2 saturation decreased during hypoxia intervals ($ps<.001$). In the IH condition, antisaccade reaction times (RTs) improved by 7% from T0 to T2 ($p = .004$), with no significant changes from T0 to T1 ($p = .22$), nor in the control condition ($ps > .32$). Accordingly, results provide a first demonstration that a single bout of IH provides a transient EF “boost”, potentially via enhanced cortical oxygen extraction and EF network efficiency. Supported by the Natural Sciences and Engineering Research Council of Canada.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A115 - The effect of acute stress on mental effort allocation across motivational contexts

Tony El Nemer[1] (tony_el_nemer@brown.edu), Ziwei Cheng[2], Chanel Johnson[1], Joonhwa Kim[1], Amitai Shenhav[2]; [1]Brown University, [2]University of California, Berkeley

Both positive and negative incentives shape one’s motivation to invest cognitive effort in a task. However, the role of stress in shaping this process remains under-explored. Here, we performed a preliminary examination of the influence of acute stress on cognitive control allocation across motivational contexts. Participants underwent either a stress-inducing (N=22) or neutral (N=23) version of a cold-pressor task, followed by an incentivized cognitive control task. The task independently varied levels of positive reinforcement (monetary reward per correct response), negative reinforcement (loss for failing to perform well), and punishment (monetary loss for performing poorly). Participants responded more efficiently (e.g., faster) for larger potential reinforcements (positive or negative) and more cautiously (e.g., more accurate) for larger potential punishment ($ps < 0.001$). Acute stress attenuated the effect of reinforcement on speeding ($p < 0.05$) and had a qualitatively similar but non-significant impact on punishment-related increases in accuracy ($p > 0.06$). These findings provide initial evidence that acute stress reduces incentive salience in positive and negative reinforcement contexts, offering insights into how stress influences incentive evaluation and control allocation across motivational contexts.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A116 - A Single Bout of Low "Density" Exercise Optimizes a Post-exercise Executive Function Benefit

Antonio Mendes[1] (amende@uwo.ca), Denait Haile[1], Jianchun Yin[2], Matthew Heath[1]; [1]Western University, [2]Shanghai Normal University

An extensive literature reports that a single bout of exercise provides a postexercise executive function (EF) benefit. Research has focused on the exercise type (e.g., aerobic vs. resistance) and/or duration optimizing the benefit; however, limited work has examined whether the distribution of exercise compared to the time spent at rest (density) impacts the magnitude of an EF benefit. Density represents a salient issue because it provides a framework to understand the physiological "supply and demand" mechanisms supporting transient and long-term EF changes. Healthy young adults (N=7) completed conditions involving ten 1-min intervals of metronome-paced leg extensions interspersed with 1-min (high-density: HD) and 2-min (low-density: LD) rest intervals. For all conditions, transcranial Doppler ultrasound measured middle cerebral artery velocity (MCAv) to estimate cerebral blood flow (CBF) and EF was assessed before and immediately after each protocol via the antisaccade task (saccade mirror-symmetrical to an exogenous target). Results showed that HD and LD conditions produced a baseline to steady state increase in MCAv (ps<.001) with a larger magnitude increase in the former condition. The LD (p<.04) – but not HD (p>.25) – condition produced a pre- to postexercise reduction in antisaccade reaction time (RT) (p<.04), and the magnitude of MCAv and RT changes in both exercise conditions were not correlated (ps>.45). These preliminary findings demonstrate that "density" is a potential moderator of a postexercise EF benefit and indicate that a change in CBF does not represent a primary mechanism supporting the benefit.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A117 - Leveraging Continuous Psychophysics to Study Cognitive Control Allocation in Dynamic Environments

Yihuan Dong[1] (yihuand1025@gmail.com), Ivan Grahek[2], Dominik Straub[3], Atsushi Kikumoto[4], Amitai Shenhav[2]; [1]Harvard Medical School, [2]University of California, Berkeley, [3]Technische Universität Darmstadt, [4]Brown University

Cognitive control processes allow for adjustments in how we process information and select actions. In everyday life cognitive control operates on dynamically changing inputs (e.g., a friend talking in a crowded cafe) and allows us to continuously select goal-directed actions (e.g., what we say in response). However, cognitive control is commonly measured using discrete stimuli and responses (e.g., Stroop or Flanker tasks). Here, we leverage a continuous psychophysics approach to investigate cognitive control allocation in a continuous tracking task. Participants used their cursor to track a randomly moving target (Gaussian blob) using their mouse over a 20s period. We test whether task performance is affected by two manipulations known to modulate cognitive control: incentives and distractors. In Study 1 (N=38), we show that tracking performance improves when participants are expecting to earn high compared to low performance-based incentives. In Study 2 (N=38), we show that distractors moving in a direction opposite to the target impair performance relative to static or direction-congruent distractors. To characterize the mechanisms that drive reward and distractor-induced changes in performance, we fit participant data to the Linear Quadratic Gaussian model, a bounded optimal control model which assumes that people track targets based on the noisy perception of their position while minimizing their motor effort. This analysis revealed that perceptual noise decreased with higher incentives, while increasing in the presence of incongruent distractors. These findings pave the way for using continuous tracking paradigms in conjunction with optimal control models for studying cognitive control allocation in continuous domains.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A118 - Dissociating early and late error monitoring with the target-masking paradigm

Marco Steinhauser[1] (marco.steinhauser@ku.de), Julia Dumsky[1], Martin E. Maier[1], Francesco Di Gregorio[2]; [1]Catholic University of Eichstätt-Ingolstadt, [2]University of Bologna

Errors in choice tasks elicit a cascade of event-related potentials, the error-related negativity (Ne/ERN) and the error positivity (Pe). While the early Ne/ERN is a fast error signal indicating response conflict or prediction error, the later Pe has been related to error awareness. Traditional views assumed that these components reflect two stages of a unitary monitoring system with the Ne/ERN delivering the input to the later Pe. To test this assumption, we have recently developed the target-masking paradigm, which allows for observing errors that are detectable without knowing the correct response. These errors lead to a Pe but no Ne/ERN, which demonstrates that the two components reflect two independent systems of error monitoring. Here, we report two novel studies using this paradigm. In Study 1, we demonstrate that also error awareness is possible without an Ne/ERN. In Study 2, we show that autonomic responses to errors such as error-related heart rate deceleration and pupil dilation are differentially linked to the Ne/ERN and Pe. These findings show that human error monitoring relies on two dissociable systems with different functional significance.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A119 - Both stimulus-control state associations and stimulus-response associations contribute to item-specific proportion congruency effect

Bingfang Huang[1] (bingfang-huang@uiowa.edu), Jiefeng Jiang; [1]University of Iowa

Cognitive control coordinates our thoughts and actions with internal goals. The cognitive control system is adaptive when conflict conditions change. Item-specific proportion congruent (ISPC) effect is a classic phenomenon of the adaptative conflict effect. It means when participants unconsciously experience 50% congruent condition and 50% incongruent condition overall while mostly congruent (MC) condition for one set of stimuli and mostly incongruent (MI) condition for another set of stimuli, the conflict effect (i.e., performance in incongruent condition compared to congruent condition) in the MI condition decreases compared with that in the MC condition. Many studies have been done to explore the mechanisms of the ISPC effect. ISPC effect is believed to be triggered by the learning of the stimulus-control state (SC) associations and/or contingency learning of the stimulus-response (SR) associations. The current consensus is that SC and SR associations learning will dominate the ISPC effect under different situations. However, it is currently unknown whether the learning of both SC and SR simultaneously contribute to the ISPC effect. We try to address this question by decoding the SC and SR associations from Electroencephalogram (EEG) data in a 4-key Stroop task with ISPC manipulations (n = 40). The behavioral results repeated the classic ISPC effect. EEG results showed both SC and SR associations can be decoded early following stimulus onset. Therefore, our study provides initial evidence for concurrent contributions of SC and SR learning in cognitive control.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A120 - STOP You're Under ArREST! Harnessing Resting-State fNIRS to Predict Stop-Signal Performance

Eman elrayah[1], Jessica Samir, Nick DeMille, Katie Cooke, Carole Scherling, PhD; [1]Neuroscience, Department of Psychological Science and Neuroscience, Belmont University

The prefrontal cortex (PFC) is widely involved in executive functioning and notably, in response inhibition. This extends to resting states, where decreased activity associates with higher impulsivity (Gentili, 2020). While typically-studied using fMRI and EEG techniques, the current study examined fNIRS resting-state PFC activity as a predictor of performance on an impulse-control task. Forty-six undergraduates completed a 72-trial stop-signal task (18 stop trials), with outcome measures of accuracy and latency. Additionally, two 8-minute resting-state sessions with eyes-open and -closed (8x8 PFC montage) assessed oxygenated hemoglobin concentrations in bilateral dorsolateral PFC (dlPFC) and ventromedial PFC (vmPFC). Results revealed higher eyes-open dlPFC activity compared to eyes-closed ($r_s(46) = -0.290$, $p = 0.051$; similar to Marx, 2004). Meanwhile, a novel vmPFC investigation showed higher eyes-closed activity associated with higher eyes-open ($r_s(46) = 0.333$, $p = 0.024$). When correlating rest activity with task performance, higher eyes-closed vmPFC activity was associated with quicker latency on non-stop trials ($r_s(46) = -0.313$, $p = 0.034$). A dlPFC laterality effect was revealed during eyes-open, where higher right-side activity correlated with increased accuracy ($r_s(46) = 0.296$, $p = 0.045$). Findings support the use of novel fNIRS to probe resting state activity and brain laterality effects. Results suggest that PFC resting-state activity serves as predictors of subsequent inhibitory control performance, with specialized functions for different PFC divisions. Future research should additionally involve handedness as a modulatory factor. Overall, fNIRS provides significant opportunity to better understand the neural bases of response inhibition and may help develop clinical applications for cohorts exhibiting inhibitory control deficits.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A121 - Naturalistic assessment of response inhibition in adolescence using gamification

Larisa-Maria Dina[1] (larisa.dinu@kcl.ac.uk), Martin Dechant[2], Maximilian Friehs[3], Eleanor Dommett[1]; [1]King's College London, [2]University College London, [3]University of Twente

Inhibitory control is essential for goal-directed behaviour, and impairment is associated with numerous psychiatric disorders. Despite its importance in everyday behaviours and psychopathology, it is typically measured in non-naturalistic, tightly controlled environments, often using paradigms that often rely on static, decontextualized tasks. Games, and gamified tasks that integrate game-like elements for non-gaming purposes, are intrinsically intuitive and facilitate a level of enjoyment, therefore offering a promising approach to increase participant engagement and age appropriateness. This is especially important for the assessment of inhibitory control, which develops progressively from childhood through adolescence into early adulthood. Our recent review of naturalistic assessments of inhibitory control highlighted a paucity of studies using gamification in adolescence. To address this gap, the current study aims to validate a block-designed gamified stop-signal task (gSST) against a standard computerised stop-signal task (SST) using a remote study design in a UK-based sample of 10- to 24-year-olds. The aims of this study are to (1) establish if the gSST is suitable for capturing neurodevelopmental differences in inhibitory control, (2) validate a block-designed version of a naturalistic inhibition task with the view to integrate it with neuroimaging techniques utilising the hemodynamic response function; and (3) determine the feasibility and acceptability of the gSST in remote studies. The results of this proof-of-concept study may open potential new approaches to studying cognitive development, providing a validated block-designed, naturalistic task that can be used outside the laboratory, therefore facilitating data collection from difficult to recruit samples, such as adolescents.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A122 - Exploring Saccade Task Performance in Early-Middle-Aged Adults with Hypertension

Kelsey Roberts[1] (kelsey.roberts@uga.edu), Audrey Beradi[1], Ling-Yu Huang[2], Michelle Altvater[3], Emily Dumas[1], Brooke Jackson[1], Qun Zhao[1], Nathan Yanasak[3], Catherine Davis[3], Xiaoling Wang[3], Shaoyong Su[3], Jennifer McDowell[1]; [1]University of Georgia, [2]Beth-Isreal Deaconess Medical Center, [3]Augusta University Medical College of Georgia

Hypertension is a risk factor for cerebrovascular disease and is associated with cognitive decline. The extent to which this affects neurocognition in middle adulthood remains unclear. Saccade tasks can reliably measure basic behavior and neurocognitive performance and are understudied in hypertensive populations. Prosaccade tasks measure basic, reflex-like behaviors where participants direct their gaze to the stimulus. Antisaccade tasks measure voluntary eye movements where participants direct their gaze to the mirrored location of a stimulus. This study evaluated pro and antisaccade performance in early-middle-aged adults with low (<84.99mmHg), medium (>85mmHg, <95.99mmHg), and high (>96mmHg) levels of mean arterial blood pressure (MAP). Group comparisons were made on saccade latency and percent correct, as well as models of saccadic main sequences (the relationship between amplitude and peak velocity) and speed-accuracy trade-offs (SATO). Direct comparisons revealed significantly slower latencies for the high MAP group than the low group and no differences in percent correct. No significant group differences were found in the main sequence or SATO models. Nonsignificant trends showed lower peak velocity in main sequence models and slower trade-off rates in SATO models in the high MAP group. Collectively, these results show that the high MAP group took longer to reach the same level of performance as the low MAP group, alluding to an association between cognitive performance and blood pressure in early middle-aged adults. Results could be used to support measures of early detection and intervention of hypertension. Future studies could compare these results with other cognitive and neuroanatomical measures.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A123 - Home-based transcranial direct current stimulation (tDCS) improves cognitive control in patients with ADHD

Yoonju Cho[1,2], Nicole L. Brocious[1], Arielle R. Rubel[1], Haojue Yu[1], Alexandra G. O'Neil[1], Allyson Smith[1], H. Hamdi Eryilmaz[1,2], Asif Jamil[1,2], Joan A. Camprodon[1,2,3]; [1]Massachusetts General Hospital, Department of Psychiatry, Division of Neuropsychiatry and Neuromodulation, [2]Harvard Medical School, [3]Massachusetts General Hospital, Department of Neurology

ADHD is a debilitating disorder. Current treatments are effective for inattention and hyperactivity, but not for the dysexecutive symptoms, most closely associated with functional impairments. Our previous work showed that transcranial direct current stimulation (tDCS) can improve cognitive control and its neurophysiological signatures in patients with ADHD. Based on this work, we devised a parallel-design, randomized, placebo-controlled mechanistic trial to assess the impact of 4 weeks of daily home-tDCS on clinical, cognitive, and neurophysiological measures of executive function in adults with ADHD. Participants self-administer tDCS (left dorsolateral prefrontal anodal, right orbitofrontal cathodal, 2mA, 30min/day, 28 days) at home and complete 4 in-office visits (baseline, week 1, week 4 or immediately after, and week 8 or 1 month after stimulation completion) to capture clinical and cognitive scales, and the Eriksen Flanker Task with EEG. Preliminary analyses from 31 completers show that home-tDCS is safe and well tolerated. Active tDCS improves reaction time in Incongruent trials at week 4 (β=73.4ms; 95% confidence interval, [49.29ms, 97.508ms]; $p<0.001$) and at week 8 (β=109.9ms; [90.104ms, 129.696ms]; $p<0.0001$), which is significantly different from sham at week 4 (β=80.7ms; [61.83ms, 99.57ms]; $p<0.001$) and week 8 (β=112ms; [91.42ms, 132.58ms]; $p<0.001$). Active tDCS improves accuracy at week 4 (β=-0.360; [-0.580, -0.140]; $p<0.01$), but not at week 8 (β=-0.0189; [-0.2443, 0.2065]; $p=0.983$). Preliminary results suggest that 4 weeks of daily home-tDCS effectively improves executive functioning in adults with ADHD. Analysis of clinical, neurophysiological and additional cognitive measures is ongoing and will be presented at the conference.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A124 - The Role of Human Subthalamic Nucleus in Inhibition of Competing Task Representations

Nathan Cremers[1] (nathan-cremers@uiowa.edu), Nathan Chalkley[1], Benjamin Rangel[2], Jan Wessel[1]; [1]University of Iowa, [2]Brown University

Inhibitory control is crucial for flexible, intelligent behavior. Evidence suggests that the subthalamic nucleus (STN) plays a critical role in domain-general inhibition of both actions and cognition. In this study, we examine the domain-general role of STN by testing its role in inhibiting task representations. We leverage data from Parkinson's Disease patients with deep brain stimulators (DBS) implanted in the STN. STN-DBS disrupts normal STN activity, allowing us to assess its causal role by comparing performance during DBS-on and DBS-off conditions. To test inhibition of task representations, we utilize a task that prompts the reactivation of conflicting representations. The necessary inhibition of the conflicting representation incurs a reaction time cost which serves a behavioral marker of representational conflict. So far, 16 STN-DBS patients have performed two sessions of this task – one with DBS-on and one with DBS-off – while undergoing EEG recording. We used representational similarity analysis (RSA) of scalp-wide EEG to measure the strength of the correct and conflicting task representations. We predicted that reaction time costs and strength of the conflicting representation would be greater with DBS-on, due to the disruption of the STN. However, behavioral results show no group-level differences in reaction time or accuracy between DBS sessions. Conversely, RSA shows that conflicting task representation are suppressed with DBS-off. Finally, using mixed effect modelling, we show that stronger conflicting representations predict slower reaction times specific to the DBS-on session. While preliminary, these results suggest that the STN may be active in the inhibition of task representations.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A125 - Does the anticipation of stuttered speech involve inhibitory control?

Kien Huynh[1] (kien-huynh@uiowa.edu), Julia Kerrigan[1], Carson Lovig[1], Naomi Rodgers[1], Jan Wessel[1]; [1]University of Iowa

Adults who stutter (AWS) can anticipate instances of stuttering. Past work using magnetoencephalography found increased beta-band activity in the pre-supplementary motor area during stuttered speech anticipation. Similar neural activity is found during action stopping, providing indirect evidence for the involvement of inhibitory control during stuttered speech anticipation. However, this purported mechanistic overlap has not been directly tested. This was the goal of the current study. Thirty-one AWS first met with a speech-language pathologist to generate a personalized list of likely-stuttered vs. likely-fluent words. Then, they performed a motor task that required verbal responses to both likely-stuttered and likely-fluent words after an anticipatory delay period. In some blocks of the task, visual stop-signals additionally prompted participants to stop their verbal responses. This design allowed identifying neural activity associated with both proactive and reactive inhibitory control. Proactive control is measurable as anticipatory go-trial activity in stop-signal blocks that is absent in go-only blocks, whereas reactive control is found after stop-signals but not go-signals. Using multivariate pattern analysis (MVPA) of whole scalp-EEG, we trained decoders to identify the associated neural activity patterns. A third decoder was trained to distinguish anticipatory delay period activity between likely-stuttered and likely-fluent words. All decoders were successful in identifying the targeted activity. However, cross-decoding analyses found no significant neural overlap between stuttered word anticipation and reactive or proactive inhibitory control. This suggests that stuttered speech anticipation does not involve either of these mechanisms. We discuss alternative possibilities that could explain neural activity patterns found during stuttered speech anticipation.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A126 - A Model of the Temporal Dynamics of Automatic and Goal-Directed Processing during Conflict Resolution

Jacob Sellers[1] (jacobsel@umich.edu), Han Zhang[1], John Jonides[1], Taraz Lee[1]; [1]University of Michigan

Cognitive control allows us to overcome habitual and automatic processing to enable goal-directed behavior. Doing so is an inherently time dependent process, as control needs time to overcome the influence of faster, automatic processing. However, most research on conflict resolution processes measures free response times (RTs), which index only the time it takes to fully resolve conflict. This approach makes it difficult to disentangle how the contributions of automatic and goal-directed processing evolve over time to produce behavior. To overcome this limitation, the forced-response method can be employed. This method allows one to trace out the time course of conflict resolution processes by forcing people to respond at predetermined times, turning RT into an independent variable. This approach allows for the direct measure of habitual responses that are rarely observed in free RT tasks. Here, we apply a new response preparation model (RPM) to data from forced-response conflict tasks to disentangle the component processes of cognitive control. This model independently estimates how long it takes to prepare habitual and goal-directed responses. We show that conceptualizing the conflict resolution process in terms of the underlying competing responses can account for congruency effects in the Simon and flanker tasks. We also demonstrate that the RPM can model control adjustments that take place over long and short timescales (e.g., the proportion congruency effect and the congruency sequence effect). These results suggest that the RPM may be fruitful for examining cognitive control adjustments that regulate the competition between automatic and goal-directed processes.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A127 - On the Reliability and Factor Structure of Sustained Post-Error Slowing

Clifford Hauenstein[1] (chauens2@jh.edu), Eunbee Kim[2], Alexis Phillips[1], Alana Montanez[1], Derek Smith[1]; [1]1Division of Cognitive Neurology/Neuropsychology, Department of Neurology, The Johns Hopkins University School of Medicine, [2]School of Psychology, Georgia Institute of Technology

Post-error slowing (PES) is the widely observed tendency to slow down after error commission. Evidence suggests that the magnitude of PES is correlated across tasks, implying that PES reflects a domain general process. However, the extant research has given less attention to PES sustained across multiple trials and all but neglected cross-task correlations in sustained PES. Recent experimental research provides evidence demonstrating that PES may emerge from different processes, depending on the elapsed time since error commission. Reanalysis of published data reveals that, unlike the initial PES, sustained PES did not correlate between three different cognitive control tasks. However, these diminished correlation estimates for sustained PES may be driven by relative unreliability in sustained PES. To determine if the diminished cross-task correlations observed for sustained PES are explained by a true difference in processing or merely attenuated reliability, we employed a multi-level model that accurately distinguishes within-subject variability from between-subjects variability. Although within-subject variability was smaller for sustained PES (relative to initial PES) the between-subjects variability in sustained PES was drastically smaller (relative to initial PES). Thus, sustained PES as an individual difference measure is less reliable than initial PES, principally due to less variability between persons. As part of this project, we are also developing a multi-level structural equation model to evaluate the corrected cross-task correlational structure of PES (correlations that account for the relative unreliability of sustained PES measures).

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A128 - Anhedonic Features in Effort-Related Reward Processing

Harold Rocha[1] (harochapsych@gmail.com), John Shuford[1], Bradley Buchanan[1], Peter Clayson[1]; [1]University of South Florida

Emerging evidence suggests that distinct stages of reward processing uniquely contribute to psychological traits linked to anhedonia, a core mood-disorder symptom characterized by diminished enjoyment of pleasure. However, the relationship between reward-processing stages and dispositional traits related to mood and anhedonia remains unclear. The present study investigated interindividual reward processing differences in a healthy college sample (n = 83) using self-report measures and event-related brain potentials (ERPs) indexing anticipatory and consummatory subprocesses across high- and low-effort conditions using a recently developed effort-doors task. The goal of the study was to expand our understanding of the temporal-dynamics of effort-related reward processing by incorporating mood-related traits as predictors using an incremental model comparison approach. Consistent with the original effort-doors study, P3 component in response to an effort-termination cue (cue-P3) was greater following high effort, and feedback stimulus preceding negativity (SPN) was larger following low effort. Unlike the original study, Reward Positivity (RewP) scores reflected effort-related reward discounting, consistent with Expected Value of Control (EVC) theory, while feedback-P3 yielded no statistically significant experimental effects. Surprisingly, anticipatory pleasure (TEPS-AP) negatively correlated with RewP, suggesting reduced feedback engagement in those with greater reward anticipation, and cue-P3 negatively correlating with depressive symptoms, indicating heightened salience of effort in those with mood-related traits. These findings provide evidence for EVC-like reward discounting in ERPs related to effort and interindividual differences tied to reward anticipation and mood.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A129 - Deficient Executive Control in Transformer Attention

Suketu Patel[1] (suketu.patel18@qmail.cuny.edu), Hongbin Wang[2], Jin Fan[1]; [1]CUNY Queens College, [2]Texas A&M University

Although transformers in the large language models (LLMs) effectively implement a self-attention mechanism that has revolutionized natural language processing, they lack an explicit implementation of executive control of attention found in humans which is essential for resolving conflicts and selecting relevant information in the presence of competing stimuli, and is critical for adaptive behavior. To investigate this limitation in LLMs, we employed the classic color Stroop task that is widely regarded as the gold standard for testing executive control of attention. Our results revealed a typical conflict effect of better performance in terms of accuracy in the congruent condition (e.g., naming the ink color of the word RED in red) compared to the incongruent condition (e.g., naming the ink color of the word RED in blue), which is similar to human performance, in short sequences. However, as sequence length increased, the performance degraded toward chance levels on the incongruent trials despite maintaining excellent performance on congruent trials and near-perfect word reading ability. These findings demonstrate that while transformer attention mechanisms can achieve human-comparable performance in smaller contexts, they are fundamentally limited in their capacity for conflict resolution across extended contexts. This study suggests that incorporating executive control mechanisms akin to those in biological attention could be crucial for achieving more general reasoning and reliable performance toward artificial general intelligence.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A130 - Neural modeling of frontal evoked responses predicts transient beta events influence inhibitory control via slow GABAergic inhibition

Darcy Diesburg[1] (darcy_diesburg@brown.edu), C. J. Abeshaus[2], Stephanie Jones[1]; [1]Brown University, [2]Scripps College

In the Stop-Signal Task, frontocentral (FC) EEG signatures such as event-related potentials (ERPs) and pre-stop transient beta (15-29Hz) events (BEs) are often considered proxies of inhibitory control processes. However, minimal understanding of the neural circuit-mechanisms that create these signals makes it challenging to integrate them within behavioral-cognitive theories of stopping. Recent work with Human Neocortical Neurosolver's (HNN) biophysical model of the thalamocortical cell- and circuit-mechanisms producing human M/EEG signals predicted mechanisms of stop-signal-locked FC-ERPs (Diesburg et al., 2024). Changes in timing and strength of thalamocortical inputs produced differences in timing and amplitudes of FC-ERP deflections in successful (SS) versus failed stops (FS). A larger P2 deflection in FS emerged from stronger early pyramidal cell spiking, possibly associated with erroneous responding. While insightful, these simulations did not account for influences of pre-stop BEs, known to be more numerous during SS and predicted to influence ERPs and underlying cell spiking via recruitment of GABAb-ergic currents (Law et al., 2022). Here, we tested whether BE-generating mechanisms induce differences in SS versus FS FC-ERP amplitudes and modeled spiking activity related to behavior. Simulating pre-stop BEs that recruit GABAb currents, we found that BEs in the 300ms preceding the first thalamocortical input in SS simulations

reduced the amplitude of the P2, analogous with the data. Further, pyramidal cell spiking was reduced, supporting the notion that a decrease in early spiking supports SS. These results suggest that the mechanisms that generate BEs drive condition differences in FC-ERPs and downregulate early spiking to support inhibitory control.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A131 - Conflict Expectation Shapes Prefrontal Activity: Distinct Mechanisms of Anticipatory and Reactive Control

Anas Khan[1] (anaskhan1107@gmail.com), Colin Hoy[2,3], Kris Anderson, Vitoria Piai[4,5,6], David King-Stephens[7,8], Kenneth Laxer[8], Peter Weber[8], Jack Lin[9], Robert Knight[3], Nicole Bentley[1]; [1]University of Alabama Heersink School of Medicine, [2]University of California, San Francisco, [3]University of California, Berkeley, [4]Radboud University, Nijmegen, Netherlands, [5]Radboud University Medical Center, Nijmegen, Netherlands, [6]Donders Institute for Brain, Cognition, and Behavior, Nijmegen, Netherlands, [7]California Pacific Medical Center, San Francisco, CA, [8]University of California, Irvine, [9]University of California, Davis

Goal-directed behavior requires adjusting cognitive control to both react to and prepare for conflict. Previous work indicates theta oscillations and population activity in dorsomedial prefrontal cortex (dmPFC) and dorsolateral prefrontal cortex (dlPFC) are critical for reactive control. However, the neural mechanisms supporting proactive control are less clear. Here, we investigated the neural basis of behavioral adaptations when control is prepared in anticipation of conflict using intracranial EEG (iEEG) in dmPFC and dlPFC during a Stroop task where conflict frequency was manipulated across blocks. We observed canonical conflict-driven increases in dmPFC and dlPFC local population activity, as indexed by high frequency activity (HFA), and in dmPFC theta power. Conflict also suppressed theta power in both regions after the response, and accentuated a pre-response beta desynchronization selectively in dlPFC along with a post-respond beta rebound in both regions. Importantly, we show dmPFC theta power increased before trial onset when conflict was expected, and theta, beta, and HFA conflict signals in both regions were enhanced when conflict was rare and diminished when conflict was common. These findings reveal shared population but dissociable oscillatory dynamics in dmPFC and dlPFC during reactive conflict processing, highlight dmPFC theta as a potential substrate for proactive control, and refine the roles of dmPFC and dlPFC in control adaptations.

Topic Area: EXECUTIVE PROCESSES: Monitoring & inhibitory control

A133 - Attention compensates for reduced reinforcement learning in older adults

Daniel Oppermann Peixoto[1] (dpeix001@ucr.edu), Ian C Ballard[1]; [1]University of California, Riverside

Adaptive learning requires tracking the value of conjunctions of features in the environment, as when one learns that cinnamon and oatmeal can be combined into a delicious dish, even though cinnamon is unpleasant on its own. Previous work has shown that conjunctive representations in the hippocampus support such conjunctive reinforcement learning. Given age-dependent declines in hippocampal function, we hypothesized that older adults would exhibit reduced conjunctive reward learning. We tested younger (n=194) and older (n=196) adults on a speeded target detection task in which four stimulus configurations differentially predicted the appearance of a target (70% for target-positive stimuli AB+ and B+ and 30% for target-negative stimuli AC- and B-). Because each feature alone (A, B, C) was not target-predictive, forming conjunctions (e.g., “AB”) was necessary to maximize task performance. We also included a recognition memory task to assess whether episodic memory mediated age-related differences in conjunctive learning performance. As predicted, older adults exhibited reduced conjunction-based learning. Surprisingly, older adults also exhibited reduced feature-based learning, indicating an overall reduction in reinforcement learning. The degree of conjunction and feature learning correlated with recognition memory performance, consistent with a model in which hippocampal representations of task features support reinforcement learning. Strikingly, older adults earned as many points in the task as younger adults. Indices of sustained attention were correlated with the number of points earned, and this effect was more pronounced in older adults, suggesting that attention compensates for age-related differences in reinforcement learning.

Topic Area: EXECUTIVE PROCESSES: Other

A134 - Brain network flexibility enables learning: Evidence from modal control in adaptive visual attention training

Alexanndra Angebrandt[1], Ramsey Wilcox[1], Aron Barbey[1]; [1]University of Nebraska-Lincoln

Adaptive visual attention relies on cognitive control to prioritize relevant stimuli and suppress distractors, processes governed by top-down mechanisms that regulate attention and enable flexible brain activity. The brain uses substantial energy to engage and maintain the network states that support these top-down control mechanisms. The energy required to transition to these states is further influenced by task complexity, with greater task demands (e.g., more distractors in visual search) necessitating increased cognitive control and transition energy (Beynel et al., 2020). Modal controllability quantifies how effectively brain regions facilitate these high-energy transitions, an ability commonly associated with networks involved in top-down control. In the present study, we investigated how individual differences in modal controllability, assessed prior to the intervention, affected learning during a 16-week adaptive visual attention training program designed to improve visual attention and visual working memory. We hypothesized

that individuals with higher modal controllability would exhibit more efficient learning, particularly in networks associated with top-down control, such as the frontoparietal network. Using diffusion tensor imaging (DTI), we measured structural brain connectivity in 40 healthy college students prior to training. Our results revealed that individuals with higher modal controllability, both globally and within cognitive control networks, demonstrated faster learning. By revealing how modal control influences learning, this study advances our understanding of the network mechanisms that enable adaptive behavior in complex, dynamic environments.

Topic Area: EXECUTIVE PROCESSES: Other

A135 - Impact of focal thalamic lesions on task-evoked aperiodic EEG activity

Shannon Stokes[1] (sestokes@uiowa.edu), Neha Nargarkar[1], Boes Aaron[1], Kwang Kai[1]; [1]University of Iowa

The goal of this study is to determine the effects of focal thalamic lesions on task-evoked aperiodic slope. Aperiodic activity in EEG recordings may be associated with neural excitation/inhibition(E:I) balance, which can be measured by calculating the slope of the power spectrum. A steeper slope has been interpreted as an increase in inhibition over excitation and vice versa. The neural drivers that change large-scale aperiodic slope properties are relatively understudied. However, converging evidence from anatomical, functional, and lesion studies point to the thalamus being a central subcortical region driving cortex wide E-I balance. This study aims to determine whether a cognitively demanding task can modulate the aperiodic slope and to further investigate whether the human thalamus contributes to this phenomenon using a human lesion study approach. We used the FOOOF algorithm (Donoghue et al., 2020) to extract the aperiodic slope in an EEG dataset from 18 patients with focal brain lesions (5 thalamus, 13 non-thalamus). The patients performed a cognitively demanding hierarchical cognitive control task while EEG data were recorded. We found that in all lesion patients, the aperiodic slope was significantly higher in the task-epoch when compared to baseline. Critically, thalamus lesion patients had a significantly shallower slope in a left temporal cluster of electrodes. These results suggest onset of a task-related stimulus is related to an increase in slope, potentially to promote neural information processing related to cognitive control. Furthermore, we provide unique causal evidence demonstrating that thalamus lesions specifically disrupt task-evoked E:I balance.

Topic Area: EXECUTIVE PROCESSES: Other

A136 - Resting-State EEG Dynamics and Neurophysiological Mechanisms of Transcranial Direct Current Stimulation Responses in Neuropsychiatric Disorders

Katerina Nasto[1] (knasto@mgh.harvard.edu), Samadrita Chowdhury[2], Asif Jamil[2], Shane Walsh[1], Joan Camprodon[2]; [1]Massachusetts General Hospital, [2]Massachusetts General Hospital, Harvard Medical School

Background: Transcranial direct current stimulation (tDCS) is a promising neuromodulation approach for addressing cognitive deficits in neuropsychiatric disorders. However, outcomes show significant heterogeneity, partially due to patient-specific differences in pathophysiology and/or normal neurobiology, highlighting the need for precision approaches. Variations in baseline brain states, captured through resting-state EEG, may explain differential responses. This study investigates neurophysiological signatures of tDCS efficacy, emphasizing their role in efficient neural processing and cognitive control. Methods: We applied unsupervised machine learning (ML) to stratify tDCS outcomes based on resting-state EEG in individuals with ADHD, Substance Use Disorders, and healthy controls (n=102). Participants underwent tDCS targeting executive function circuits, with pre-/post-stimulation behavioral task assessments (Flanker, N-Back, Stop Signal) and EEG. Baseline EEG profiles were created by extracting spectral features, including relative/absolute power, entropy, and the spectral exponent (1/f slope of power spectral density). Similarity Network Fusion (SNF) and spectral clustering identified EEG-based clusters. Correlations between clusters and post-tDCS outcomes were assessed, with EEG feature contributions evaluated via normalized mutual information and ANOVA. Results: The two EEG-based clusters showed significant differences in behavioral response ($p=0.0028$, $p=4.8e-5$) and electrophysiology ($p<2.2e-16$). The responder cluster exhibited higher frontal alpha power and a steeper 1/f slope, indicative of optimized excitatory-inhibitory balance and cognitive control. ML-derived clusters outperformed diagnostic categories in predicting tDCS response ($p=0.018$), highlighting the value of data-driven stratification. Conclusion: Our approach identified distinct neurophysiological signatures of tDCS outcomes, advancing our understanding of the intervention's mechanisms and highlighting the potential of ML-based and neurobiology-informed methods for personalized neuropsychiatric interventions.

Topic Area: EXECUTIVE PROCESSES: Other

A137 - Functional connectivity in dynamic brain networks across different levels of suspense during naturalistic viewing.

Aleah Davis[1] (aleah5sos@gmail.com), Sakshi Dawan[1], Matthew Bezdek[2], Shella Keilholz[3], Eric Schumacher[1]; [1]School of Psychology, Georgia Institute of Technology, [2]Department of Psychological & Brain Sciences, Washington University in St. Louis, [3]Wallace H. Coulter Department of Biomedical Engineering, Emory University/Georgia Institute of Technology

An important narrative tool used to elicit emotions and draw attention is suspense, which is characterized by its ability to evoke excited or anxious uncertainty about what will happen in a story. A goal in human neuroscience is to understand how our brain modulates shifts in arousal that are required to maintain attention in everyday-life. Through fMRI data analysis, patterns of activity in dynamic brain networks have been shown to fluctuate at rest and across different tasks. These have been coined Quasi Periodic Patterns (QPPs) and are recurring low-frequency cyclical patterns that fluctuate every ~20 seconds. Brain networks implicated in these patterns include the default mode network (DMN) and the task positive network (TPN), whose activation increases with internally and externally directed attention respectively. Another network is the ventral attention network (VAN), which has shown higher activation in response to contextual cueing and stimuli driven attentional control. Previous studies in our lab have collected fMRI data from 32 participants who watched ~3min movie clips with varying suspense levels. Using this data, we investigated how the correlations between activity in dynamic brain networks changed across suspense levels at specific time points during naturalistic viewing. An increase in overall suspense in clips lead to higher negative correlation in activity between the DMN and the fronto-parietal network, as compared to clips lower in suspense. There was also an increase in dynamic connectivity between the fronto-parietal network and VAN. This emphasizes QPP's potential use as a biomarker that can be used to understand arousal.

Topic Area: EXECUTIVE PROCESSES: Other

A138 - Using electroencephalography to determine the relationship between emotional regulation and executive attention

Dara Olopade[1], Kristie Stephens, Karlie Souder, Sinead Mukolo-Villegas, Aram Akbari, Emma Chacon, Emily Stripling, Michael Oliver; [1]Belmont University

Executive attention is defined as the ability to control the stimuli we pay attention to by discriminating between targets and distractors. Difficulties with working memory and attention are related to slower information processing and greatly affects functioning in society. Emotional regulation is a large factor in lack of attentional focus. These problems may also be associated with exposure to adverse childhood experiences (ACES), as individuals try to cope with the emotional toll of traumatic life events. However, research is limited regarding an understanding of the relationship between executive attention and emotional regulation in relation to one's childhood experiences. In the study, participants were asked to complete the Attention Networking Task (ANT) while measuring electroencephalography (EEG). Then participants completed both the Emotional Regulation Questionnaire (ERQ) and ACEs Questionnaire to assess if experiences in childhood may have affected their levels of emotional regulation in adulthood. It was hypothesized that the relationship between emotional regulation and executive attention would be moderated by ACEs. While number of ACEs was not associated with the relationship between emotional regulation and executive attention, it was found that the relationship between the two variables differed as a function of the presence of ACEs. There was a significant correlation between emotional regulation and executive attention when at least one ACE is reported, whereas no significant relationship was observed when no ACEs were reported. These findings aid in our understanding of the relationship between frontal-mediated cognitive abilities and the effect of developmental trauma from both a behavioral and electrophysiological standpoint.

Topic Area: EXECUTIVE PROCESSES: Other

A139 - A Communication Subspace Relays Behaviorally-relevant Information from Human Prefrontal to Motor Cortex

Neha Binish[1] (neha.binish@uni-tuebingen.de), Robert T. Knight[2], Randolph F. Helfrich[1]; [1]Hertie Institute for Clinical Brain Research, University Medical Center Tübingen, Tübingen, Germany, [2]Helen Wills Neuroscience Institute, UC Berkeley

Flexible routing of context-dependent neural information between cortical areas is essential for adaptive human behavior. The mechanisms underlying this selective routing at the large-scale network level remain poorly understood. Here, we assessed how contextual information is encoded in the prefrontal cortex (PFC) and transmitted to the motor cortex (M1) to enable efficient visual target detection. We recorded intracranial electroencephalography (iEEG) from subdural grid electrodes in 12 pharmacoresistant epilepsy patients. All participants exhibited a clear behavioral advantage of the predictive context, responding faster to predicted than random targets ($P = 0.0333$). Despite a clear behavioral difference, univariate analyses of neural recordings from PFC and M1 did not reveal context-specific electrophysiological signatures predictive of the behavioral benefit. However, both regions, PFC and M1, displayed high-dimensional neural dynamics. We hypothesized that context-relevant information might be confined to a subset of PFC population activity. Using multivariate analyses, we identified a low-dimensional communication subspace between PFC and M1 in humans. Critically, PFC activity projected onto this subspace correlated with behavioral outcome ($\rho = 0.79$, $P = 0.0037$). Hence, latent subspace dynamics tracked context-dependent behavior. These findings reveal a population-level mechanism for the selective routing of contextual information between PFC and M1, offering new insights into how neural circuits dynamically adapt to varying task demands. Our results highlight the importance of multivariate analysis approaches to uncover behaviorally-relevant neural dynamics that are often hidden in high-dimensional neural activity patterns. In sum, our findings highlight the role of communication subspaces in mediating flexible, context-dependent behavior.

Topic Area: EXECUTIVE PROCESSES: Other

A140 - A novel framework to link insight to general brain mechanisms

Maxi Becker[1,2] (almaxi@gmail.com), Simon Davis[1,2], Roberto Cabeza[2]; [1]Humboldt University Berlin, [2]Duke University

Sudden insights rank among the most captivating human phenomena. They combine a cognitive breakthrough with the distinctive "Aha" moment—marked by suddenness, surprise, pleasure and confidence in the solution. Why are we surprised and certain about thoughts we generate ourselves? While classical theories emphasize the cognitive processes leading to insights, a novel framework, the insight-as-prediction-error hypothesis, offers a broader explanation, linking the Aha! experience to enhanced memory and general brain mechanisms. According to this framework, the brain forms an internal model based on prior experience, predicting patterns to interpret problem elements. Negative cognitive prediction errors (PEs) accumulate when predictions fail. Insight occurs when the internal model is restructured such that negative cognitive PEs are sharply reduced generating positive meta-cognitive PEs (representing surprise about the sudden solution) which leads to a strong internal model update and enhances its long-term memory encoding. We provide evidence from behavioral, eye-tracking and neuroimaging data to empirically support this theoretical framework. Behaviorally, we demonstrate that the intensity of the Aha! experience is directly influenced by PEs associated with both the solution and its process, as well as by pupil dilation before the solution, a marker for reward PEs. Neurally, we show a sharp reduction in negative PEs during visual insight in higher visual brain areas. Additionally, we identify modality-independent activity in hippocampus, ACC and medial PFC during insight and subsequent memory, reflecting the detection and integration of metacognitive PEs. These findings deepen our understanding of the neurocognitive mechanisms underlying insight and its role in adaptive learning.

Topic Area: EXECUTIVE PROCESSES: Other

A141 - Meet me in the Middle: Does fNIRS Resting State Activity Correlate with Line Bisection Performance?

Hannah Kershner[1], Sinead Mukolo-Villegas[2], Karlie Souder[3], Jasmine Clark[4], Carole Scherling, PhD.; [1]Belmont University, [2]Department of Psychological Science and Neuroscience

Functional near-infrared resonance imaging (fNIRS) is a novel brain imaging technique (Zhang, 2020) that warrants validation through replications of imaging findings, to establish tool capability. EEG is an example, and previous work revealed the Line Bisection Task as a predictor of left PFC alpha-asymmetry and a valid measure of approach-motivation (Nash, 2010). The current study partially replicated this study, examining rest brain-lateralization and executive-task performance in 34 undergraduates (22F; age (SD)= 19.91 (1.38); right-handers). Participants completed eyes-open and -closed resting fNIRS sessions (8X8 PFC montage), completed questionnaires (Rosenberg Self-esteem (SE) and handedness), and indicated subjective centrality on 14 lines for the bisection task. We hypothesized higher SE related to fewer marker movements and that higher left dorsolateral prefrontal (dlPFC) resting activity will correlate with higher SE and rightward bias. Results revealed an expected negative correlation between SE and marker movement ($r_s(34)= -0.361$, $p= 0.018$). However, lateralized rest activity was inverted, with more right dlPFC associated with higher SE ($r_s(31) = 0.442$, $p = 0.013$). No significance was shown between rest and line bias. Overall, results support Nash's findings for behavioral outcomes, but not brain laterality. EEG and fNIRS provide different temporal and spatial resolutions, which could account for differential findings. While further replications are necessary to elucidate rest-activity and centrality judgements, the current study supports the use of fNIRS to probe brain activity and brain lateralization. Future studies should investigate cohorts with matured PFC (vs. emerging) and consider effects of handedness.

Topic Area: EXECUTIVE PROCESSES: Other

A142 - Structural Network Efficiency and Self-Reported Cognitive Symptoms After Sports-Related Concussion

Heather C Bouchard[1,2] (hbouchard2@huskers.unl.edu), Ramsey R Wilcox[1,2], Douglas H Schultz[1,2], Aron K Barbey[1,2]; [1]Center for Brain, Biology and Behavior, University of Nebraska-Lincoln, [2]Department of Psychology, University of Nebraska-Lincoln

Concussion results in diverse symptoms, including self-reported cognitive concerns. Prior research has investigated the effects of concussion on local brain networks, with limited attention to global network disruptions. This study examines global efficiency, a measure of system-wide network integration, to elucidate how concussion alters brain network organization and contributes to clinical presentation and recovery. We collected MRI and self-reported symptoms from collegiate athletes ($n = 35$) at three time points: baseline (pre-injury), within approximately 48 hours of a diagnosed concussion (post-injury), and after clearance to return-to-play (recovery). Athletes reported symptoms using the Post-Concussion Symptom Scale, which were categorized into cognitive, somatic, affective, and sleep-related domains. Structural connectomes were constructed from diffusion-weighted MRI using anatomically-constrained tractography, and global efficiency was calculated for each time point. Linear mixed-effects models were employed to assess the relationship between global efficiency and symptoms across the three time points. Athletes showed reduced global efficiency following concussion when controlling for prior concussion history, which persisted through recovery compared to baseline. Total symptom reports increased after concussion and decreased at recovery. Additionally, there was an interaction between global efficiency and cognitive symptoms, indicating lower global efficiency after concussion was associated with more cognitive symptoms. Our findings demonstrate that decreases in global efficiency may reflect a neurobiological marker of cognitive symptoms following concussion, such as slowed thinking, difficulty concentrating, and memory concerns. This relationship appears to diminish with clinical recovery, highlighting the need to further explore longitudinal effects and how these changes relate to objective markers of recovery.

Topic Area: EXECUTIVE PROCESSES: Other

A143 - Enhancement of gripping force by a simultaneous cognitive task via increase in the overall arousal level

Sofia Nagisa[1], Ethan Oblak[1], Shinsuke Shimojo[2], Kazuhisa Shibata[1]; [1]RIKEN Center for Brain Science, [2]California Institute of Technology

When two tasks are performed simultaneously, interference often degrades the performance of each task. This interference is typically explained by the interaction or competition between different brain systems. This study aimed to test whether simultaneously performing tasks can benefit, rather than degrade, the performance of the tasks. Participants performed a muscular endurance task in which they gripped a force sensor for 12 seconds with their maximum sustainable force. They simultaneously performed one of three cognitive tasks with increasing difficulty: 1) merely watching a sequence of images, 2) performing a 1-back task, or 3) performing a 2-back task on the images. Average gripping force increased with cognitive task difficulty, indicating that engagement in the demanding cognitive task improved performance of the unrelated muscular endurance task. Pupil diameter, a physiological measure of arousal, also increased with cognitive task difficulty and strongly correlated with gripping force during each trial. We found similar increases in gripping force and correlations of force and pupil diameter when arousal was manipulated by the amount of monetary reward given for the 2-back task. We also observed increased force production in a separate double task experiment with a tactile discrimination task instead of a visual one. Increased gripping strength was found irrespective of whether participants attended to tactile stimulations on the gripping or non-gripping hand. These results suggest that the double task benefit likely occurred due to an overall increase in arousal level by the cognitive effort, which in turn enhanced the exerted force in the endurance task.

Topic Area: EXECUTIVE PROCESSES: Other

A144 - The Effects of Short-Form Mindfulness Training on the Vigilance Decrement

Jason S. Tsukahara[1] (jason.tsukahara@miami.edu), Brooke Schwartzman[1], Anthony P. Zanesco[2], Ekaterina Denkova[1], Scott Rogers[1], Amishi P. Jha[1]; [1]University of Miami, [2]University of Kentucky

The vigilance decrement, declining performance with greater time-on-task, highlights the challenges of sustaining attention over prolonged task engagement. For high-demand occupations, such as the military, such performance deterioration may jeopardize safety and mission success. Mindfulness training (MT) has shown promise in protecting and strengthening overall attentional performance, but its potential to mitigate the vigilance decrement has been underexplored. Here, US Army soldiers undergoing intensive military training were recruited to serve as no-training controls (NTC, n=71), or receive a 4-week, 8-hour MT program (MT, n=161) referred to as mindfulness-based attention training (MBAT). Attentional performance on a 20-minute Sustained Attention to Response Task (SART) was examined before (T1) vs. after (T2) the 4-week MT interval. Overall task performance as well as time-on-task effects indexing the vigilance decrement were examined. Relative to NTC, MT showed less decline in overall SART performance (indexed via A' and response time variability) from T1 to T2. Examination of the vigilance decrement via growth curve modelling confirmed that A' decreased and response time variability increased with greater time on task at both T1 and T2. While there were no group by time (i.e., T1 vs. T2) differences, for those in the MT group, greater mindfulness practice over the 4-week interval, was associated with a diminished vigilance decrement at T2. These results suggest that mindfulness training is protective for overall task performance and that greater mindfulness practice further protects against the vigilance decrement, which may mitigate attentional failures in high-demand occupations such as the military.

Topic Area: EXECUTIVE PROCESSES: Other

A145 - Intrinsic fluctuations in global connectivity reflect transitions between states of high and low prediction error

Paul C. Bogdan[1] (paulcbogdan@gmail.com), Shenyang Huang[1], Lifu Deng[2], Simon W. Davis[1], Roberto Cabeza[1]; [1]Duke University, [2]Cleveland Clinic

Some researchers claim all brain functions are linked to prediction error (PE) minimization. Others argue PE drives low-level computations but less so abstract and whole-brain cognitive operations. We investigated this topic, and specifically, whether even stimulus-free cognition – daydreaming during a resting-state scan – involves the omnipresent minimization of PE. We investigated this issue using a three-part design involving fMRI and EEG data. Study 1 used task-fMRI to establish templates of high-PE and low-PE global states. This was done using both semantic and reward PE tasks, which revealed that high-PE information broadly upregulates ventral-dorsal connectivity whereas low-PE information upregulates posterior-anterior connectivity. Study 2 used resting-state fMRI data collected from the same participants and showed that, even in the absence of stimuli, the brain continuously fluctuates between ventral-dorsal (high-PE) and posterior-anterior (low-PE) dynamic connectivity states. Additionally, individual differences in PE task responses track differences in resting-state fluctuations, suggesting that these fluctuations represent PE minimization at rest. Finally, Study 3 used combined fMRI-EEG to assess the temporal properties of these high/low-PE fluctuations and whether they occur at speeds that could index functions like redirecting attention, planning behavior, and updating working memory. Indeed, fMRI-EEG correlations suggest the resting-state ventral-dorsal and posterior-anterior PE networks specifically oscillate at 3-6 Hz. This whole-brain layout and timeline together speak to high/low-PE fluctuations playing a role in integrative, sub-second mental operations.

Topic Area: EXECUTIVE PROCESSES: Other

A146 - PRIMED and READy: Prefrontal Cortex Resting-State Activity Modulates Cross-Modal Linguistic Priming Performance.

Maria Angelina Bekhit[1] (mariaangelina.bekhit@bruins.belmont.edu), Cecilia Garcia[2], Kerlous Aziz[3], Zoe Niesen[4], Carole Scherling[5]; [1]Neuroscience, Department of Psychological Science and Neuroscience, Belmont University Nashville, TN

The prefrontal cortex (PFC), particularly the left side, plays a crucial role in integrating context and guiding linguistic processes, such as those involved in priming (Hamilton & Hsu, 2023). The current study examined PFC resting-state activity laterality and linguistic priming performance. Thirty right-handed undergraduates (17F, age (SD)= 20.37 (1.273)) completed an eyes-open and -closed resting fNIRS session (8x8 PFC montage), and laterality indices for each channel pair were extracted after data processing [(L-R)/(L+R)]. During a cross-modal linguistic priming task, participants first heard a word and then viewed a word on the screen. Participants judged multiple auditory/visual pairs on word-relatedness, extracting accuracy rates and latency for primed (related) or unprimed (unrelated) pairs. Results expectedly revealed faster latency for primed (vs. unprimed) pairs (rs(28)= 0.650, p< 0.001) but no differences were uncovered regarding accuracy. When examining global left PFC activity for both eyes-open and -closed, no significant relationships were found with both latency and accuracy (p> 0.05). Exploratory analyses targeted the dorsolateral PFC (dlPFC) due to its high involvement in verbal performance (Hertrich, 2021) and priming (Fassbender, 2006). Results revealed higher eyes-open activity with lower accuracy for primed-pairs (rs(27)= -0.387, p< 0.05), but no association with latency. Findings suggest that left dlPFC resting preparatory states may influence cross-modal priming task accuracy, with higher activity decreasing active task engagement potential and thereby influencing associated performance. Overall, fNIRS is an assessable tool that can probe resting-state activity and brain lateralization and is highly applicable to examine the neural correlates of executive functioning.

Topic Area: EXECUTIVE PROCESSES: Other

A147 - Investigating Differences in Eye Tracking Metrics Between Numeric and Alphanumeric Test Complexities in the Traill Making Test

Bailey Uitz[1] (uitz.b@northeastern.edu), Ethan Wong[1], Isabella Frenzilli, Erin Lynch, Eugene Tunik, Mathew Yarossi; [1]Northeastern University

Tailoring interventions for neurological impairment relies on precise diagnosis of deficits across multiple domains. Existing clinical scales to assess cognitive-motor function typically offer limited performance metrics in a single domain. By digitizing these tools, it's possible to capture the spatial-temporal aspects of behavior, providing insight into domain-specific deficits. Furthermore, quantitative capture of eye-hand coordination can provide unparalleled insights about the interplay of the cognitive-visual-motor triad that is critical for complex behavior. With this aim, we developed a novel digitized TMT (dTMT) with integrated eye-tracking to allow for extraction of more in-depth outcome measures, necessary for multi-domain assessment. The dTMT shows strong criterion validity in young healthy individuals in comparison to the original paper TMT. Healthy young participants (N=21) completed numeric (1-2-3-4...) and alphanumeric (1-A-2-B...) versions of the eye tracking-integrated dTMT. Hand path, gaze path, and spatial and temporal distribution of fixation targets relative to hand target were measured to assess differences in the cognitive resources required between test complexities. In a comparison of the alphanumeric and the numeric tasks there was a significant (p<0.001) increase in the number of fixations and an increase (p<0.001) in fixations on previously achieved targets. These results indicate that greater cognitive resources are required for the alphanumeric test characterized by more complex spatial planning (increased number of fixations), less attention to the peripheral visual field, and a greater strain on working memory (increased re-fixations). This work establishes the utilization of an eye-tracking integrated dTMT for the detection of individualized domain-specific deficits in neurologically impaired populations.

Topic Area: EXECUTIVE PROCESSES: Other

A148 - Anxiety and stress symptoms are robustly associated with global negative metacognitive biases

Obinna Megwa[1], Sam Agnoli[1,2,6], Catherine Fortier[1,5], William P. Milberg[1,5], Michael Esterman[1,2,3,4], Joseph DeGutis[1,2,5]; [1]Translational Research Center for TBI and Stress Disorders (TRACTS), VA Boston Health Care System, [2]Boston Attention and Learning Lab, VA Boston Health Care System, [3]National Center for PTSD, VA Boston Health Care System, [4]Boston University Chobanian and Avedisian School of Medicine, [5]Harvard Medical School, [6]Northwestern University

More negative metacognitive bias, the tendency to underestimate one's abilities, has been associated with increased anxiety/stress, depressive, and post-traumatic stress disorder (PTSD) symptoms. Studies often combine depressive and anxiety/stress symptoms into a single factor or focus exclusively on depressive symptoms. We sought to assess the unique contribution of depression, anxiety/stress, and PTSD to negative metacognitive bias in post-9/11, combat-deployed veterans. Participants (N=623, 90%-male, mean age=34.27 years) from the Translational Research Center for TBI and Stress Disorders (TRACTS) were administered the Depression Anxiety Stress Scale and Clinician-Administered PTSD Scale. Global metacognitive bias was calculated by subtracting self-reported cognitive ability (World Health Organization Disability Assessment Schedule-II Understanding and Communicating) from a global composite of validated neuropsychological assessments (executive function, memory, attention). 261 participants performed all assessments 2 years later to examine how longitudinal changes in symptoms related to changes in negative metacognitive bias. At baseline, more negative metacognitive bias was robustly associated with greater anxiety/stress (ρ=-.44), depressive (ρ=-.40), and PTSD symptoms (ρ=-.31). In a multiple regression, anxiety/stress (β=-.31, p<.001) and depressive symptoms (β =-.12, p=.045) predicted unique variance, though PTSD symptoms did not (β=-.03, p=.556). When examining 2-year changes in metacognitive bias, we found that changes in anxiety/stress symptoms (β=-0.32, p<.001) and changes in PTSD symptoms (β=-.18, p=.003) were significant unique predictors, while changes in depressive symptoms were not (β =-.10, p=.144). Anxiety/stress was uniquely associated with metacognitive bias relative to depression and PTSD, and changes in anxiety/stress predicted changes in bias over time.

Topic Area: EXECUTIVE PROCESSES: Other

A149 - Causal evidence for the role of cognitive control networks in motor performance in Parkinson's Disease: a combined fMRI-TMS approach

Rupsha Panda[1] (rupsha@umich.edu), James Brissenden[1], Ritika Tiwari[1], Michael Vesia[2], Roger Albin[3], Taraz Lee[1]; [1]University of Michigan, Department Psychology, [2]University of Michigan, Department of Kinesiology, [3]University of Michigan, Department of Neurology

Parkinson's disease (PD) is a neurodegenerative disorder marked by cognitive and motor deficits. Recent research implicates an Attention-Motor Interface (AMI) between cognitive control networks, basal ganglia, and motor networks as a key contributor to motor deficits in PD. However, human studies linking AMI disruption to motor dysfunction remain correlational. This study employs transcranial magnetic stimulation (TMS) and functional magnetic resonance imaging (fMRI) to examine the causal role of AMI nodes in motor impairment across multiple sessions. In all sessions, motor performance was assessed while in the scanner using a precision force-tracking task that has been shown to correlate with gait impairment. In half of the force-tracking blocks, participants were required to simultaneously perform a cognitively demanding 2-back working memory task to tax attentional systems. Following an initial baseline fMRI session, participants subsequently underwent three separate fMRI-TMS sessions using theta burst stimulation (TBS) to transiently increase and reduce excitability in the dorsolateral prefrontal cortex (DLPFC), a key AMI node in the fronto-parietal control network (FPN). Excitatory stimulation over DLPFC led to a significant improvement in motor performance relative to both control stimulation and inhibitory stimulation. Preliminary fMRI results further suggest that these performance improvements coincide with increased activity locally at DLPFC, but also in other frontal regions more typically associated with the cingulo-opercular control network (CON). These findings suggest a causal role for cognitive control networks in the underlying motor dysfunction in PD and highlight the AMI as a potential therapeutic target.

Topic Area: EXECUTIVE PROCESSES: Other

A150 - How Does Task Structure Impact Metacognitive Judgment?

Tanvi Palsamudram[1] (tanvi_palsamudram@brown.edu), Haley Keglovits[1], David Badre[1]; [1]Brown University

Metacognition is the knowledge and regulation of one's own cognition. An open question concerns how people judge their own performance on a task, even prior to performing it, and what aspects of task structure affect those judgments. Prior research suggests that people perceive cognitive control tasks requiring higher degrees of policy abstraction as being more effortful, and they will avoid them, even based only on instructions and even when performance is otherwise matched (Sayalı et al., 2023). Given that people use this aspect of task structure to predict effort independent from their actual performance, we asked whether this feature of task structure could also influence metacognitive judgments. We hypothesize that as a task's policy abstraction increases, the accuracy of metacognitive judgments will decrease. Thirty participants completed established stimulus-response tasks (Badre and D'Esposito, 2007), which manipulate policy abstraction while controlling for load. Participant judgments of their performance and their confidence in these judgments were measured before and after each task. As policy abstraction increased, performance was more error prone and slow, matching the findings of previous studies. Further, participants' judgment of their own performance improved with task experience. Nevertheless, preliminary findings showed an interaction between abstraction and pre- and post-diction of objective performance, such that as task abstraction increases, the accuracy of metacognitive judgments decreases, consistent with our hypothesis. Overall, the results suggest that metacognition is influenced by task structure, such as policy abstraction. These features contribute to human estimates of their own task performance, even before performing it.

Topic Area: EXECUTIVE PROCESSES: Other

A151 - Unpredictable auditory stimuli and risk-taking: The role of executive functioning, affect, and sensation-seeking.

Calvin Moen[1] (cwmoen@edgewood.edu), Ferrinne Spector; [1]Edgewood College

Risk-taking behavior is influenced by complex interactions between cognitive and emotional processes such as executive functioning and anxiety. This study examines how unpredictable aversive auditory stimuli impact risk-taking preferences, and how individual differences in executive functioning moderate this relationship. Adult participants (n = 27) completed a modified Balloon Analogue Risk Task (BART), a virtual gambling task involving the inflation of a balloon for a cash reward at the risk of it popping. This task was completed across three conditions, a control condition and two unpredictable sound conditions. Auditory stimuli were drawn from the International Affective Digitized Sounds (IADS-2) database to evoke anxiety without excessive distress. The unpredictable sounds were either response-bound, playing randomly only after a response, or temporally bound, which presented randomly throughout. Affective states were measured using an Affective Slider measuring affective valence and intensity before and after each condition. The experimental conditions had significant effects on affect, with a decrease in positive affect (F = 16.55, p<.001) and increase in intensity (F = 4.09, $p<.01$). Overall, sound condition did not affect response (F = 1.547, p = 0.225). However, regression analysis showed that state affect, executive functioning, sensation-seeking, and difficulties in emotion regulation explained a considerable degree of variance in risk taking - as measured by number of balloon "pumps" across conditions ($R2 = .519$, $p<.001$) with higher sensation seeking scores and positive affect significantly predicting the number of pumps. The study highlights the nuanced relationships between traits and affect in risk-taking behavior.

Topic Area: EXECUTIVE PROCESSES: Other

A152 - Regional, But Not Brain-Wide, Graph Theoretic Metrics Are Robustly and Reproducibly Linked to General Cognitive Ability

M. Fiona Molloy[1] (mfionamolloy@gmail.com), Aman Taxali[1], Mike Angstadt[1], Tristan Greathouse[1], Katherine Toda-Thorne[1], Katherine M. McCurry[1], Alexander Weigard[1], Omid Kardan[1], Lily Burchell[1], Maria Dziubinski[1], Jason Choi[1], Melanie Vandersluis[1], Cleanthis Michael[1], Mary M. Heitzeg[1], Chandra Sripada[1]; [1]University of Michigan

General cognitive ability (GCA), also called "general intelligence", is thought to depend on network properties of the brain, which can be quantified through graph theoretic measures such as small worldness and module degree. An extensive set of studies examined links between GCA and graphical properties of resting state fMRI connectomes. However, these studies often involved small samples, applied just a few graph theory metrics in each study, and yielded inconsistent results, making it challenging to identify the architectural underpinnings of GCA. Here, we address these limitations by systematically investigating univariate and multivariate relationships between GCA and 17 whole-brain and node-level graph theory measures in individuals from the Adolescent Brain Cognitive Development study (N=5,937). GCA was computed using bifactor modeling of a battery of neurocognitive tasks, spanning a range of domains including learning and memory, language, and cognitive control. We demonstrate that whole-brain graph theory measures, including small worldness and global efficiency, fail to exhibit meaningful relationships with GCA. In contrast, multiple node-level graphical measures, especially within-module degree (within-network connectivity), exhibit strong associations with GCA. We establish the robustness of these results by replicating them in a second large sample, the Human Connectome Project (N=847) and across a variety of modeling choices. This study provides the most comprehensive and definitive account to date of complex interrelationships between GCA and graphical properties of the brain's intrinsic functional architecture.

Topic Area: EXECUTIVE PROCESSES: Other

A153 - Combining gamified cognitive training and walking: A pilot study

Julissa Ruiz[1] (julissa.ruiz@cshs.org), Michael Sobolev[1], Katherine Barnhill[1], Marie Lauzon[1], Arash Asher[1], Jun Gong[1], Celina H. Shirazipour[1], Gillian Gresham[1], Aaron Seitz[2], Sarah-Jeanne Salvy[1]; [1]Cedars-Sinai Medical Center, [2]Northeastern University

Introduction: Cognitive training and physical activity independently benefit cognitive functioning. Their combined benefits are not well understood. This pilot trial tests the efficacy of supplementing daily walking with gamified inhibitory control on cognitive and activity outcomes among individuals experiencing cognitive challenges. Methods: Participants were randomly assigned to (1) daily 30-min walks (Walk), or (2) alternating days of 30-min walks and 30-min app-based cognitive training (Walk & Play). Participants completed a cognitive battery at baseline and post-intervention. Activity metrics and adherence to cognitive training were captured through self reported and objective data. Paired t-test and repeated measures ANOVA were used for pre vs. post comparisons. Results: Participants (n=32; M age = 61) were majority women (84%), with cognitive challenges related to cancer history (75%). Adherence was high, with 81% (Walk) and 94% (Walk & Play) of participants completing all assigned walks. Over 87% of Walk & Play participants completed all of cognitive trainings. Post intervention, Walk & Play participants' performance improved on Rule Switch (p = 0.028), UCancellation (p = 0.007), and Corsi (p = 0.04) tasks compared to pre assestment. Walk & Play further showed significant increase in active minutes (p=.014), while Walk had a significant reduction in sedentary time (p=.0006). Conclusions: These findings support the feasibility of remotely delivered physical activity and cognitive training, with benefits in cognitive performance and activity metrics. Research is needed to determine the sustainability of intervention gains, as well as how to best combine activity and cognitive training for optimal transfer to real-world tasks.

Topic Area: EXECUTIVE PROCESSES: Other

A154 - Implementing Deep Learning Models to Personalize Learning in Cognitive Training

Elnaz Vafaei[1] (e.vafaei@northeastern.edu), Jaap Munneke[1], Susanne Jaeggi[1], Aaron Seitz[1]; [1]Northeastern University

Cognitive training programs have demonstrated potential in improving cognitive abilities. However, due to a one-size-fits-all approach, the reported effectiveness of cognitive training has been inconsistent. This highlights the need for adaptive interventions that personalize characteristics of cognitive training tasks based on participants' performances in a real-time manner. In this study, we propose a framework for a closed-loop adaptive interactive system designed to enhance individual performance on a series of cognitive training tasks. In the first stage, we aimed to model individual differences in performance trajectories (Accuracy and N-level) extracted from a working memory (WM) task, serving as the initial prototype. Predicting the performance trajectory for the next trial can serve as a strategy to define the proportional characteristics of subsequent tasks. We employed several deep learning models, including Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU), to predict participants' performance based on data from 277 undergraduates recruited from the Universities of California, Irvine, and Riverside, who completed 20 sessions of the N-back task. The results demonstrate that deep learning models accurately predict performance trajectories in the N-back task, achieving an R-squared value of 0.9168. In addition, no meaningful difference was observed between the GRU and LSTM models' performance. Deep learning models can accurately predict participant performance and can be used to create personalized cognitive training systems that enhance engagement and task compliance. Future research would benefit from exploring the application of the proposed model in a real-time closed-loop system.

Topic Area: EXECUTIVE PROCESSES: Other

A155 - The Impact of Collegiate Amateur Boxing on Cognitive Functioning and Psychological Health

Samara Quintero[1], Ava Romerosa[2], Julia Torre[3], Matt Birnhak[4], Sarah Raskin[5]; [1]Trinity College

Competitive boxing presents a paradox: while repeated head impacts raise concerns about cognitive decline due to brain trauma, the sport's intense aerobic demands may lead to improved cognitive functioning, reduced symptoms of depression and anxiety, and increased resilience. While research has documented cognitive impairment in professional boxing, little is known about collegiate amateur boxing. This study included 75 participants from three groups: collegiate amateur boxers (CAB, n=25), non-impact student-athletes (NISA, n=24), and low-exercise individuals (LE, n=26, exercising ≤3 hours per week). Participants completed a 90-minute Zoom session assessing memory, executive function, verbal fluency, depression, anxiety, and resilience. Data on concussion history and symptoms were also collected. Results revealed that CAB and LE participants performed significantly better than NISA participants on the backward digit span task of working memory ($F = 6.135$, $P = .003$) and verbal fluency ($F = 4.892$, $P = .010$), with no other cognitive differences. However, LE participants reported significantly higher depression ($F = 3.900$, $P = .025$) and anxiety symptoms ($F = 7.536$, $P = .001$) than both groups. Collegiate amateur boxing participants reported significantly higher resilience than LE participants, with NISA showing no difference between groups ($F = 3.971$, $P = .023$). These findings suggest collegiate amateur boxing may enhance working memory and resilience without compromising cognitive health. Additionally, elevated depression and anxiety symptoms in LE participants suggest inactivity may pose greater mental health risks than boxing, warranting further research.

Topic Area: EXECUTIVE PROCESSES: Other

A156 - Differential Effects of State and Trait Anxiety on Task Engagement

Ceyda Sayali[1], Emma Heling[2], Roshan Cools[2]; [1]Johns Hopkins University School of Medicine, [2]Donders Institute for Brain, Cognition, and Behaviour

Cognitively demanding tasks are often perceived as costly due to the cognitive control resources they require, leading to effort avoidance, particularly in psychiatric populations with motivational impairments. Theories of cognitive effort evaluation offer conflicting predictions regarding the role of anxiety. Processing Efficiency Theory suggests that anxiety increases cognitive costs, promoting effort avoidance, whereas the Process Model of Cognitive Emotion Regulation posits that cognitively demanding tasks may serve as adaptive coping mechanisms, enhancing engagement. To reconcile these perspectives, we examined the interaction between state and trait anxiety in relation to cognitive effort evaluation and engagement. We hypothesized that state anxiety would enhance task engagement as task difficulty increased, but this effect would diminish in individuals with high trait anxiety. Experiment 1 assessed self-reported anxiety in an online sample, while Experiment 2 manipulated state anxiety through autobiographical recall. Both experiments employed flow induction and effort discounting paradigms. Results partially supported our hypothesis, revealing nuanced effects. Experiment 1 showed that participants with high trait anxiety and low state anxiety experienced enhanced flow as task difficulty increased. In contrast, Experiment 2 found that individuals with both low state and trait anxiety reported the highest flow. Separately, individuals with low state exhibited lower effort discounting scores, whereas those with low trait showed the opposite pattern. Across both experiments, flow and effort discounting were influenced by distinct factors. These findings suggest that state and trait anxiety interact with task difficulty in engagement, while trait anxiety undermines it, and flow and effort discounting are dissociable cognitive processes.

Topic Area: EXECUTIVE PROCESSES: Other

A157 - High boredom proneness and the (in)tolerance of disruptions to agency.

V. Baaba Dadzie[1] (bbdadzie@uwaterloo.ca), James Danckert[1]; [1]University of Waterloo

Recent work from our lab and others shows that those high in boredom proneness report feeling diminished levels of agency. In other work, we have shown that boredom proneness is unrelated to the perception of agency in others – that is, the highly boredom prone do not struggle to perceive agency external to themselves. Here, we investigated the possibility that the highly boredom prone would be more sensitive (and less tolerant) to disruptions in agency. We had participants play the video game Pong, with gradual introduction of a delay between the initiation of movements of the paddle in the game and actual movement on the screen as a means to disrupting agency. In addition, participants had the option to reset the game at any time. For those who reset the game at least two times during the 20 minutes of play, we found that boredom proneness was predictive of the total number of resets and the time in between resets. That is, those higher in boredom proneness tended to reset the game more frequently and did so at lower levels of disruption to their agency. Further work is needed to determine how this intolerance of disruptions to agency might influence (or be influenced by) the failure to launch into action that is characteristic of boredom proneness.

Topic Area: EXECUTIVE PROCESSES: Other

A158 - The interplay of within and between-sensory binding cues in audiovisual scene analysis

Qiong Wu[1], Noppeney Uta[1]; [1]Donders Institute for Brain, Cognition, and Behaviour

To transform the sensory cacophony into a coherent percept of the environment, the brain should integrate signals from common causes and segregate those from separate causes. How the brain combines within- and between-sensory binding cues for causal inference in complex audiovisual scenes remains unknown. We addressed this using novel ambiguous audiovisual scenes in which human observers (N=24) were presented with alternating high- and low-pitched tones from the center, alone or synchronized with blobs flashing alternately in the left and right hemifields. Across auditory trials the auditory sequences were presented at three levels of frequency separation. Across audiovisual (AV) trials the flashes were presented at three levels of symmetric eccentricities, which manipulated both the inter-flash distance and the audiovisual spatial disparity. By combining the subjective causal inference reports ("one" vs. "two streams") and objective deviant detection performance (d-prime), our results confirm previous findings that larger frequency separation enhances auditory stream segregation and thereby facilitates deviant detection. Crucially, inter-flash distance, a visual binding cue, influenced auditory perception non-monotonically: At small distances, close flashes were integrated into one stream of apparent motion flashes, promoting auditory stream integration via AV binding. At intermediate distances, the perception of two distinct visual streams enhanced auditory stream segregation via AV binding. At large distances, auditory stream segregation was comparable to that in a purely auditory context, as pronounced AV spatial disparities hindered AV binding. Our results show that the brain combines within- and between-sensory binding cues to attribute sensory signals to their underlying causes.

Topic Area: PERCEPTION & ACTION: Multisensory

A159 - Causal Inference Modulates Auditory Spatial Recalibration in Accordance with Bayesian Principles

Wenshu lou[1] (wenshulou795@gmail.com), Uta Noppeney[1]; [1]Donders Institute for Brain, Cognition and Behaviour

Our sensory systems continuously adapt to changing sensory statistics in our environment. To maintain internal consistency and external accuracy with respect to the outside world, an observer must rapidly recalibrate auditory and visual senses. Crucially, evidence suggests that auditory spatial recalibration may inherently rely on causal inference—that is, determining whether audiovisual signals originate from a common source. To investigate the role of causal inference in recalibration, we presented observers with synchronous audiovisual (AV) signals at varying spatial disparities, followed by unisensory A or V signals. Observers reported: (1) whether the AV signals originated from a common source, (2) their confidence in this causal judgment, and (3) the perceived location of the subsequent unisensory signals. Psychophysics results show that recalibration of the less reliable A cue depends non-linearly on spatial disparity and is enhanced when observers perceive a common cause. Moreover, the uncertainty of causal judgment (i.e., confidence) also influences recalibration—observers recalibrated less when reporting higher confidence. To further examine the underlying mechanisms, we developed a set of observer models incorporating both Bayesian and heuristic strategies for recalibration and causal inference. Group-level Bayesian model comparison results indicate that Bayesian strategies outperformed their non-Bayesian counterparts in terms of BIC. Importantly, behavioral patterns were captured and well explained by Bayesian causal inference models but not by heuristic models. Our findings demonstrate that causal inference and its uncertainty modulate auditory spatial recalibration in response to varying spatial discrepancies, with underlying computations following Bayesian principles.

Topic Area: PERCEPTION & ACTION: Multisensory

A160 - An expected visual location biases observers' perception and neural encoding of sound locations

Claire Pleche[1], Uta Noppeney[1]; [1]Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, the Netherlands

To interact with the multisensory world the brain combines noisy sensory signals with prior knowledge into a coherent percept. While integrating information from multiple sources reduces uncertainty, it can introduce perceptual biases as illustrated by the ventriloquist illusion: When presented with spatially disparate audiovisual signals, observers perceive the sound as shifted towards the visual location. We investigated whether prior expectations about the location of a visual stimulus biases an observer's perception and neural encoding of sound locations. Participants observed a visual object moving from various locations along the azimuth to the bottom of the screen, its trajectory partially occluded by a wall. When the object was expected to hit the ground, a sound was presented alone or in synchrony with the ball's reappearance at the expected location. The sound came either from the ball's: (i) expected location, (ii) final location before the occlusion or (iii) an unexpected location. Observers indicated their perceived sound location via a keypress. Participants' perceived sound location was shifted towards the ball's final location before the occlusion and also to the location where it was expected to reappear. Additionally, the neural response differed when the sound was presented at a spatially predicted compared to unpredicted location. Our results demonstrate that both a visual but also an expected visual input can bias where observers perceive sounds. From a Bayesian perspective, they show that the brain forms prior expectations based on inputs in one sensory modality that to some extent affect perceptual inference of stimuli in another modality.

Topic Area: PERCEPTION & ACTION: Multisensory

A161 - The effect of object familiarity on EEG signal in auditory and visual semantic processing

Emma Karn[1] (ekarn@fordham.edu), Elissa Aminoff[1], Joseph Toscano[2]; [1]Fordham University, [2]Villanova University

Previous literature using the event-related potential (ERP) technique has revealed a distinct time course of neural activity associated with processing semantic categories. However, there has been limited research on the effects of familiarity on the neural dynamics of semantic processing. To address this, we record electroencephalographic (EEG) data from the scalp during the performance of a cross-modal semantic categorization task. We ask whether pre-experimental familiarity with the stimuli affects EEG signal amplitude associated with semantic processing across visual and auditory modalities. We use a 2 (stimulus category: animal vs. tool) x 2 (modality: spoken word vs. visual picture) repeated-measures design. Participants' task was to press a button indicating whether the stimulus corresponded to an animal or a tool. EEG data were recorded and time-locked to stimulus presentation. After completing these trials, participants completed a questionnaire to assess their familiarity with the objects they encountered. Data was binned into frequent and infrequent conditions based on each individual's responses. We analyzed data from nine standard electrodes across the scalp. We observed a difference in average ERP amplitude between frequent and infrequent conditions in animal-audio trials. Higher familiarity generated a stronger negative response in the 300-500 ms time window. This experiment demonstrated unique familiarity effects–our data is distinct from prototypical N400, where more novel stimuli elicit a more negative response. Overall, we propose that the neural time course associated with semantic understanding is influenced by previous familiarity.

Topic Area: PERCEPTION & ACTION: Multisensory

A162 - A practical multi-measure approach assessing compromised color perception

Javid Sadr[1] (sadr@uleth.ca); [1]University of Lethbridge

Visual object perception is a crucial, complex, and ubiquitous component of moment-to-moment behavior in daily life. For certain classes of objects, however, fast and robust visual search, discrimination, etc may succeed using just one or a few easily quantified dimensions (e.g., individual invariant, non-accidental, even pre-attentive features), such as a diagnostic color. Color perception in particular, however, relies on cortical processing of color constancy: the broader analyses of the light source, surface reflectances, and context, which allow us to handle varying lighting conditions and maintain accurate color percepts. Nevertheless, certain natural and artificial circumstances can disrupt color constancy and disable color perception, and here, in a common and potentially dangerous real-world application, we find that the filtering of light by colored translucent containers -- common prescription bottles dispensed by pharmacies -- results in gross misperception of colored items within, i.e., prescription pills. Using simple, physical, real-world tasks and testing materials, we find that normal color vision is thoroughly disrupted when colored pills are viewed in this common form of containment -- and that this persists across multiple behavioral measures and scenarios, whether attempting to name, match, or simply discriminate colors. Critically, these complementary tasks and testing approaches also serve to confirm that the extreme color perception errors observed are not due to linguistic, memory, or other capacity limits but are fundamentally perceptual in nature. Equally, in a practical real-world sense, this generates great concern regarding the very real and common danger of medical mishaps in prescription pill handling by patients.

Topic Area: PERCEPTION & ACTION: Vision

A163 - The effects of targeted memory reactivation of rescripted content during sleep on subsequent intrusive memories

Neda R. Morakabati[1] (nmorakab@uci.edu), Maya Pourreza[1], Ria Karve[1], Eitan Schechtman[1]; [1]Department of Neurobiology and Behavior, University of California, Irvine

Individuals living with post-traumatic stress disorder (PTSD) often experience intrusions, which are unwanted trauma-related memories that come to mind inadvertently. They are often distressing and can prevent those with PTSD from living full lives. Imagery Rescripting Therapy (IRT) is an effective therapy used to re-script the traumatic narrative into a more positive, resolved outcome, resulting in decreased symptoms. Our aim is to leverage sleep's established benefit for memory consolidation along with IRT to reduce intrusions in an analogue trauma design. Targeted memory reactivation (TMR), a technique to unobtrusively reactivate specific memories during sleep, has recently been used to relieve patients suffering from Nightmare Disorder of their distressing nightmares by preferentially reactivating alternative positive dreams. In our study, participants watched a distressing film then engaged in an adapted version of IRT to rescript the film's content. They then took a nap in one of three conditions: TMR targeting the rescripted ending, TMR using an unrelated sound, and no-TMR. We compared the number and distressfulness of intrusions between groups and hypothesize that consolidating the resolved version of distressing content through TMR will reduce the number of intrusions and distress it causes in the week following exposure. The results inform us on TMR's potential benefits for clinical populations living with PTSD and further our understanding on how traumatic memories are consolidated.

Topic Area: LONG-TERM MEMORY: Episodic

Poster Session B

Sunday, March 30, 2025, 8:00 – 10:00 am, Back Bay Ballroom/Republic Ballroom

B1 - Age-related Changes to Recollection and Familiarity in Supporting Auditory Working Memory

Chris Hawkins[1] (hawkins@ucdavis.edu), Sharon Li[1], Edward Jenkins[1], Andrew Yonelinas[1]; [1]University of California, Davis

Prior work has suggested that visual working memory as measured in change detection tasks can be based on recollection, whereby participants consciously identify a specific feature of a stimulus that has changed, or on assessments of familiarity, whereby participants sense that a change has occurred but are unable to consciously identify what has changed. Recent work revealed that the two processes also support auditory working memory (aWM) performance in younger adults, and that they are functionally dissociable in a manner analogous to visual working memory. Whether recollection and familiarity support auditory working memory in older adults, and whether they dissociate in aging, remains unclear. The present change detection study sought to address that gap in knowledge by having older adults make confidence judgments about whether pairs of speech sounds and pure tones presented through headphones were the same or different. Overall performance between younger and older adults was comparable for speech sounds, but an examination of parameter estimates revealed that older adults showed reduced familiarity for all conditions compared with younger adults. However, for pure tones, overall performance for older adults was significantly lower than younger adults. Critically, this performance difference was driven entirely by a selective reduction in estimates of familiarity in older adults compared with younger. The results indicate that recollection and familiarity contribute to aWM for speech sounds and pure tones in older adults, and that the processes may be differentially impacted in aging.

Topic Area: EXECUTIVE PROCESSES: Working memory

B2 - The visual cortex in the blind but not the auditory cortex in the deaf becomes multiple demands regions

Hasan Duymuş[1,2,3] (hasanduymus9@gmail.com), Mohini Verma[2,3], Ausaf Ahmed Farooqui[2,3]; [1]Ankara Yıldırım Beyazıt University, [2]Bilkent University, [3]National Magnetic Resonance Reseach Center, Bilkent University

When sensory brain regions are deprived of their standard inputs, they activate differently compared to non-deprived sensory regions. In blind individuals, visual regions activate during a range of auditory, tactile, and olfactory tasks, while in deaf individuals, auditory regions activate during visual and tactile tasks. These findings suggest that deprived sensory regions in blind and deaf individuals may integrate into the multiple-demand (MD) network—a group of fronto-parietal regions activated by any task-relevant events and cognitive control demands across different task modalities. In this study, we investigated whether deprived sensory cortices showed the key characteristics of MD regions, that is, activation of the same foci in response to diverse control demands. We recruited 22 congenitally and early blind individuals, 10 early deaf individuals, and 20 sighted controls to perform up to four fMRI tasks involving different modalities. In the hard blocks of these tasks, participants: (1) made difficult tactile size judgments, (2) maintained and updated more working memory items, (3) performed more demanding time-duration judgments, and (4) executed more rapid motor responses. In the blind group, almost the entire occipital cortex, alongside MD regions, activated during the hard blocks of all tasks. Further, the same sets of individual occipital voxels in the blind activated to the four different control demands (BF10 > 28). However, auditory regions in the deaf group did not exhibit control-related activation (BF01 > 3). These findings showed that the visual cortex in the blind, but not the auditory cortex in the deaf, becomes MD regions.

Topic Area: EXECUTIVE PROCESSES: Working memory

B4 - Dopamine modulates prefrontal connectivity to promote schema-dependent learning

Mushfa Yousuf[1] (mus.yousuf@uni-luebeck.de), Jannik Prasuhn[2,3,4], Norbert Brüggemann[2,3,4], Lluís Fuentemilla[5,6,7], Nico Bunzeck[1,4]; [1]Universität zu Lübeck, [2]Department of Neurology, University Medical Center Schleswig-Holstein, Lübeck, Germany 3 Institute of Neurogenetics, University of Lübeck, Germany, [3]Institute of Neurogenetics, University of Lübeck, Germany, [4]Center of Brain, Behavior and Metabolism (CBBM), University of Lübeck, Lübeck, Germany, [5]Cognition and Brain Plasticity Group, Bellvitge Institute for Biomedical Research, Hospitalet de Llobregat 08907, Spain, [6]Department of Cognition, Development and Educational Psychology, University of Barcelona, Barcelona 08035, Spain, [7]Institute of Neurosciences, University of Barcelona, Barcelona 08035, Spain

The integration of novel information into long-term memory can be supported by presenting it within a known semantic context. This so-called congruency effect has long been described in the psychological literature as an example for schema-dependent learning, but the underlying neural mechanisms still remain unclear. Therefore, and on the basis of theoretical frameworks, we tested the hypothesis that dopamine plays a critical role through the regulation of prefrontal connectivity. In a double-blind between-subjects design, healthy humans received either a dopamine agonist (1.25

mg bromocriptine), a dopamine antagonist (400 mg sulpiride), or a placebo before the encoding of semantically congruent and incongruent words, while their brain activity was scanned using functional magnetic resonance imaging (fMRI). Behaviorally, semantic congruency was associated with enhanced recognition memory on the next day in all three groups, and this effect was modulated by drug following an inverted u-shaped function. Specifically, the congruency effect was highest under placebo and significantly reduced by both the agonist and antagonist. On the neural level, semantic congruency was associated with activity in the prefrontal cortex and medial temporal lobe regions, including the hippocampus. Importantly, subsequent memory effects for congruent items in the left inferior frontal gyrus and its connectivity with the left substantia nigra and right nucleus accumbens, respectively, was also modulated by drug in a quadratic fashion resembling the behavioral pattern. Taken together, our findings give novel insights by showing that schema-dependent learning is modulated by prefrontal dopamine and interconnected mesolimbic regions.

Topic Area: EXECUTIVE PROCESSES: Working memory

B5 - Content-independent pointers mediate working memory storage for both visual and verbal stimuli

Woohyeuk Chang[1] (woohyeukchang@uchicago.edu), Will Epstein[1], Will Ngiam[2], Henry Jones[1], Ed Awh[1]; [1]University of Chicago, [2]University of Adelaide

Visual working memory (VWM) and verbal working memory have often been treated as distinct processes. However, recent research suggests potential overlap between these two forms of memory. For instance, varying the number of letters and words elicits similar contralateral delay activity (CDA)—a load-sensitive electrophysiological signature of VWM that has typically been examined with visual stimuli (e.g., colored squares; Rajsic et al., 2019). In a re-analysis of these data, we applied multivariate load decoding and representational similarity analysis (RSA) to confirm the presence of a generalized load signal across words and colors, while also demonstrating that distinct variance in EEG activity tracked the stored content (words versus colors). To further test this finding, we replicated the study while eliminating perceptual differences by presenting colored words and asking observers to selectively store one of the features. Once again, we observed a generalized load signal across color and word features, even while other aspects of EEG activity tracked the attended feature. These results strengthen the case for a distinction between neural activity related to content-independent "pointers" and parallel neural signals that track the stored feature values.

Topic Area: EXECUTIVE PROCESSES: Working memory

B6 - EEG correlates of active removal from working memory

Jiangang Shan[1] (jshan23@wisc.edu), Bradley Poslte[1]; [1]University of Wisconsin-Madison

The removal of no-longer-relevant information from visual working memory (WM) is important for the functioning of WM, given its severe capacity limitation. Previously, with an "ABC-retrocuing" WM task, we have shown that removing information can be accomplished in different ways: by simply withdrawing attention from the newly irrelevant memory item (IMI; i.e., via "passive removal"); or by or "actively" removing the IMI from WM (Shan & Postle, 2022). Here, to investigate the neural mechanisms behind active removal, we recorded electroencephalogram (EEG) signals from subjects performing the ABC-retrocuing task. Specifically, we tested the hijacked adaptation model, which posits that active removal is accomplished by a top-down-triggered down-modulation of the gain of perceptual circuits, such that sensory channels tuned to the to-be-removed information become less sensitive. Behaviorally, analyses revealed that, relative to passive removal, active removal produced a decline in the familiarity landscape centered on the IMI. Neurally, we focused on two epochs of the task, corresponding to the triggering, and to the consequence, of active removal. With regard to triggering, we observed a stronger anterior-to-posterior traveling wave for active versus passive removal. With regard to the consequence(s) of removal, the response to a task-irrelevant "ping" was reduced for active removal, as assessed with ERP and with posterior-to-anterior traveling waves, suggesting that active removal led to decreased excitability in perceptual circuits centered on the IMI.

Topic Area: EXECUTIVE PROCESSES: Working memory

B7 - Differential Effects of Pubertal Hormones on Adolescent Activation During a Working Memory Task

Attakias Mertens[1] (attakias.mertens@boystown.org), Katrina Myers[1], Delaney Sherman[1], Jordanna Kruse[1], Gaelle Doucet[1]; [1]Boys Town National Research Hospital

The development of cognitive processes responsible for working memory (WM) are refined throughout adolescence. While previous fMRI research has found activation differences associated with age during WM tasks, there are less studies that assess the influence of pubertal hormones. This study investigated the impact of pubertal hormones (testosterone and estradiol) on brain activation during a n-back task, within males and females separately. The sample included 140 typically developing individuals (77 females). Hormonal levels were quantified through a saliva sample. We tested the differential impact of hormones between adolescents (12-17) and adults (18-25) on the brain activation for the 2back – 0back contrast, controlling for age. We found that only females had significant results for both hormones. In detail, the adolescent group had a positive association between estradiol and activation within the left precentral gyrus (pFWE=.042) and the left superior parietal lobule (pFWE=.017). Additionally, adolescent females showed a negative association between testosterone and activation within the right cerebellum crus I (pFWE=.021), the right insula (pFWE<.001), the left posterior cingulum (pFWE=.006), the left pars triangularis of the inferior frontal gyrus (pFWE=.026), and the left thalamus (pFWE=.002). Thus, adolescent females with higher levels of estradiol showed higher activation in regions involved in movement, spatial orientation, and WM; while lower levels of testosterone were associated with higher activation in regions involved in WM, speech production, memory, and motivation. These results suggest that adolescent females' brain activation, during a WM task, is differentially affected by testosterone and estradiol compared to adult females.

Topic Area: EXECUTIVE PROCESSES: Working memory

B8 - Large-scale synchronized networks control stability and flexibility in cognition

Julia Ericson[1] (julia.ericson@ki.se), Nieves Ruiz Ibanez[1], Mikael Lundqvist[1], Torkel Klingberg[1]; [1]Karolinska Institutet

A key question in cognitive neuroscience is how the brain alternates between functional states. For instance, in working memory (WM), the temporal coordination of brain states is essential. When relevant stimuli are presented, the brain should be in an encoding state, and else it should be in a stable state, maintaining stored information and suppressing distractions. Using two magnetoencephalography (MEG) datasets collected during WM tasks, we identified global brain states based on synchronized networks in the theta and alpha frequency bands. Specifically, we identified an encoding state dominated by posterior theta synchronization and a maintenance state dominated by dorsal alpha synchronization. While the theta synchronization decreased with WM load, the dorsal alpha synchronization increased. To better understand the state mechanics, we simulated the influence of the maintenance and encoding networks on information flow using an in-silico brain model. The model incorporated a spiking cortical layer and an oscillatory cortical layer, interacting through phase-amplitude coupling. The simulations showed that the states differentially modulated information flow between visual and higher-order association areas. Finally, we investigated how the frequency of state-switches correlated with both WM task performance during brain scanning and outcomes on a separate battery of tests assessing executive functions and perception. We identified an optimal state switching frequency, where too many or too few state switches lead to worse behavioral performance. These results suggest that the ability to regulate state transitions is a fundamental aspect of cognition.

Topic Area: EXECUTIVE PROCESSES: Working memory

B9 - Hierarchically structured neural variability balances sensory reliability with behavioral flexibility in the human brain

Jonas Terlau[1] (jonas.terlau@gmx.de), Jan Martini[1,2], Randolph Helfrich[1]; [1]Hertie-Institute for Clinical Brain Research, University Medical Center Tuebingen, [2]International Max Planck Research School for the Mechanisms of Mental Function and Dysfunction, University of Tuebingen

Human behavior is remarkably complex, balancing the seemingly opposing traits of reliability and flexibility. In contrast to the ensuing behavior, the underlying neural population activity is inherently time-varying; thus, raising the question how ever-changing neural activity can support both, stable and adaptive behaviors. Using large-scale human intracranial electroencephalography (iEEG) recordings that cover the cortical hierarchy from sensory to association areas, we tested the hypothesis that neural variability shapes perceptual and cognitive performance in a context- and demand-dependent manner. Our results uncover that neural variability does not reflect random noise, but supports the spatiotemporal unfolding from perceptual to cognitive processing that underlies successful encoding and maintenance of sensory information. Neural variability decreases in sensory areas improve the fidelity of sensory representations, while increased variability in association cortex supports memory maintenance. In sum, these results demonstrate that neural variability captures the duality underlying the complexity of human behavior – it can be consistent during sensory processing, yet adaptable when needed.

Topic Area: EXECUTIVE PROCESSES: Working memory

B10 - Increased neural delay activity for simple features when they are remembered as part of real-world objects

Yong Hoon Chung[1] (yong.hoon.chung.gr@dartmouth.edu), Sadye Law[1], Timothy Brady[2], Viola Störmer[1]; [1]Dartmouth College, [2]University of California San Diego

Visual working memory is a core cognitive function that allows active storage of task-relevant visual information over a short duration of time. While previous studies postulated that the capacity of this system is fixed, recent research suggests that its capacity is increased for meaningful stimuli (i.e., real-world objects). Here we show that working memory performance for a simple visual feature – color – is also improved when this feature is encoded as part of a real-world object relative to an unrecognizable scrambled object. Using EEG (N = 24), we further show that this performance increase is accompanied by enhanced neural activity during the delay period (indexed by the contralateral-delay-activity), suggesting that the behavioral benefit is linked to the active maintenance process of working memory. Interestingly, we also find robust condition differences in EEG activity during the encoding period when participants are viewing the stimuli, suggesting that the meaningfulness benefit may arise during perceptual processing already. Overall, our results demonstrate that active visual working memory capacity for simple features is not fixed but can expand depending on what context these features are encoded in.

Topic Area: EXECUTIVE PROCESSES: Working memory

B11 - Analysis of EEG complexity in patients with mild cognitive impairment.

Xu Chen[1] (cxwp65@163.com), Benju Zhu[1], Limei Cao[1]; [1]Shanghai Eighth People's Hospital

Objective: Mild cognitive impairment patients and normal elderly people were selected in this research. EEG complexity (Lempel-Ziv Complexity, LZC) and P300 value of the two groups were compared in two statuses (quiet eyes closed, cognitive load), The brain functional characteristics of different cognitive states were explored, it was expected to construct a simple and objective cognitive function evaluation approach to provide criteria for early diagnosis of cognitive dysfunction and disease evaluation. Methods: The clinical data was from 50 MCI patients in Neurology department of the 8th People's Hospital. 45 normal elderly people with corresponding sex, age and education level was chosen as control group. 5 minutes EEG signals were recorded and measured with P300 for both groups with quiet eyes closed and cognitive load states. Due to smooth baseline and inconspicuous artifacts, 2048-point EEG (about 8s) were selected to perform LZC analysis and complexity calculation in Mat tab. Results: Normal elderly people showed higher LZC than MCI patients. Moreover, LZC was higher in those complex brain function areas such as temporal and frontal areas. The cognitive related brain areas showed more obvious degradation than other brain areas. Under the cognitive load status, the complexity value in cognitive related brain areas of MCI patients decreased significantly. Conclusion: The brain electrical LZC value in normal elderly people group was higher than that in cognitive impairment group. The prolonged latency of P300, these results of cognitive impairment in patients could also predict the degree of cognitive decline.

Topic Area: EXECUTIVE PROCESSES: Working memory

B12 - Immediate reselection of visual and motor memories after external interference

Daniela Gresch[1,2] (daniela.gresch@yale.edu), Larissa Behnke[3], Anna C. Nobre[1,2], Sage E.P. Boettcher[2]; [1]Yale University, [2]University of Oxford, [3]University of Zurich

During natural behavior, we must often maintain internal representations in working memory while concurrently engaging with perceptual events in the external world. Though previous research has demonstrated working memory to be susceptible to external interference, internal representations generally withstand such challenges without complete failure. Here, we investigated the neural dynamics underlying the reselection of internal representations after engagement with an external task. Specifically, we asked which contents of internal representations are reselected after an interrupting task and when this reselection occurs. To address these questions, we developed a visual-motor working memory task in which participants were retrospectively cued about an item during the retention interval. In most trials, after a retro-cue was presented, participants were required to respond to a perceptual discrimination task. Using electroencephalography, we tracked the reselection of visual (i.e., spatial location) and motor (i.e., response hand) representations through contra- vs. ipsilateral modulations of posterior alpha (8–12 Hz) and central beta (13–30 Hz) activity, respectively. Our findings revealed the concurrent reselection of visual and motor contents immediately after the perceptual task was completed, rather than just-in-time when internal information was required for memory-guided behavior. These findings demonstrate the early reinstatement of visual working memory into a ready-to-use state and underscore the pivotal role of visual-spatial information in scaffolding internal representations after external interference.

Topic Area: EXECUTIVE PROCESSES: Working memory

B13 - Motivated for memory: Young and older adults prioritize working memory in an effort trade-off task

Dahlia Kassel[1] (dahliak@umich.edu), Cindy Lustig[1]; [1]University of Michigan

Monetary incentives are often used motivate effort in monetary tasks, but in 'the real world" the reward or punishment for good or poor performance often comes in the form of making future tasks easier or more difficult. Moreover, income differences between older and younger adults complicate the interpretation of age differences in the response to monetary incentives. We investigated how young and older adults responded to easy/hard work incentives for performance on a working memory task. Each set of working memory trials was followed by math verification problems. Each correct trial in the working memory task meant an easy trial in the math task; each incorrect trial meant a hard math problem. Incentivized participants were informed of these contingencies; control participants were not. We did not find significant effects of instruction (incentive vs control) for either age group. However, while data collection is ongoing, preliminary results indicate that older adults had significantly higher accuracy on the working memory task than the younger adults, and rated themselves as more motivated to perform well on it, despite rating it as being more demanding. Older adults also gave higher importance ratings to the working memory and easy math problems than young adults, whereas both age groups gave equally low importance ratings to the hard math trials. These results suggest that participants overall, and especially older adults, put more importance and motivation on the working memory task despite its difficulty.

Topic Area: EXECUTIVE PROCESSES: Working memory

B14 - Individual differences in post-error slowing: the role of working memory capacity and positive schizotypy

Wanchen Zhao[1] (wanchen.zhao@yale.edu), Samuel McDougle[2], Tyrone Cannon[3]; [1]Yale University

Why do we slow down after an error? The cognitive control account attributes post-error slowing (PES) to working memory (WM) recruitment to optimize future performance, while the orienting account argues for distraction from unexpected errors. Though seemingly contradictory, these hypotheses may jointly explain PES: errors initially distract and then prompt WM engagement with previous trials. Positive schizotypy, involving impaired WM and inflexible expectations, provides a framework to explore WM capacity and distraction in PES. In this study, 153 participants from Prolific completed a reinforcement learning task, where they learned the stimulus-response association through trial and error. Participants reported schizotypy using the Multidimensional Schizotypy Scale - Brief. We modeled individual WM capacity parameters with Reinforcement Learning Working Memory (RLWM) model and analyzed results with mixed-effects linear regression and robust regression. Participants slowed down more after errors when they had accumulated more correct responses for a stimulus (reward) or when the same stimulus was presented further in the past (delay). In a robust regression, PES was most strongly associated with learning rate from negative feedback, while WM decay rate was linked to reduced PES. Higher positive schizotypy is associated with less PES and higher WM decay, but intact learning rate from positive feedback. Effects of reward and delay from our results suggest both cognitive control and orienting accounts can explain PES in general. WM decay rate largely accounts for attenuated PES in positive schizotypy.

Topic Area: EXECUTIVE PROCESSES: Working memory

B15 - Maintenance suppression reduces access to fear-conditioned information in working memory

Caleb N. Jerinic-Brodeur[1] (cjerinic@utexas.edu), Joseph E. Dunsmoor[1], Jarrod A. Lewis-Peacock[1]; [1]University of Texas at Austin

Prior work has shown that suppressing the maintenance of intrinsically emotional content in working memory can impair access to that information in immediate memory tests, regardless of valence. However, it remains unclear how acquired emotion influences cognitive control processes that target information in working memory. In everyday life, neutral information often gains emotional significance through learning and experience. We hypothesized that information in working memory that is associated with threat may be more resistant to suppression due to its heightened salience. Participants completed a multi-phase experiment using three semantic categories of intrinsically neutral images. Images from one category were pre-exposed before fear learning to ensure they remained neutral. Participants then underwent Pavlovian fear conditioning, where images from one category were paired with mild electric shocks (CS+) and images from another category were never paired with shocks (CS-). Finally, participants completed a working memory removal task using trial-unique images from the three categories. Participants encoded a single image (CS+, CS-, Neutral), were cued to either suppress, maintain or do nothing further to that image, and then responded to a memory probe after a brief delay. Our results demonstrate that participants were faster to endorse an item that had been cued for maintenance, and slower to endorse an item that had been suppressed, regardless of its learned emotional value. This suggests that maintenance suppression is successful in reducing the accessibility of fear-conditioned information, and therefore could be an effective tool to control aversive memories that occupy the focus of attention.

Topic Area: EXECUTIVE PROCESSES: Working memory

B16 - Change detection and repetition detection reflect functionally distinct forms of visual working memory

Stephanie Norris[1] (sjnorris@ucdavis.edu), Andrew Yonelinas; [1]Department of Psychology, University of California, Davis

To examine the roles of change-detection and repetition-detection in visual working memory, we analyzed three working memory tests expected to rely differentially on these processes. Subjects studied an array of colored squares and then completed three tests. In the complex-probe test, subjects indicated if a test array matched the study array or if an item's color changed. In the single-probe test, they judged if a single item's color matched the study color, and in the item recognition test, they identified if a centrally presented color was studied. We collected 'same/different' confidence responses and analyzed receiver operating characteristics (ROCs) to evaluate memory strength distributions for changed and repeated trials, and used a mixture signal detection model to estimate each process. As expected, the complex-probe test showed more high-confidence memory for changed trials, while the item recognition test showed more high-confidence memory for repetitions. The single-probe test showed similar or lower-confidence memory for both trials. Moreover, model estimates indicated that the probability of recollecting a change was higher in the complex-probe than in the item recognition tests, and the probability of recollecting a repetition was higher in the item recognition than the complex-probe tests. The single-probe test showed moderate recollection for both. These results show that change-detection and repetition-detection are functionally dissociable, with test-type affecting their contributions to working memory. These findings have implications for studying populations, such as aging, that may exhibit impairments in one or the other and raise the question of whether different neural systems underlie these processes.

Topic Area: EXECUTIVE PROCESSES: Working memory

B17 - Capacity not required: A long-term memory model that exhibits key signatures of working memory

Sean Polyn[1] (sean.polyn@vanderbilt.edu), Geoffrey Woodman[1]; [1]Vanderbilt University

In the study of working memory, it is viewed as critical to show a capacity limit in storage as a way of demonstrating that one is measuring the limited capacity working memory store and not the unlimited capacity long-term memory store. The validity of this hallmark of working memory depends on the contention that a long-term memory system would not exhibit the same performance limitations as a capacity-limited system. Here we show that the set-size effects observed in the change-detection task (short-term recognition) and the continuous report task (short-term cued recall) for visuospatial materials (colored squares) fall out of existing models of human long-term memory. We introduce the Context Maintenance and Retrieval-Working Memory (CMR-WM) model, in which a core component of working memory theories, the capacity-limited store, is replaced by context-guided retrieval from long-term memory. Rapid attentional scanning of a study array produces a long-term memory trace for each study item, with each trace simulated as a composite of color, spatial, and temporal context information. These traces do not decay in strength or fidelity with the passage of time or intervening cognitive events, no noise is added to the traces during storage, and there is no guessing process. The capacity limitations of the model arise from the dynamics of the temporal context representation, and interference from stored long-term memory traces. We discuss how the situation motivates a re-examination of unified models of human memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

B18 - Semantic activation hinders suppression from visual working memory

Edward Leung[1] (edjoeleung@utexas.edu), Jarrod Lewis-Peacock[1]; [1]The University of Texas at Austin

Suppressing the maintenance of an item in working memory reduces subsequent access to its representation. However, the view of working memory as activated long-term memory suggests that its representations are integrated with their context, including semantic connections to related long-term memory information. While these semantic activations can facilitate the retention and retrieval of information from working memory, they may also hinder the suppression of associated information. The current experiment tested this hypothesis. On each trial, participants (N=30) encoded four unique images (e.g. lettuce, cake) from two semantic categories (e.g. vegetable, dessert) in either a grouped (high semantic activation) or an interleaved (low semantic activation) order. They were then cued to either maintain or suppress one of the items for 3 sec, before responding to a three-alternative forced choice memory probe for one of the items (the cued item on 50% of trials). Our results replicate the maintenance suppression effect from previous studies, where reaction time was fastest for maintained items, followed by uncued items, and slowest for suppressed items. Furthermore, there was a significant interaction between semantic grouping and operation on accuracy ($p=0.01$). While suppression significantly reduced accuracy in the low-semantic activation condition relative to maintenance (-8.61%, $p < 0.001$, BF = 160), this effect was abolished in the high-semantic activation condition ($p = 1$, BF = 0.198). These results provide behavioral evidence that the activation of semantic knowledge for an item in working memory may impair the ability to remove that item from mind.

Topic Area: EXECUTIVE PROCESSES: Working memory

B19 - Flexible redistribution of working memory resources enables distraction-resilient behaviors in dynamic environments

Ziyao Zhang[1] (ziyaopsy@gmail.com), Jarrod Lewis-Peacock[1]; [1]Department of Psychology, University of Texas at Austin

Navigating daily tasks relies on working memory to recall past information and plan future actions. When managing multiple goals, individuals must allocate limited working memory resources across them. A key factor influencing this resource allocation is the agent's state. For instance, when following a shopping list, decisions about which memory item to prioritize depend largely on the person's location. In real-world scenarios, agent states are dynamic and often disrupted by distractions (e.g., promotions altering shopping plans). How people adapt to such perturbations remains unclear, as classical studies typically fix agent states. To address this, we developed a working memory paradigm (N=50) inspired by the arcade game Snake, simulating agent movements in a dynamic environment. Participants controlled a snake to locate memorized targets (apples) and earn points. Each trial required encoding 1, 2, or 4 apple locations, followed by memory-guided navigation to capture all apples. In half of the trials, distractions (grapes) forced participants to deviate from initial plans and update the snake's position. Without distractions, participants prioritized proximate targets, using proximity as a cue for memory resource allocation. When distractions perturbed the agent's position, participants flexibly redistributed resources to prioritize targets nearer the updated position. This flexibility declined with higher memory loads: proximity biases persisted under set size 2 but weakened under set size 4 with strong distractions. These findings reveal a novel mechanism of dynamic working memory resource redistribution that enables resilience to distractions and supports adaptive goal-directed behavior in naturalistic environments.

Topic Area: EXECUTIVE PROCESSES: Working memory

B20 - Differential roles of frontoparietal regions in working memory and decision-making demand

Sophie E. Ack[1] (sophie.ack@northwestern.edu), Samantha M. Gray[1,2], Adam J. O. Dede[1], Jack J. Lin[3], David King-Stephens[4,5], Peter B. Weber[4], Kenneth D. Laxer[4], Ignacio Saez[3,6], Fady Girgis[3,7], Stephan U. Schuele[1], Joshua M. Rosenow[1], Edward F. Chang[8], Kurtis I. Auguste[8], Eishi Asano[9], Robert T. Knight[10], Rodrigo M. Braga[1], Elizabeth L. Johnson[1]; [1]Northwestern University, [2]Stanford University, [3]University of California, Davis, [4]California Pacific Medical Center, [5]Yale School of Medicine, [6]Ichan School of Medicine at Mt. Sinai, [7]University of Calgary, [8]University of California, San Francisco, [9]Children's Hospital of Michigan, [10]University of California, Berkeley

Decision-making (DM) is a complex cognitive function with processes that rely on working memory (WM). DM and WM are both associated with a distributed network including regions of the posterior parietal cortex (PPC) and prefrontal cortex (PFC), but the shared and distinct roles of these regions and their coordination in DM and WM remain poorly understood. Here, we use intracranial EEG from 24 adult neurosurgical epilepsy patients with seizure- and artifact-free electrodes sampling PPC and/or PFC (n = 524) performing a delayed match-to-sample task. On each trial, patients memorized a sequence of three shapes (sample; WM demand) to compare to presentation of three more shapes (test; WM with additive DM demand). Sample and test sequences were followed by a 2-s delay with a randomly jittered star presented to disrupt ongoing processing. We compared high-frequency broadband activity (HFA; 70-150 Hz) between the sample and test delays to derive DM and WM effects in three PFC and three PPC subregions defined by sulcal boundaries. DM effects were defined by test-greater-than-sample HFA and WM effects by sample-greater-than-test HFA. Sustained DM effects in the inferior frontal gyrus disappeared following the star. Conversely, sustained WM effects in the middle frontal gyrus disappeared following the star and transient WM effects in the superior frontal and angular gyri appeared following the star. These results suggest an active inferior frontal DM process and diverging active vs. latent WM representations between frontoparietal subregions. Further analyses will use orthogonal, data-driven clustering to further characterize frontoparietal DM and WM functions.

Topic Area: EXECUTIVE PROCESSES: Working memory

B21 - Visuospatial Encoding in Adults with ADHD: Aperiodic vs. Periodic EEG Spectral Components

Talía V. Román-López[1,2], Fang Yu Chang[1,2], Holly Troung[1,2], Timothy Kelley[1,2], Joel P. Diaz-Fong[1,2], Andrea Dillon[1,2], Sandra K. Loo[1,2], Agatha Lenartowicz[1,2]; [1]Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles, [2]Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles

In previous research, our group identified differences in the occipital alpha band (8–12 Hz) in children with Attention-Deficit/Hyperactivity Disorder (ADHD) (ages 7–14) during a visuospatial Sternberg working memory (SWM) task. During the encoding phase, children with ADHD exhibited reduced occipital alpha event-related decreases (ERD), consistent with a maturational delay. Older children with ADHD showed greater alpha ERD compared to younger ones, similar to developing (TD) children, indicating that this delay may diminish with age. This study revisited a subset of these participants, now adults, to assess whether alpha patterns observed during SWM encoding persist. In addition to EEG periodic patterns (alpha ERD), aperiodic (1/f) EEG components, including broadband exponent and offset, were analyzed. A total of 107 participants were included (TD: n = 42, mean age = 22.66 ± 8.96; ADHD: n = 65, mean age = 22.69 ± 7.0). Participants completed an SWM task with varying loads (1, 3, 5, or 7) while EEG was recorded. Age was included as a covariate in all analyses. Behaviorally, ADHD and TD groups did not differ significantly, but increasing task load led to slower reaction times and fewer correct responses. No group differences were observed in alpha power during encoding. However, ADHD participants showed higher aperiodic exponent and offset, with no load-related differences. These results suggest alpha activity in ADHD may normalize with age, reflecting visuospatial attention pathway maturation, while aperiodic components reveal persistent neural differences.

Topic Area: EXECUTIVE PROCESSES: Working memory

B22 - Underlying mechanisms to exercise-induced working memory improvements

Sofi Sandstrom[1,2] (sofi.sandstrom@umu.se), Emma Simonsson[1,2], Mattias Hedlund[1], Nina Lindelöf[1], Erik Rosendahl[1], Carl-Johan Boraxbekk[1,2,3,4]; [1]Umeå University, [2]Umeå center for Functional Brain Imaging, [3]University of Copenhagen, [4]Copenhagen University Hospital Bispbjerg

Introduction: Physical exercise has shown positive effects on cognitive functions such as working memory (WM) among older adults, however large individual differences in response to exercise exist and underlying mechanisms are not well-understood. We tested the hypothesis that change in leg strength following high intensity training (HIT) will improve WM via changes in prefrontal functional brain activity. Methods: This study was based on the Umeå HIT study, a randomized controlled trial assessing the effects of 12 weeks of watt-controlled HIT versus moderate intensity training for non-exercising older adults. Forty-three participants (66-79 years, 56% females) underwent functional magnetic resonance imaging while performing a WM task. Outcomes of interest were changes in WM performance, as measured by a WM composite of three tasks, WM task activation, cardiorespiratory fitness, and leg strength. Results: For WM performance, we found no significant between-group difference in change, however there was a significant within-group change for HIT in the WM composite. For HIT, change in leg strength significantly predicted increased activation in the right BA 44, which in turn was associated with improved performance in the in-scanner WM task. Cardiorespiratory fitness did not predict change in brain activity. Conclusion: Exercise-induced increases to WM performance may be associated with increased leg strength inducing positive effects on the right BA 44.

Topic Area: EXECUTIVE PROCESSES: Working memory

B23 - Eye-movement pattern reveals optimal mental organization during memory encoding and maintenance

Qiaoli Huang[1] (qiaolihuang0818@gmail.com), Christian Doeller[1,2]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]Kavli Institute for Systems Neuroscience, Center for Neural Computation, The Egil and Pauline Braathen and Fred Kavli Center for Cortical Microcircuits, Jebsen Center for Alzheimer's Disease, Norwegian University of Science and Technology

We have limited attentional and memory resources, which restricts what we can process and remember. Efficient coding theory argues that resource limitations are mitigated by efficient representational codes that are optimized with regard to the specific stimulus statistics of the environment. Eye movements are involved in the active exploration of the external and internal mental world, which for instance reflect memory content, spatial relations of scenes and relational structure of concepts. Here we are interested in whether eye movements support the optimal mental organization to efficiently hold multiple information in working memory. To answer this question, three gratings with different colors (ranging from green to blue) and frequencies were simultaneously presented at different locations and participants were asked to remember all stimulus information. Crucially, in each trial, grating with relative lower frequency was always associated with green color stimuli. We observed that trials with the same spatial configuration showed higher eye-movement trajectory similarity compared to trials from different spatial configurations both during memory encoding and maintanence periods. This effect was related to behavioral performance. Furthermore, we showed that gaze position moved from the grating with lowest frequency to the middle and then the one with highest frequency, i.e., the shortest mental path, during encoding and maintanence periods, and this sequential eye-movement pattern was also highly related to behavioral performance. These findings provide evidence for the role of eye movements during efficient organisation of information held in working memory and highlight the interplay between processes during memory encoding and maintanence periods to efficiently store multiple information.

Topic Area: EXECUTIVE PROCESSES: Working memory

B24 - Novel Multi-Analysis of Binary Features in Ripple, Beta, and Gamma Bursts for SVM Classification of Memory-Related Event Order in iEEG

Hamed Aliyari[1] (hamed.aliyari@utsouthwestern.edu), Bradley Lega[1]; [1]Department of Neurological Surgery, UT Southwestern Medical Center, Dallas, TX, U.S.A.

Remembering the order of events is a fundamental component of episodic memory. Cognitive theories propose that recall of a serial-ordered representation is driven by an internally maintained context that integrates new information over an extended time scale. This study obtained intracranial EEG (iEEG) recordings from 60 neurosurgical patients engaged in a serial recall task. The dataset encompassed simultaneous recordings from various brain regions, including the hippocampus, prefrontal cortex, and posterior cingulate cortex. A novel pattern extraction classifier, inspired by mechanisms of order memory observed in non-human primates and the temporal relationships among binary gamma bursts, beta bursts, and ripple events in working memory, was employed to investigate whether smoothed ripples, beta bursts, low gamma bursts, and high gamma bursts could serve as predictive features for recalling the sequence of events at each serial position. The analysis revealed that applying a modified Support Vector Machine (SVM) classifier to the orbitofrontal middle frontal gyrus (oMFG) in the right hemisphere, the orbital part of the inferior frontal gyrus (IFGorb) in the left hemisphere, and the middle temporal gyrus (MTG) in both hemispheres facilitated accurate identification of the correct word order in the sequence. These findings highlight the importance and applications that the innovative approach of smoothing neural features, such as ripples and bursts, can have for subsequent use in predictive modeling. Moreover, the classifier demonstrated its efficacy in addressing order memory tasks localized to the frontal cortex, thereby underscoring its potential to advance the understanding of neural mechanisms underlying episodic memory.

Topic Area: EXECUTIVE PROCESSES: Working memory

B25 - Precision Neuromodulation using closed-Loop TMS/fMRI and Neural Network-Based Brain State Decoding

Ahsan Khan[1] (ahsan.khan@pennmedicine.upenn.edu), Hongming Li[1], Camille Blaine[1], Julie Grier[1], Ethan Hammet[1], Almaris Figueroa[1], Sarai Garcia[1], Romain Duprat[1], Justin Reber[1], Joseph Deluisi[1], Yong Fan[1], Desmond Oathes[1]; [1]Perelman School of Medicine, University of Pennsylvania

Transcranial magnetic stimulation (TMS) has transformed non-invasive brain therapies but faces challenges due to variability in outcomes, likely stemming from individual differences in brain structure and function. This study aims to address this challenge by integrating individualized functional connectivity networks (FCNs) derived from functional magnetic resonance imaging (fMRI) with a neural network-based decoder for adaptive, real-time stimulation delivery. We investigated how TMS targeting a brain region associated with working memory affects task performance over several days of neuromodulation in healthy participants. After collecting behavioral measures and screening questionnaires in the first two visits, participants underwent a concurrent TMS/fMRI session on the third visit. Real-time decoder readouts during this session identified stimulation frequencies classified as optimal or suboptimal based on their effects on brain activity and behavior. Participants then underwent a crossover design, receiving three optimal and three suboptimal stimulation sessions (six total) in randomized order. During each session, participants completed both a working memory task and a control task. Post-training TMS/fMRI sessions (visits 7 and 11) assessed the effects of stimulation and decoder performance. Results showed improved working memory performance during optimal stimulation compared to suboptimal stimulation, with no changes observed in the control task. Further analysis showed a consistent negative correlation between the brain readouts (larger value indicates more engaged in working memory task) and reaction time and error rates during the working memory task. This highlights the potential of real-time brain decoding to enhance TMS efficacy and pave the way for precise, personalized neuromodulation.

Topic Area: EXECUTIVE PROCESSES: Working memory

B26 - The representation of ordinal context in visual working memory

Jung Woo Hur[1], Jacqueline M. Fulvio[1], Bradley R. Postle[1]; [1]University of Wisconsin-Madison

The binding of stimulus information to the context in which it was encountered (i.e., the "where" and "when") is essential of visual working memory. To study this mechanism, we trained recurrent neural networks (RNNs) to perform a double-serial retrocuing (DSR) task in which two stimulus items (S1 and S2) are presented serially, followed by a first cue indicating which will be tested at the first recall epoch, then a second cue, indicating which will be tested at the second recall epoch. In order to visualize the representational geometry of the encoding of context, we applied demixed principal component analysis (dPCA) to the hidden layer during the presentation of S1 and of S2, then projected data from subsequent epochs into these "stimulus encoding" subspaces, to track representational transformations. This revealed that the initial representational geometry of S1, during its encoding, underwent a representational 'flip' (i.e. reflection) upon presentation of S2, and S2 was encoded into the subspace that had been occupied by S1. This representational transformation of S1 suggests that order-context (i.e., "when" an item was presented) may be encoded chronologically (i.e. most-recent, second most-recent, etc.) rather than ordinally (i.e. 1st, 2nd, etc.). Next steps for this work are to extend it to more than two items, and assess its applicability to human working memory performance.

Topic Area: EXECUTIVE PROCESSES: Working memory

B27 - Working Memory Demands Influence the Balance between Detailed and Gist-Level Representations during Planning

Zhuojun Ying[1] (z5ying@ucsd.edu), Anastasia Kiyonaga[1]; [1]University of California, San Diego

Working memory (WM) is thought to support planning by maintaining representations of future actions and rewards. Our recent work examined WM for reward information during planning using an information-theoretic model approximated by a variational recurrent neural network. Participants chose the best path in a decision tree with nodes revealed sequentially and varying in value. Both model and behavior showed better memory for nodes most informative for path selection, suggesting dynamic WM allocation based on choice relevance. According to the model, this dynamic allocation arises from limited WM resources, predicting that higher WM demands would shift priority toward the overall path quality over detailed node values. Here we manipulated WM demands to examine their impact on path selection and memory. Using a decision task with node rewards indicated by color, we varied the tree size and the color space resolution. In the larger tree condition, participants recalled node values less accurately and selected the best path less frequently. In the higher-resolution condition, participants recalled node values faster and consistently selected high-value alternative paths, even when the best path was missed, suggesting a satisficing strategy. WM demands also interacted with reward magnitude and path quality: individual node values influenced recall most in smaller trees, while overall path value influenced recall most in larger, higher-resolution trees. This suggests that cognitive systems dynamically shift from encoding individual rewards to overall path qualities under increased WM demands, illuminating how neural circuits might adaptively allocate WM resources to balance action- and plan-level representations during planning.

Topic Area: EXECUTIVE PROCESSES: Working memory

B28 - Developmental Alterations in the Load-Dependent Oscillatory Dynamics of Verbal Working Memory Processing in Youth

Augusto Diedrich[1,2,3] (augusto.diedrich@boystown.org), Yasra Arif[1,2], Maggie Rempe[1,2,4], Zhiying Shen[1,2,3], Elizabeth Heinrichs-Graham[1,2,3]; [1]Institute for Human Neuroscience, Boys Town National Research Hospital, Omaha, NE, [2]Center for Pediatric Brain Health, Boys Town National Research Hospital, Omaha, NE, [3]School of Medicine, Creighton University, Omaha, NE, [4]College of Medicine, University of Nebraska Medical Center, Omaha, NE

Background: Studies using electroencephalography (EEG) and magnetoencephalography (MEG) show that working memory-related activity is sensitive to both load and age, but little is known regarding the spatiotemporal dynamics of load-dependent working memory (WM) processing in youth. The purpose of this study was to probe how working memory-related oscillations differ as a function of stimulus load. Participants & Methods: A sample of 57 typically developing children between the ages of 7-15 successfully completed two blocks of a modified Sternberg verbal WM task during MEG (i.e., one block of 2-letter, "low load" trials and one block of 4-letter, "high load" trials). Neural data were preprocessed and transformed into the time-frequency domain. Significant oscillatory responses were identified and imaged using beamforming. Load-by-age interactions were identified, and peak pseudo-t values for each significant cluster were extracted and related to task performance. Results: Behavioral data revealed significant main effects of load and age for both accuracy and reaction time. There was also a significant load-by-age interaction on accuracy. The source-level LME analyses revealed significant load-by-age interactions in alpha-beta activity in the right middle and inferior temporal cortices during encoding and maintenance, with each WM phase showing distinct load-by-age dynamics. Importantly, these neural dynamics significantly predicted performance on the task. Conclusion: Load-sensitive neural oscillatory dynamics underlying working memory differentially scaled with development and were significantly related to task performance. These data could enable researchers to better understand how the developing brain serves increasing cognitive demand in health and disease.

Topic Area: EXECUTIVE PROCESSES: Working memory

B29 - Working memory under retrieval uncertainty

Lena L. Kemmelmeier[1] (lkemmelmeier@unr.edu), Jenna N. Pablo[1], Marian E. Berryhill[1]; [1]University of Nevada, Reno

Frontoparietal networks are essential for working memory (WM), with recognition relying more on the parietal cortex and WM recall depending more on the frontal cortex. We investigated how college students (n=37) performed when retrieval demands were predictable (blocks of recall/recognition trials) and unpredictable (intermixed conditions) contexts. Unpredictable retrieval demands significantly impaired recall performance (M=45.8 degrees error, SD=7.49) relative to recall-only blocks (M=27.7 degrees error, SD=8.77; p<.001). Participants may have relied on a familiarity-based strategy. Yet, previous studies found that adults' recall performance was comparable or better when retrieval demands were unpredictable. These conflicting findings raise questions about why recent participants adopted a less effective strategy. We suspect that motivation — linked to WM performance and influencing maintenance-related frontal midline theta — or an emphasis on testing via recognition-based assessments (e.g., multiple choice) may drive the results. To answer these questions, we will next evaluate participants' strategy, WM performance, motivation levels, and how they are assessed in their classes (prevalence of multiple choice versus recall) in a similar design. Participants will be assigned to either a free-strategy group, without strategy instructions, or an instructed-strategy group, advising a verbal recall strategy. These manipulations will allow us to determine what aspect of WM performance faltered. These results will offer important takeaways for pedagogy (e.g., testing using multiple choice versus short answer questions) and cognitive training.

Topic Area: EXECUTIVE PROCESSES: Working memory

B30 - Cerebellum causally influences spatial working memory tuning in frontoparietal and visual cortex

James Brissenden[1] (brissend@umich.edu), Rupsha Panda[1], Jacob Sellers[1], Taraz Lee[1]; [1]University of Michigan

Despite extensive research focused on identifying the specific brain structures and mechanisms involved in working memory (WM), much of the prior literature has relied on correlational methods to explore the neural substrates of WM. We sought to investigate the causal role of brain areas spanning the cerebral cortex and cerebellum in WM using a combination of functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation. Across multiple sessions, we applied continuous theta-burst stimulation to perturb activity in intraparietal sulcus (IPS), frontal eye fields, cerebellar lobule VIIb, and a somatosensory control site immediately prior to the performance of a continuous report spatial working memory task both inside and outside of the fMRI scanner. A baseline fMRI session collected structural MRI, resting-state, and population receptive field (pRF) mapping scans. We examined the effect of stimulation on parameters of a variable precision mixture model for each session. We also investigated how stimulation impacted delay-period spatial tuning properties across a network of spatial WM areas. Information-theoretic analyses investigated how spatial tuning changes affected the fidelity of spatial population coding across the brain. Cerebellar and frontal stimulation resulted in reduced recall precision relative to control stimulation, while IPS stimulation increased precision variability. We also demonstrated a causal influence of cerebellum on neural response variability in higher-order visual cortex, IPS, and frontal cortex to repeated presentations of the same stimulus. Further analysis revealed that this change in variability resulted in reduced Fisher information throughout the delay period across this spatial WM network.

Topic Area: EXECUTIVE PROCESSES: Working memory

B31 - Neural differentiation in working memory operations predicts individual differences thought control difficulties

Jacob DeRosa[1,2] (jacob.derosa@colorado.edu), Harry Smolker[2], Hyojeong Kim[3], Jarrod Lewis-Peacock[3], Marie Banich[1,2]; [1]Department of Psychology and Neuroscience, University of Colorado Boulder, [2]Institute of Cognitive Science, University of Colorado Boulder, [3]Department of Psychology, University of Texas at Austin

Prior work from our group demonstrated that each of four working memory (WM) control operations—maintaining an item, replacing it, specifically suppressing it, or clearing the mind of all thought—are associated with unique multi-voxel patterns of brain activation (Kim et al., 2020). We also identified four brain networks – visual network (VN), somatomotor network (SMN), default mode network (DMN), and frontoparietal control network (FPCN) – that represent these operations in unique configurations (DeRosa et al., 2024). For example, the FPCN differentiates among all four operations, whereas the VN groups maintain and replace together, and clear and suppress together. The current study investigates individual differences (N=48) in the distinctiveness of control operations within these networks. Specifically, we tested the hypothesis that less differentiated fMRI activity patterns for these operations are linked to self-reported difficulties in thought control. This is clinically significant, as impairments in thought control are strongly associated with pathological rumination and worry. We operationalized thought-control difficulty as the average of three self-report scales: White Bear Suppression Inventory, Penn State Worry Questionnaire, and the brooding scale of the Ruminative Response Scale. Consistent with our hypothesis, thought-control difficulty was associated with less differentiated control patterns. In particular, the representation of the suppression operation in DMN was less distinct from its representations in other networks, and the representation of suppression within the FPCN was more variable. These neural patterns explain up to 30% of the variance in self-reported thought difficulties, suggesting their potential utility in uncovering the neural mechanisms underlying repetitive negative thinking.

Topic Area: EXECUTIVE PROCESSES: Working memory

B32 - A novel eye-tracking paradigm reveals reduced vividness under combined visuospatial imagery and visual working memory requirements

Emaad Razzak[1], Tengyu Song[1], Elmina Aghayeva[1], Jiayi Wang[1], Tim Mousseau[1], Jacqueline Gottlieb[1], Alfredo Spagna[1]; [1]Columbia University

Visual mental imagery (VMI) and visual working memory (VWM) are required in tasks involving visuospatial reasoning, yet their interaction remains unclear. We developed a delayed match-to-sample mental rotation task to examine their interaction. Typical imagers (VVIQ > 32) assessed whether two rotated stimuli at 0°, 60°, 120°, or 180° were identical. Expanding upon Shepard and Metzler's 3D paradigm, stimuli were presented simultaneously or sequentially with a 1s delay. 2D analogs assessed spatial complexity. Metrics included accuracy, RTs, gaze patterns, pupillometry, and subjective ratings of vividness, confidence, and strategy, analyzed via repeated-measures ANOVAs. Accuracy decreased with larger angles, VWM demand, and 3D stimuli, with a steeper decline at larger angles in 3D trials (all $p < 0.001$). Vividness ratings declined with greater angles, VWM trials, and 3D objects (all $p < 0.001$)—more steeply under VWM demand ($p < 0.01$). RTs increased with larger angles and 3D objects (both $p < 0.001$). Pupillometry revealed larger pupils at greater angles ($p < 0.01$) and VWM conditions ($p < 0.05$) aligning with cognitive effort. Gaze tracking reveals inspection of empty first stimulus locations in VWM trials ($p < 0.001$), suggesting imagery-based memory reinstatement. Findings suggest VMI and VWM compete for cognitive resources. Interaction between VWM and angle on vividness suggests reduced capacity for vivid representations under combined demands. Pronounced decline in accuracy with larger angles for 3D trials highlights spatial complexity's burden on mental imagery. Eye tracking supports imagery-based memory reinstatement. These insights underscore VMI and VWM's competition of cognitive processing in visuospatial tasks.

Topic Area: EXECUTIVE PROCESSES: Working memory

B33 - Flexible gaze reinstatement during working memory for natural scenes

Yueying Dong[1] (yud070@ucsd.edu), Sihan Yang[1], Yun-Chen Hung[1], Anastasia Kiyonaga[1]; [1]University of California, San Diego

Prominent working memory (WM) models assert that feature-specific WM content is stored in sensorimotor cortical activations, and newer evidence suggests that even peripheral oculomotor signals carry WM information. For instance, during a WM delay, small gaze biases veer toward locations in memorized visual space. Yet the specificity and functional relevance of such oculomotor WM signatures is unclear. In long term memory, gaze patterns at retrieval have been found to recapitulate the spatiotemporal pattern from encoding, and the degree of such gaze reinstatement may functionally relate to performance. Here, we ask whether oculomotor patterns during WM exhibit a similar degree of spatiotemporal specificity and relevance to function. We tracked participants' eye gaze during encoding and WM maintenance of naturalistic images, and we manipulated whether they would be tested on the visual or semantic features of the image. In two experiments, we found that gaze patterns during a blank WM delay resembled the spatiotemporal sequence of eye movements observed during visual encoding of the same image. Gaze patterns during WM may therefore track the identity of complex, natural images that are held in mind. Moreover, we found a stronger degree of such WM gaze reinstatement when the task prioritized precise visual information as compared to semantic categories. Peripheral oculomotor signatures of WM content are therefore malleable to how the content will be used. These results highlight a potential role for the earliest levels of visual processing in WM content representation, and suggest that ocular WM signals are functionally flexible to upcoming demands.

Topic Area: EXECUTIVE PROCESSES: Working memory

B34 - Stability of working memory related theta synchrony over time

Jenna N. Pablo[1] (jpablo@unr.edu), Beau Oster[1,2], Marian E. Berryhill[1]; [1]University of Nevada, Reno, [2]Johns Hopkins University School of Medicine

There is tremendous interest in developing protocols to preserve or enhance working memory (WM) performance. One emerging target is strengthening underlying neural oscillations, including theta-gamma coupling to improve WM. Recent noninvasive brain stimulation (NIBS) studies tailor interventions to an individual's peak phase-locking value (PLV) theta frequency over anterior-posterior sites. An assumption of this approach is that this peak value is stable across multi-session training paradigms occurring over time. To test this assumption, we examined (1) intra-individual and (2) inter-individual stability of peak PLV theta frequencies across time. We recorded EEG (BioSemi, 32-channel cap) from n=30 participants during three sessions (separated by >48 hours) as they performed a visual WM change detection task. Reaction times significantly improved across sessions ($p<.001$), but WM accuracy did not change. We conducted single-trial time-frequency decomposition with Morlet wavelets to extract the peak PLV (Fz to Pz electrodes) theta frequency over the delay period of correct trials. A mixed-effects model revealed no main effect of session on peak PLV frequencies ($p=0.34$). However, the low intraclass correlation coefficient (ICC=0.14) indicated substantial intra-individual variability (accounts for 86.3% of the variability) relative to inter-individual variability (13.7%). This suggests individualized peak PLV theta frequencies should be reassessed before each neurostimulation session to optimize tuning. These findings challenge the assumption of stable oscillations over time and raise questions regarding the mechanism by which NIBS benefits WM.

Topic Area: EXECUTIVE PROCESSES: Working memory

B35 - Differential Patterns of Neural Activation during Control Operations on Positive vs. Negative Information in Working Memory.

Brynn Paulsen[1], Boman Groff[1], Jacob DeRosa[1,2], Jarrod Lewis-Peacock[3], Marie T. Banich[1,2]; [1]Department of Psychology and Neuroscience, University of Colorado at Boulder, [2]Institute of Cognitive Science, University of Colorado at Boulder, [3]Department of Psychology, University of Texas at Austin

Repetitive negative thinking is a core symptom of internalizing disorders, shown to predict and prolong symptoms of psychopathology. Therefore, developing effective strategies to remove negative thoughts is crucial. Past work by our group has shown that each of four working memory (WM) control operations — maintaining an item, replacing it, specifically suppressing it, or clearing the mind of all thought — engage unique neural regions (Banich et al. 2015). The present study examined whether these operations show similar patterns when the information to be manipulated is valenced (negative, positive). We recorded fMRI while participants (N=83) performed these operations on both negative and positive information in WM. Over all operations, regions of the right anterior insula exhibited greater activation for positive than negative items. Regions mainly within the default mode network (left retrosplenial cortex, left parahippocampal region, right hippocampus, left posterior cingulate) exhibited an interaction between operation and valence. Specifically, whenever an item needed to be held in working memory (i.e., maintain, replace), there was greater deactivation for negative stimuli compared to positive stimuli. In contrast, when information needed to be removed from WM (i.e., suppress, clear), there was slightly less deactivation for negative stimuli than for positive stimuli. These findings suggest that control operations in WM influence regional brain activity differently, depending on the valence of the information manipulated. Together, these results provide insight into the neural mechanisms supporting the regulation of emotional information in WM, which may inform targeted interventions to mitigate repetitive negative thinking and its associated psychopathology.

Topic Area: EXECUTIVE PROCESSES: Working memory

B36 - Neural and behavioral correlates of spatiotemporal memory organization and recall

Colin Bruce[1,2] (brucec8@mcmaster.ca), Deepti Tantry[2,3], Michael Kahana[2]; [1]McMaster University, [2]University of Pennsylvania, [3]Johns Hopkins University

We investigated the neural and behavioral mechanisms of memory encoding and retrieval during a quasi-naturalistic spatial-episodic memory task, where epilepsy patients undergoing intracranial electroencephalographic (EEG) monitoring delivered items to landmarks in a virtual town and later recalled both the items and their corresponding locations. Transition probabilities and latencies revealed the spatial and temporal organization of memory, showing that as patients gained experience navigating the virtual town, their spatial knowledge improved, leading to more efficient navigation and enhanced spatial organization during recall. Intracranial EEG signals demonstrated a subsequent memory effect, with increased gamma and decreased alpha activity marking periods of successful encoding in multiple brain regions including both lateral and medical temporal cortices (LTC and MTL) and prefrontal cortex (PFC). This subsequent memory effect survived correction for serial position confounds. Increased gamma, decreased alpha, and increased theta activity were observed in these same regions immediately prior to recalling an item. These findings extend our understanding of the behavioral and neural signatures associated with successful memory encoding and retrieval to a naturalistic task that incorporates both spatial and temporal components of learning.

Topic Area: EXECUTIVE PROCESSES: Working memory

B37 - Fronto-parietal contributions to temporal, spatial, and category biases in visual working memory

Sihan Yang[1] (siy009@ucsd.edu), Jason M. Scimeca[2], Anastasia Kiyonaga[1]; [1]University of California, San Diego, [2]Louisiana State University

Working memory (WM) recall and representations can be biased by recent perceptual history, concurrent perceptual input, and prior knowledge. WM-related activity is distributed across the cortex, but it’s unclear what unique contributions different cortical activations make to preserving WM fidelity or integrating WM information across time, space, and existing knowledge. Here we build on a prior study of fronto-parietal WM functions to examine how specific regions contribute to WM biases — influences from recent trial history (serial bias), concurrently-maintained items (swap errors and surrounding bias), and semantic knowledge (color-category bias). During fMRI, participants completed a color WM recall task, wherein set-size varied from trial-to-trial. Individual functional activations were used to guide transcranial magnetic stimulation (TMS) to three critical regions: superior intraparietal sulcus (sup-IPS), inferior intraparietal sulcus (inf-IPS), and mid-lateral prefrontal cortex (PFC). Behavioral analyses revealed strong interactions between multiple types of WM bias. E.g., serial biases were minimized for more prototypical (categorical) colors and when concurrent WM items were more similar to each other. TMS also impacted bias magnitudes, but depended on a combination of TMS site and set-size. E.g., serial biases increased at higher set sizes under control stimulation, but PFC stimulation dampened that increase. Given that serial biases are thought to adaptively smooth noisy representations, this implies that the targeted region of PFC critically underlies this temporal integration process. These results suggest complex interdependence between multiple sources of WM bias, highlighting the role of fronto-parietal regions in not just WM maintenance but spatial and temporal context integration.

Topic Area: EXECUTIVE PROCESSES: Working memory

B38 - Neural signatures of coding and storing time in working memory

Yunyun SHEN[1] (yunyunshen77@gmail.com), Sophie K. Herbst[1], Virginie van Wassenhove[1]; [1]CEA, DRF/Joliot, NeuroSpin; INSERM, Cognitive Neuroimaging Unit; CNRS; Université Paris-Saclay, F-91191 Gif/Yvette, France.

Working memory (WM) critically relies on temporal processing for the order and duration of cognitive information. However, the neural mechanisms underlying the representation and the maintenance of time intervals in WM remain largely unresolved. Previous work using a novel n-item delayed duration reproduction task suggested that durations can be stored as abstract items in WM (Herbst et al., 2023). Herein, participants were presented with duration sequences consisting of either one or three temporal intervals (items), marked by brief tones. After a retention period, participants reproduced these item(s). We used this protocol with magnetoencephalography and contrasted brain activity as a function of the number of item(s) and their durations. First, we observed that during the encoding of the temporal sequence, the amplitude of the evoked response to the last tone increased with a smaller number of items and longer sequence duration. Similarly, for a single item of short duration, this amplitude correlated with the length of participants' reproduction. Second, we examined how WM load modulated oscillatory power during the retention interval. Our preliminary observations suggest that alpha (8-12 Hz) and beta (14-30 Hz) power are modulated by the number of items and the sequence duration. Overall, as for other WM content, our findings suggest that evoked responses and oscillatory power serve as neural signatures of temporal information encoding and maintenance, respectively. We expect that this study will help further clarify the representation of duration in WM.

Topic Area: EXECUTIVE PROCESSES: Working memory

B39 - Using Electrical Stimulation to Test the Causal Role of Aperiodic Activity in Working Memory

Quirine van Engen[1] (quvaneng@ucsd.edu), Gabriela Freedland[1], Justin Riddle[2,3], Bradley Voytek[1,4,5,6]; [1]Department of Cognitive Science, University of California, San Diego, [2]Department of Psychology, Florida State University, [3]Program in Neuroscience, Florida State University, [4]Halıcıoğlu Data Science Institute, University of California, San Diego, [5]Neurosciences Graduate Program, University of California, San Diego, [6]Kavli institute for Brain and Mind, University of California, San Diego

Working memory (WM) is a cognitive function that enables temporary storage and manipulation of information for tasks like reasoning and decision making. While research has focused on oscillatory activity in narrow frequency bands, most neuronal activity is asynchronous, manifesting as aperiodic activity. Aperiodic activity is characterized by a 1/f power law distribution, and its slope is speculated to reflect the E:I balance. Recent evidence suggests aperiodic activity dynamically changes with cognitive demands, including WM, but lacks causal evidence. To investigate this causal connection, we collected EEG data from participants (n = 36) completing two days of a visual delayed continuous report task with varying WM loads. We developed a novel non-invasive electrical stimulation paradigm that mimics aperiodic activity: transcranial Random Aperiodic Stimulation (tRAS). Day two included this paradigm targeting the fronto-parietal network with the goal to causally manipulate endogenous neural aperiodic activity to become steeper or flatter while they performed the task. From day 1, we replicate classic WM findings: worse performance on higher WM load conditions than lower loads. We hypothesize that steeper stimulation causes the slope of aperiodic activity to increase, and will be paired with an increase in WM performance. If our results support our hypothesis, this research is critical for aging, since aperiodic activity flattens with age, paralleling a cognitive decline. If we find evidence for a direct, causal connection between aperiodic activity and WM, we have opened the door to finding a way to slow mental aging and improve the longevity of their minds.

Topic Area: EXECUTIVE PROCESSES: Working memory

B40 - The influence of crowding and cortical spacing on visual working memory

Taryn Green[1] (tgre116@lsu.edu), Naria Quazi[2], Jason Scimeca[1]; [1]Louisiana State University, [2]University of California, Berkeley

The neural basis of visual working memory (VWM) remains contentious. One prominent theory, the sensory recruitment hypothesis, posits that the visual cortex both perceives and maintains visual information. In contrast, competing theories propose that only cortical regions outside visual cortex maintain visual information after perception. The current study addresses this debate by investigating the effects of spatial crowding – constraints on cognition due to object spacing that are typically observed during perception – on VWM maintenance. We hypothesized that crowding would influence cortical competition in visual cortex during maintenance and impair VWM performance, even if crowding cannot occur during initial perception. In Experiment 1, we address this hypothesis using a VWM recall task for color. Participants encoded five sequentially-presented colored squares that were displayed at locations either closer together (crowded in space) or farther apart. At test, a single location was highlighted and participants used a continuous color wheel to report the color of the probed location. In Experiment 2, we address this hypothesis using a VWM recall task for spatial orientation. We found significantly impaired memory for objects initially presented closer together compared to objects presented farther apart. Model-based analyses revealed that this difference in VWM performance was due to an increase in spatial binding errors, instead of a decrease in memory precision for the remembered feature. Together, these results emphasize the importance of spatial crowding on VWM maintenance and support the hypothesis that cortical competition in visual cortex is an important constraint on working memory performance.

Topic Area: EXECUTIVE PROCESSES: Working memory

B41 - Computational modeling of the impact of synaptic pruning defects on Working Memory in Autism Spectrum Disorder

Hikaru Sasaki[1] (c0b2107561@edu.teu.ac.jp), Masayuki Kikuchi[2]; [1]Tokyo University of Technology

Synaptic pruning plays an important role in the maturation of neural networks in the brain and is also thought to help shape small-world properties for efficient information transmission. In autism spectrum disorder (ASD), genetic abnormalities linked to synaptic pruning defects may disrupt these properties. Although the mechanism is still unknown, ASD symptoms are thought to be caused by dysfunction of neural networks. Working memory (WM) deficits in ASD are associated with communication issues and stereotypical behavior. This study aimed to explore the previously unexamined link between synaptic pruning defects and reduced WM ability in ASD using a computational model. We used Echo State Networks (ESNs), consisting of an input, reservoir, and output layers. The structure of reservoir layer follows the Watts-Strogatz model, enabling small-world networks by rewiring edges with a given probability. We constructed two models: the "ASD Model" (rewiring probability = 0.007) in which majority of connections are local and the "TD Model" (0.07) in which a small number of connections are global. In reservoir layer, each node corresponds to a group of randomly connected spiking neurons whose behavior is described by Izhikevich model. The model performed a 2-back task, identifying grating patterns presented two steps earlier. Results showed that the TD model had a higher accuracy rate than the ASD model ($p<0.05$). This result suggests that the loss of small-world properties due to defective synaptic pruning may contribute to the decline in WM ability in ASD.

Topic Area: EXECUTIVE PROCESSES: Working memory

B42 - Side-by-Side Regions in Dorsolateral Prefrontal Cortex Robustly Dissociate Salience and Working Memory

Anne Billot[1,2], Wendy Sun[1,3], Kathryn Rodrigues[1,2], Xiangyu Wei[3], Mark C. Eldaief[1,2,4,5], Randy L. Buckner[1,3,4,5]; [1]Division of Medical Sciences, Harvard Medical School, Boston, MA 02115, [2]Dept. of Neurology, Massachusetts General Hospital, Charlestown, MA 02129, [3]Dept. of Psychology, Center for Brain Science, Harvard University, Cambridge, MA 02138, [4]Dept. of Psychiatry, Massachusetts General Hospital, Charlestown, MA 02129, [5]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA 02129

Emphasis has traditionally been placed on the role of the dorsolateral prefrontal cortex (DLPFC) in working memory. Here we used precision functional mapping to identify two juxtaposed DLPFC regions that participate in distinct distributed networks and investigated putative behavioral dissociations between these networks. Functional networks were estimated within 14 individuals using intensive repeat sampling (Du et al., 2024). fMRI responses of adjacent DLPFC regions belonging to separate networks were repeatedly measured within each participant during N-back working memory and oddball detection tasks. We found that one DLPFC region belonging to a network coupled to the ventral striatum responded robustly to salient, transient events and could be double dissociated from an adjacent region that responded to traditional working memory demands. We further isolated these two DLPFC regions in additional controls and in patients with MDD using a single-session protocol and are now prospectively testing their response properties. These findings indicate that, at the individual level, a single fMRI acquisition session can identify side-by-side regions of DLPFC associated with distinct large-scale networks which exhibit functional double dissociations. Of interest, the DLPFC region we identified as responding to salient/transient events is the likely neuromodulatory target for the treatment of Major Depressive Disorder (MDD) in most individuals (Sun, Billot et al., 2024), further supporting its putative functional specialization.

Topic Area: EXECUTIVE PROCESSES: Working memory

B43 - Persistent Nociceptive Pain Alters Verbal Working Memory Neural Oscillatory Dynamics

Amy Proskovec[1,2], Megan White[3], Lin Guo[4], Mahak Virlley[1,2], Una Makris[2], Jason Zafereo[2], Frank Yu[2], Elizabeth Davenport[1,2]; [1]Magnetoencephalography Center of Excellence, Dallas, Texas, [2]University of Texas Southwestern Medical Center, Dallas, Texas, [3]Loyola University, Chicago, Illinois, [4]Baylor Scott & White All Saints Medical Center, Fort Worth, Texas

Pain-related working memory deficits are well documented. The motivational theory posits that managing persistent pain can become a goal that consumes limited neural resources, leading to cognitive dysfunction. However, few studies have examined how pain affects working memory neural dynamics. We investigated the effects of persistent pain on the neural oscillations serving specific phases of verbal working memory (VWM). Thirty adults with persistent moderate-to-severe nociceptive pain (M age = 63.5, 18 female) and thirty adults with no pain (M age = 62.1, 18 female) completed a Sternberg-type VWM task during magnetoencephalography (MEG). MEG data underwent standard preprocessing, were transformed into the time-frequency domain, and significant oscillatory responses relative to baseline were imaged using a beamformer. To determine group effects (pain vs. no pain), ANCOVAs were performed on the resulting encoding and maintenance whole-brain maps with race, presence of mild cognitive impairment, and a composite score of anxiety and depression as covariates. Across groups, decreases in alpha-beta (9-16 Hz) activity were seen in left frontotemporal cortices throughout encoding and maintenance. Significant group differences emerged in right inferior frontal and supramarginal cortices during encoding, and in bilateral occipital cortices during maintenance, reflecting weaker alpha-beta responses in pain participants (all p's < .05, corrected). Pain participants also had significantly lower accuracy on the VWM task (p < .05). In congruence with the motivational theory, our results suggest that individuals with persistent nociceptive pain display limited recruitment of right frontoparietal cortices when encoding information, as well as limited inhibition of occipital cortices during maintenance.

Topic Area: EXECUTIVE PROCESSES: Working memory

B44 - Aging and Temporal Order Memory in Naturalistic Events

Yining Ding[1] (d.yining@wustl.edu), Devon R. Alperin[1], Jeffrey M. Zacks[1]; [1]Washington University in St. Louis

Remembering the temporal order of past events is crucial for planning future actions adaptively. Previous studies using lab-based stimuli have found that older adults perform worse than younger adults on order memory tasks, consistent with the associative deficit hypothesis in cognitive aging. However, it remains unclear whether this deficit extends to more naturalistic scenarios, where semantic knowledge and hierarchical event structure may support encoding and retrieval of temporal relations. To address this, we are investigating age-related differences in order memory using hierarchically organized narrative stimuli depicting everyday activities, with semantic order constraints among events either on the coarse-level or on the fine-level. Participants read narratives and perform recency judgment and distance rating tasks for sentence pairs after a 20-min delay. First, we hypothesize that semantic knowledge about event order will improve both younger and older adults' order memory performance. Second, we aim to test two competing theories about how hierarchical structure affects older adults' temporal memory: The event distinctiveness hypothesis proposes that older adults are worse in maintaining distinct, hierarchically organized event representation than younger adults, leading to the prediction that older adults perform worse in reconstructing fine-level event order using larger temporal structure. In contrast, the specificity hypothesis proposes that older adults may retain intact gist-level associations comparable to those of younger adults, potentially eliminating age-related differences. This study has been preregistered, and data collection is currently ongoing.

Topic Area: LONG-TERM MEMORY: Development & aging

B45 - What aspects of familiarity are linked to the volumes of the perirhinal and entorhinal cortices, the first regions affected in Alzheimer's disease?

Anaïs Servais[1] (anais.servais@uliege.be), Aurélien Frick[1], François Meyer[1], Christine Bastin[1], Emma Delhaye[1]; [1]GIGA Research CRC Human Imaging, University of Liège

The perirhinal (PrC) and the anterolateral entorhinal (alErC) cortex are among the first brain regions impacted by Alzheimer's Disease (AD). While their role in cognition remains unclear, recent models propose that these regions support episodic and lifetime (or absolute) familiarity when discriminating highly overlapping concepts is necessary. The present study assessed episodic familiarity judgments (task 1) and lifetime familiarity judgments (task 2), using materials with varying levels of conceptual overlap and lifetime familiarity for lures and targets (task 3). The study involved 57 older participants (aged 55+), including healthy individuals and those with either Subjective or Mild Cognitive Impairment. Volumes of the PrC, alErC, and hippocampal subfields were measured using structural MRI. As hypothesized, results suggest the PrC and the alErC volumes are linked with familiarity processes when discriminating highly overlapping concepts is required. This can be interpreted in line with recent ideas suggesting that familiarity feelings emerge from distinct neural pathways depending on the type of representations–PrC being involved in fine-grained representations. Moreover, clustering analysis revealed three distinct subgroups: one including healthy individuals, another including predominantly patients with established memory impairment, and a third, more heterogeneous group, which may represent preclinical cognitive decline. Participants in this subgroup appear to rely on familiarity to compensate for impaired recollection and commit more false alarms. Their recognition accuracy also decreases as conceptual overlap increases. We discuss how the pattern of performance across our three tasks highlights the promise of combining familiarity-related tasks to detect subtle cognitive changes associated with preclinical AD.

Topic Area: LONG-TERM MEMORY: Development & aging

B46 - Multi-Attribute Memory and Decision-Making Across the Adult Lifespan: Neural Representations and Behavioral Dynamics

Christina Yu[1] (sumin.yu@duke.edu), Kennedy Black[1], Jessie Chan[1], Eric Juarez[1], Elizabeth J. Marsh[1], Felipe De Brigard[1], Gregory Samanez-Larkin[1], Roberto Cabeza[1]; [1]Duke University

Although memory, aging, and decision making are independently a critical part of our daily lives, the study of the interaction of these three variables is still largely in its infancy. This study aimed to evaluate adult age differences in how memory mechanisms impact decision making. We asked participants (n = 87; age range 25 – 80) to choose between two similar consumer goods (e.g. two different stereos) that differed in the quality and quantity of hypothetical consumer ratings (1 vs 2 rows of star ratings each on a 5-star scale) while undergoing fMRI. Some trials required participants to first view a single item with star ratings and then hold that in memory before being presented, after a delay, with a second item and then asked to choose between the current item and the one presented previously. On other trials, both items and star ratings were presented simultaneously without memory demands. Results from mixed-effect regressions revealed that the right Cingulate Gyrus, right Hippocampus, and left Insula showed significant activation when memory demands were highest during decision making. Activation differences in the right Hippocampus also varied with age, such that older adults had less memory load-related modulation of this region compared to younger adults. Behavioral results also revealed that memory demands reduced decision accuracy more for older than younger adults. Taken together, these results highlight that neural memory-based decision-making mechanisms may diminish as we age even in healthy adults.

Topic Area: LONG-TERM MEMORY: Development & aging

B47 - Moderating effects of cortical thickness, volume, and memory performance on age differences in neural reinstatement of scene-related information

Joshua Olivier[1] (joshua.olivier@utdallas.edu), Sabina Srokova[2], Michael Rugg[1]; [1]University of Texas at Dallas, [2]University of Arizona

The strength of neural reinstatement, a correlate of episodic memory, has been reported to reflect the amount and quality of retrieved mnemonic content and vary with age, with weaker effects in older compared to young adults, especially for scene memoranda. The mechanisms underlying age differences in reinstatement are unclear. Given evidence that age-related declines in cortical thickness and volume are a contributing factor to age-related cognitive decline, we combined fMRI data acquired in two previous studies of healthy young and older adult samples to examine relationships between age, cortical thickness, cortical volume, and reinstatement of scene-related information in two cortical regions implicated in scene processing: the parahippocampal place area (PPA) and medial place area (MPA). A 'reinstatement index' was estimated from the fMRI data collected at retrieval during a source memory task involving words paired with scene images. A series of multiple regression analyses examined the effects of the variables of interest on reinstatement. We found robust age differences in reinstatement, cortical thickness, and cortical volume. The regression models indicated that cortical volume was the sole significant predictor of reinstatement in both the PPA and MPA. Additionally, reinstatement strength in the PPA was a significant predictor of memory performance independently of age and cortical volume. The findings suggest that age differences in reinstatement can be fully explained by age differences in cortical volume, and that memory performance and age differences in volume account for unique components of variance in reinstatement strength.

Topic Area: LONG-TERM MEMORY: Development & aging

B48 - A Cardiovascular Approach Towards a Better Understanding of Feelings of Familiarity

Hannah Del Gatto[1,2] (hdelgatto@research.baycrest.org), Nicole D. Anderson[1,2]; [1]Rotman Research Institute, [2]University of Toronto

Familiarity can be both mentally experienced and physically embodied, and is impaired in amnestic mild cognitive impairment (aMCI). Research has previously linked familiarity to cardiovascular baroreceptor signaling. The present study utilized a frequency judgment task, which included a cardiac phase manipulation that synchronized the presentation of stimuli to either systole or diastole, to determine whether familiarity would be affected by cardiovascular feedback. Data collection is ongoing, but so far we are finding higher levels of familiarity in younger and healthy older adults compared to older adults with aMCI, and higher levels of familiarity at systole compared to diastole in the two healthy groups, but not in older adults with aMCI. These findings suggest that cardiovascular feedback may work to support the experience of familiarity.

Topic Area: LONG-TERM MEMORY: Development & aging

B49 - Distributed Functional Networks Associated with Age-Related Decline in High-Fidelity Memory Retrieval

Joseph C. C. Chen[1], Adam Gazzaley[1], Peter E. Wais[1]; [1]University of California San Francisco

Fidelity of detailed information retrieved from long-term memory (LTM) declines in normal aging. This decline is related to changes in cognitive function that affect learning and remembering processes. Such behavioral deficits have been associated with alterations in the function of the dentate gyrus and CA3 regions of the hippocampus. It is not clear, however, how such aging-related decline in high-fidelity retrieval is associated with functional networks between hippocampal and cortical regions in healthy older brains. Twenty-two cognitively intact older adults (69.4 ± 4.4 years) completed a mnemonic discrimination task where participants indicated whether previously encoded targets, lures, or novel objects were old or new during functional MRI (fMRI) scans. Participants' high-fidelity memory, as measured by the lure discrimination index (LDI), was on average, 0.49 ± 0.03 – lower than previously reported LDIs in healthy young adults: 0.56 ± 0.04. High-fidelity LTM processes in older adults were implicated in bilateral hippocampal regions, and trial-wise beta-series correlation from the bilateral hippocampal regions engaged functional networks involving bilateral inferior frontal gyri, the right angular gyrus, and bilateral precuneus. Taken together, we characterize the broad distribution of hippocampal-cortical networks in older adults that underlie high-fidelity memory.

Topic Area: LONG-TERM MEMORY: Development & aging

B50 - Distinct neurophysiological mechanisms of developing medial temporal lobe in human episodic memory

Qin Yin[1], Elizabeth L. Johnson[2], Adam J. O. Dede[2], Robert T. Knight[3], Eishi Asano[4,5], Noa Ofen[1,5]; [1]University of Texas at Dallas, Dallas, TX, [2]Northwestern University, Chicago, IL, [3]University of California, Berkeley, CA, [4]Children's Hospital of Michigan, Detroit, MI, [5]Wayne State University, Detroit, MI

Anterior and posterior regions of the medial temporal lobe (MTL) are posited to support memory differentially yet the neurophysiology of MTL functional heterogeneity in the developing MTL remains largely unknown. We utilized pediatric intracranial EEG from 19 subjects (5.9-20.5 years) who completed a scene recognition memory task to investigate the neurophysiology of memory formation in the anterior (aMTL) and posterior (pMTL) MTL. Analyses focused on high-frequency activity (HFA; 70-150Hz), low-frequency theta oscillations, and HFA-theta phase-amplitude coupling (PAC). HFA timing differed between pMTL and aMTL in that HFA peaked after scene onset in pMTL and around subjects' encoding responses (indicating indoor/outdoor of a scene) in aMTL. Subsequent memory analysis revealed increased HFA in hit trials after scene onset primarily in pMTL; the increase positively correlated with memory performance. Theta oscillations were detected in both pMTL [hit, 7.59(7.73) Hz; miss, 7.61(2.89) Hz] and aMTL [hit, 7.23(6.10); miss, 7.11(5.78) Hz]. Moreover, theta was associated with memory performance. In pMTL, the frequency and performance association differed by age, such that higher frequency was associated with better performance in children but not in adolescents. In aMTL, higher frequency and lower bandwidth were associated with better performance, suggesting that a fine-tuned aMTL theta mechanism supports better memory, regardless of age. Increased PAC during hit trials was observed before subjects' responses primarily in aMTL, evincing theta-associated mnemonic representations in aMTL. These findings highlight the respective contributions of pMTL and aMTL to exogenous and endogenous processes and reveal distinct neurophysiological underpinnings of human memory in the developing MTL.

Topic Area: LONG-TERM MEMORY: Development & aging

B51 - Transentorhinal cortex integrity predicts object fine-grained perceptual and mnemonic discrimination

Emma Delhaye[1,2] (emma.delhaye@uliege.be), Gabriel Besson[3], Mohamed Ali Bahri[2], Christine Bastin[2]; [1]CICPSI, Faculty of Psychology, Lisbon University, [2]GIGA-CRC Human Imaging, University of Liège, [3]Proaction Lab, CINECC, Faculty of Psychology, University of Coimbra

The transentorhinal cortex (tErC) stands among the first regions to be affected by Alzheimer's disease (AD) neuropathology, years before any clinical symptoms manifest. Understanding the precise role of this region in cognition is key to detecting the earliest AD-related cognitive impairments. Here, we tested the hypothesis that the tErC supports fine-grained representations of unique individual objects (1) regardless of the cognitive function involved (i.e., perceptual or mnemonic) and, critically, (2) sensitively to the granularity of the demanded discrimination. Therefore, tErC alterations should be consistently and specifically associated with fine-grained object discrimination impairments. We leveraged the prevalence of early AD-related alterations in healthy aging and assessed the association of fine-grained object vs. scene discrimination with two AD-related neuroimaging markers of tErC alterations, i.e., cortical integrity alterations and resting-state functional connectivity changes. Estimating visual similarity using both a pre-trained neural network and subjective measures, our results bring compelling new evidence that the structural integrity of the tErC is specifically related to the sensitivity to visual similarity for objects, but not for scenes, exclusively using neural network similarity measures, but not using human subjective similarity measures, in perceptual discrimination, while in mnemonic discrimination, it is exclusively related with subjective visual similarity ratings but not with similarity computed through a neural network.

Topic Area: LONG-TERM MEMORY: Development & aging

B52 - Spatiotemporal episodic memory decline in MCI and Alzheimer's disease is associated with parietal alpha/beta dysregulation

Sang-Eon Park[1] (9sang9@gmail.com), Maria Jieun Hwang[1], Jeonghyun Lee[1], So Yeon Jeon[2], Sang Ah Lee[1]; [1]Department of Brain and Cognitive Sciences, Seoul National University, Seoul, Korea, [2]Department of Psychiatry, Chungnam National University Hospital, Daejeon, Republic of Korea

Our previous studies reported that episodic memory decline in Alzheimer's disease (AD) was more severe in the "where" and "when" components compared to "what" memory. In this study, we extended the investigation to mild cognitive impairment (MCI) patients, to test its potential application for predicting signs of memory impairment in a high-risk group who may be at an early stage of AD. 60 older participants (31 MCI with 19 amyloid-beta positive and 9 negative, 19 AD, 10 control; ages 62-86) performed a scene-based episodic memory task testing "what", "where", and "when" components while recording scalp EEG. All episodic memory components showed memory decline in MCI and AD patients but the "what" memory was relatively preserved compared to spatiotemporal ("where" and "when") memory. Moreover, MCI patients without amyloid beta (MCI-) showed better spatiotemporal memory while MCI patients with amyloid beta (MCI+) and AD patients failed to perform above chance level. We found that alpha and beta power (10-30Hz) in parietal EEG channels was associated with this deficit during memory retrieval: specifically, unlike healthy controls and MCI- patients, alpha and beta did not decrease from baseline in MCI+ and AD patients. This is consistent with the interpretation that amyloid plaques in MCI+ and AD patients induce neural hyperactivation and disturbance of functional connectivity across brain networks. We speculate that spatiotemporal memory may be particularly sensitive to such neural dysfunction due to its heavy dependence on the cortico-hippocampal memory network.

Topic Area: LONG-TERM MEMORY: Development & aging

B53 - The dynamic interaction between narrative and gaze reinstatement across age groups

Ziming Cheng[1,2] (zcheng@research.baycrest.org), Donna Rose Addis[1,2,3], Jennifer Ryan[1,2,4]; [1]Baycrest Health Sciences, Rotman Research Institute, [2]Department of Psychology, University of Toronto, [3]Department of Psychology, The University of Auckland, [4]Department of Psychiatry, University of Toronto

Exploring one's surroundings through eye movements is unsurprisingly beneficial in describing a scene. Interestingly, reinstating these eye movements when recalling a previously viewed scene (i.e., gaze reinstatement) can benefit memory even without visual inputs. This effect is particularly valuable for older adults, who show increased gaze reinstatement especially when facing demanding tasks. While prior research highlights the benefits of gaze reinstatement for eventual memory outcomes, the dynamic relationship between eye movements and the process of memory construction, especially across age groups, remains unclear. Here, while their eye movements were recorded, younger and older adults recounted the details present within a series of photos and subsequently recalled those descriptions. We examined the dynamic interplay between the reinstatement of encoding-related eye movements and the recall of the photo descriptions. Results revealed significant narrative reinstatement (i.e., repeating the details and temporal order of the photo descriptions) throughout the trials, with younger adults showing higher initial reinstatement than older adults. Results also revealed significant gaze reinstatement but only during a portion of the trial, with the effect emerging earlier in younger adults. A bi-directional temporal relationship occurred across time: narrative preceded gaze reinstatement; and subsequently, gaze reinstatement preceded narrative reinstatement. Such effects were less clearly delineated in older adults, suggestive of an age-related decline in the flexible use of eye movements to retrieve associated information in memory. Overall, this study expanded beyond the previous knowledge that eye movements unilaterally support memory, and showed a dynamic and age-sensitive bi-directional relationship between gaze and narrative reinstatements.

Topic Area: LONG-TERM MEMORY: Development & aging

B54 - Accelerated Long-Term Forgetting as an Objective Indicator of Subjective Cognitive Decline

Madeline A. Sullivan[1], Carina C. Samson[1], David A. Gallo[1]; [1]University of Chicago

This study will enhance our understanding of subjective cognitive decline (SCD) in older adults. Research suggests that SCD can reflect subtle memory problems that precede the onset of Alzheimer's disease (AD), but these subtle effects often go undetected on objective neuropsychological tests. Here, we will test the hypothesis that accelerated long-term forgetting (ALF) can serve as an objective indicator of SCD. ALF is a phenomenon where episodic memories are retained at a normal rate over short delays but are forgotten at an abnormally rapid rate with longer delays, making it undetectable on standard clinical neuropsychological assessments with delays of only 30-60 minutes. The current work will compare memory performance between older adults with low or high levels of SCD at multiple retention intervals (15 seconds, 20 minutes, and 24 hours). Memory tasks include a paired-associate task, which tests memory for recently learned associations, as well as the DRM task, which assesses the impact of recently learned associative categories on the formation of false memories. We predict that high-SCD participants will exhibit accelerated long-term forgetting, with a significant memory deficit at the 24-hour delay but with minimal or no differences in memory performance at the short delays compared to low-SCD participants. That is, high-SCD participants exhibiting ALF will retrieve fewer items on the paired-associate task, and they will be less influenced by associative information on the DRM task. Results from the present study may contribute to the development of more sensitive diagnostic tools, aiding in the detection of preclinical AD.

Topic Area: LONG-TERM MEMORY: Development & aging

B55 - Default and Control Network Connectivity Changes Predict Memory Performance in Aging

Shijing Zhou[1] (shijingz@uoregon.edu), Troy Houser[1], Caitlin R. Bowman[2], Dagmar Zeithamova[1]; [1]University of Oregon, [2]University of Wisconsin-Milwaukee

Aging is associated with changes in cognition, such as reduced memory performance. Aging is also associated with changes in network architecture, such as decreased within-network and increased between-network functional connectivity. The study aims to investigate the impact of brain network organization on memory specificity and generalization in young and older adults. All participants completed category learning, recognition and categorization tasks with novel stimuli. Background functional connectivity was recorded during categorization. Behaviorally, we found that older adults were impaired on measures of both memory specificity and generalization. Network-level dedifferentiation – decreased within-network and increased between-network connectivity in aging – was primarily driven by decreased connectivity within-DMN (default mode network) and increased connectivity of the control network with other networks. Both of these predicted memory specificity (but not memory generalization) in older adults but not young adults. Older adults with high memory specificity performance had stronger within-DMN connectivity that was comparable to young adults and broad increases in control network connectivity with other networks relative to young adults. The results suggest that control network may play a compensatory role to help maintain memory specificity when the functional connectivity within DMN become weaker with aging.

Topic Area: LONG-TERM MEMORY: Development & aging

B56 - Domain-Specific Neural Markers of Age-Related Episodic Memory Decline and Domain-General Markers of Compensation

Maria Jieun Hwang[1] (mariahs@snu.ac.kr), Sang-Eon Park[1], Sang Ah Lee[1]; [1]Seoul National University

In this study, we investigate the possibility that the observation of individual differences in age-related memory decline is driven, in part, by the domain-specificity of episodic memory components tested, as well as the existence of both dysfunctional and compensatory changes in the aging brain. We aimed to tease apart these factors by using an episodic memory task in which participants in the fMRI scanner were shown a sequence of scenes and subsequently tested on the objects (what), locations of objects (where), and temporal order (when) of the scenes. Results from healthy older (age 50-86; n=120) and younger adults (age 20-30; n=41) revealed a significant decline across aging in all episodic memory components (what: r=-0.67; where: r=-0.61; when: r=-0.70), with more individual variety in older adults. Among the episodic memory components, temporal memory was more severely impaired than the other components and associated with reduced hippocampal and parahippocampal activation in older adults. Interestingly, cortical activation, especially in the middle frontal gyrus, was higher in older adults and contributed to better performance overall in all three (what, where, and when) components. A hippocampal seed-based connectivity analysis further revealed that the prefrontal cortex was strongly coupled to the hippocampus during the retrieval in the older adult. Our findings indicate that dysfunction in the hippocampus and parahippocampus underlie a domain-specific spatiotemporal episodic memory decline, whereas prefrontal cortex upregulation functions as a domain-general compensatory mechanism, resulting in a complex model of individual differences in cognitive aging.

Topic Area: LONG-TERM MEMORY: Development & aging

B57 - Self-related thought alterations associated with intrinsic brain dysfunction in mild cognitive impairment

Lucie Bréchet[1,2] (lucie.brechet@unige.ch), Povilas Tarailis[1,3], Kim Lory[1], Paul Unschuld[4,5], Christoph Michel[1,6]; [1]Department of Fundamental Neurosciences, University of Geneva, [2]Department of Clinical Neurosciences, University of Geneva, Switzerland, [3]Life Sciences Center, Institute of Biosciences, Vilnius University, Sauletekio ave 7, LT-10257 Vilnius, Lithuania, [4]Geriatric Psychiatry Service University Hospitals of Geneva (HUG) Thônex, Switzerland, [5]Department of Psychiatry, University of Geneva, Switzerland, [6]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland

The subjective experience of self-awareness is attributed to the human capacity for introspective thought during periods of mind-wandering. However, how this cognitive function is impacted in individuals with mild cognitive impairment (MCI) still needs to be better understood. To address this gap, we investigated alterations in self-referential thinking in a cohort of 30 MCI patients, comparing them to 60 healthy old-aged and 60 healthy younger controls. MCI patients exhibited a notable decline in overall cognitive function, as evidenced by significantly lower scores on the Montreal Cognitive Assessment (MoCA), with particular deficits in Memory subscore and Memory Index Score (MIS). Employing the Amsterdam Resting-State Questionnaire (ARSQ) to assess mind-wandering, we observed diminished self-related thoughts relating to personal past experiences and future thinking among MCI patients. Notably, using high-density electroencephalography (hdEEG) microstate analysis, we detected reduced neural activity associated with self-related thoughts in MCI patients relative to healthy controls. This aberrant temporal activity was localized within brain regions implicated in episodic autobiographical memory and the default mode network. Our results highlight a link between impaired mind-wandering ability and dysfunction within the intrinsic neural networks of MCI patients, underscoring its implications for disruptions in the sense of self within this clinical population.

Topic Area: LONG-TERM MEMORY: Development & aging

B58 - "Recall-to-reject": A behavioral and neural investigation into age differences in the strategic use of recollection to promote lure detection

Rebecca Wagner[1] (rmw5981@psu.edu), Caitlin Bowman[2], Nancy Dennis[1]; [1]The Pennsylvania State University, [2]University of Wisconsin-Milwaukee

Using behavioral and representational similarity analyses (RSA), we examined age differences in the process of recall-to-reject, a recollection- and monitoring-based retrieval strategy important for the accurate detection of perceptually similar, yet novel information (i.e., related lures; Brainerd et al., 2003). Previous work suggests that the reliance on recall-to-reject declines with increasing age due to changes in verbatim recollection and monitoring processes (Gallo et al., 2006). Through our investigation, we tested whether age differences in the reliance on recall-to-reject would persist when younger and older adults are given a recent reminder of the original target item, as reminders have been shown to strengthen and increase the accessibility of target representations during lure rejections (Brainerd et al., 2003). Behavioral results show that when targets are re-presented during retrieval, younger adults show sharp increases in reliance on recall-to-reject when identifying similar lures while older adults show a smaller benefit. Neuroimaging results corroborated these findings, showing that in regions associated with recollection of visual stimuli – including the lateral occipital cortex, midline occipital cortex, fusiform gyrus, angular gyrus, and hippocampus – younger adults displayed increased pattern similarity between recollected targets and rejected lures compared to older adults. Thus, despite providing reminders of the original target during retrieval, older adults continue to show reduced reliance on recollection rejection to support accurate lure rejections. This, in turn, may contribute to the reductions in memory accuracy observed in older populations.

Topic Area: LONG-TERM MEMORY: Development & aging

B59 - Using novelty and expectation violation to characterise the neural underpinnings of superior memory in superagers

Darya Frank[1,2] (darya.frank@manchester.ac.uk), Marta Garcia Huescar[2], Linda Zhang[3], Bryan Strange[2]; [1]University of Manchester, [2]Universidad Politecnica de Madrid, [3]CIEN Foundation, Queen Sofia Foundation Alzheimer Center

Superagers are people aged 80 or older with episodic memory performance as good as people 30 years younger, sustained by increased grey matter density in the by medial temporal lobe (MTL). Novelty and expectation violation engage memory encoding processes, supported by MTL and midbrain structures. These regions also deteriorate during ageing, and may underlie resilience to age-related decline in superagers. We used an fMRI task combining novelty and expectation violation to examine functional neural markers that contribute to the preserved memory of superagers. Our sample included 21 superagers and 20 matched controls from the Vallecas Project cohort. Participants were first familiarised with object images and then performed a rule-learning task, associating a cue with a subsequent object (novel or familiarised). During encoding, participants saw expected (70%) and unexpected (30%) familiarised and novel objects, determined by a match or mismatch between the cue and the subsequent object (e.g. cue for novel preceding a familiar object). After the scan, a recognition test was performed. Superagers had overall better memory performance than controls, and unexpected objects were better recognised than expected ones in both groups. Initial fMRI analyses revealed superagers had increased midbrain activity during encoding of novel objects compared to controls. Furthermore, hippocampal encoding activity was increased in response to unexpected familiar objects in both groups. Future analyses will further explore these interactions and examine connectivity between the regions to inform future models of cognitive ageing trajectories and contribute to our understanding of the functional underpinnings of resistance to age-related cognitive decline.

Topic Area: LONG-TERM MEMORY: Development & aging

B60 - Fetal Exposure to Higher Maternal Inflammation is Associated with Lower Memory Capacities in Late Middle Life

Linda Hoffman[1] (tuf72977@temple.edu), Emma Smith[1], Madeleine Pike[1], Ann Kring[2], Elizabeth Breen[3], Barbara Cohn[4], Piera Cirillo[4], Nickilou Krigbaum[4], Ashby Cogan[2], Bhakti Patwardhan[2], Ingrid Olson[1], Lauren Ellman[1]; [1]Temple University, [2]University of California, Berkeley, [3]University of California-Los Angeles, [4]Child Health and Development Studies

Maternal inflammation during pregnancy has been associated with negative psychiatric and cognitive outcomes for offspring. For instance, higher levels of prenatal inflammation are associated with neurocognitive disorders (e.g., autism spectrum disorder). The current study asks whether prenatal inflammation in the first two trimesters of gestation is associated with consequences for offsprings' cognitive capacities over half a century later. Participants were 128 mother-offspring dyads from the Child Health and Developmental Studies cohort that had maternal first and second trimester (T1, T2) sera data for interleukin (IL)-6, IL-8, IL-1RA, and soluble tumor necrosis factor receptor-II (sTNFRII). In a follow-up assessment during late midlife (ages 59-62), offspring underwent neuropsychological testing assessing global cognition, IQ, memory, motor ability, executive control, and attention. Spearman's correlations were performed between cognition and prenatal cytokines from the first two trimesters. Multivariate analyses were also performed to control for factors surrounding the perinatal environment. There was a positive association between digit span backwards and T1 sTNFRII (rho=.18, p=.048*). Further, significant negative associations were identified between long-delay free recall on the CVLT-II and T2 interleukins-(ILs-) 6 (rho=-.26, p=.006**) and 8 (rho=-.30, p=.001**). After controlling for maternal education and economic burden index in the same model, only the association between IL-8 and memory performance remained significant. Our findings suggest that individuals exposed to high inflammation in the second trimester of pregnancy may have worse hippocampal-dependent memory, measurable more than half-a-century later. However, some inflammation in the first trimester may be protective for executive capacities in later life.

Topic Area: LONG-TERM MEMORY: Development & aging

B61 - Examining the influence of proximal spatial configurations on the neural correlates of item-item associative memory in older adults

Alexa Becker[1] (agb5621@psu.edu), Catherine M. Carpenter[1], Spencer O. Chase, John T. West[1], Amy A. Overman[2], Nancy A. Dennis[1]; [1]The Pennsylvania State University, [2]Xavier University

Associative memory has been shown to decline in aging while memory for single items remains relatively intact. Unitization is a process that has been demonstrated to enhance associative memory by uniting discrete items into a single ensemble. Unitization has been argued to support associative memory in older adults by taking advantage of their intact item memory. However, unitized items and single items have never been directly compared in a neuroimaging paradigm. The current study aimed to compare the neural activation patterns of unrelated image pairs encoded in a unitized manner to both image pairs encoded in a non-unitized manner and single images. Behaviorally, a presentation intended to promote unitization—where image pairs were proximally spaced and oriented logically—enhanced associative memory performance in older adults relative to image pairs that were

distally spaced (not thought to promote unitization). Neurally, pattern similarity analyses (PSA) at encoding showed greater similarity in neural patterns between the proximal and distal pairings compared to the single images and proximal pairings throughout the MTL and cortex. At retrieval, this same result is observed in the cortex; however, the proximal and distal pairings are no more similar than the single images and proximal pairings within the MTL. Additionally, univariate contrasts of proximal and distal image pairs in the MTL show a difference in the magnitude and location of activation from encoding to retrieval. Results suggest that although proximity enhances associative memory in older adults, it does not shift processing completely over to that of single items.

Topic Area: LONG-TERM MEMORY: Development & aging

B62 - Characterizing the relationship between white matter integrity and spatial navigation during early aging.

Daniela Cossio[1] (danielamcossio@gmail.com), Shuying Yu[2], Nick Krohn[1], Rosana Sabur[1], Mary Hegarty[2], Emily G. Jacobs[2], Elizabeth R. Chrastil[1]; [1]Department of Neurobiology & Behavior, University of California, Irvine, [2]Department of Psychological and Brain Sciences, University of California, Santa Barbara

Successful spatial navigation is a complex behavior comprised of various multiple cognitive functions. Due to its complex nature, characterizing the exact structural underpinnings of spatial navigation remains a challenge. Navigation is also an early marker for Alzheimer's disease, so understanding the trajectories of navigation abilities across the lifespan is also critical. To address these questions, midlife adults (ages 45-55) were recruited to undergo diffusion weighted imaging and complete three assessments of spatial navigation abilities: wayfinding, path integration (updating position and orientation without landmarks), and navigation strategy. Overall, our results indicate that white matter structural integrity supports navigational abilities in midlife adults. White matter integrity within tracts involved in limbic and motor pathways support wayfinding abilities. Path integration abilities are supported by white matter tracts which process motor and visuospatial information. Finally, white matter tracts in the limbic pathway were associated with a greater use of a hippocampal-dependent strategy. Further evidence suggests that the white matter regions that support navigation in young adults (18-35) may differ from midlife adults. Additionally, the relationship between white matter integrity and performance differs between men and women. Together our findings suggest that white matter structures may contribute to spatial navigation performance, but this relationship may differ by task, sex, and age. These results provide us with a greater understanding of human spatial navigation across the lifespan and may have implications for improving our understanding of age-related changes in cognition.

Topic Area: LONG-TERM MEMORY: Development & aging

B63 - When less is more: The impact of repetition on pattern separation across development

Bailey Agard[1], Amy Finn[1]; [1]University of Toronto

Though young children typically remember less than their older counterparts, several studies have found that what they do remember is more specific, and sometimes even more accurate than older children and adults (Gualtieri & Finn, 2022). Despite this, young children display poor memory for specifics when discriminating between an old item and a new, similar-looking lure (Rollins et al., 2023). We investigated the possibility that poor specific memory in this context is due to accelerated forgetting rates and the ongoing development of one-shot learning systems during young childhood (Forest et al., 2023). We hypothesized that if so, adding repetition during learning may help younger children to distinguish between previously studied items and perceptually similar lures-- in contrast with adults, whose specific memory can become worse with repetition (Reagh & Yassa, 2014). In the current study, children aged 5-6 (n=32), 9-10 (n=39) and adults (n=96) were shown repeating and non-repeating items during exposure before being asked to make old/new judgements about items that were identical, similar-looking, or completely novel. Additionally, similar items range from being highly to minimally similar to an item shown at exposure. For older children and adults, repetition did not improve their specific memory, and worsened their performance for lures that were highly similar to its paired exposure image. Repetition also worsened younger children's specific memory except for minimally similar lures, suggesting that poor lure discrimination in childhood may not be due to faster forgetting and slower learning, but rather to the latent development of pattern separation.

Topic Area: LONG-TERM MEMORY: Development & aging

B64 - Familiarity Deficits in aMCI: Insights from Event-Related Potentials and Skin Conductance Response

Evi Myftaraj[1,2] (emyftaraj@research.baycrest.org), Hannah Del Gatto[1,2], Nicole Anderson[1,2,3]; [1]Rotman Research Institute, Baycrest, Academy for Research and Education, [2]Department of Psychology, University of Toronto, [3]Department of Psychiatry, University of Toronto

Familiarity, the sense of knowing without the recollection of specific details, is a critical component of memory processing. This cognitive ability is mediated by the perirhinal cortex, a brain region essential for differentiating objects with high feature overlap and one of the first areas affected in amnestic mild cognitive impairment (aMCI). Event-related potential (ERP) and skin conductance response (SCR) studies show more familiarity-based positive responses to old items between 300-500ms post-stimulus onset (N400) and larger SCR amplitudes and longer SCR latencies. In the present study, healthy younger adults, healthy older adults, and older adults with aMCI completed a frequency judgment task for highly similar items, with ERP and SCR measures collected. Preliminary results indicate that individuals with aMCI have the poorest performance in correctly identifying how often an object was presented. Among those with aMCI, reduced performance was associated with smaller N400 amplitudes, as well as smaller SCR amplitudes and shorter latencies. Results suggest that biomarkers of familiarity, as assessed through ERP and SCR measures, may prove useful for early detection of cognitive decline in individuals at risk of dementia. This work could potentially offer new insights into the use of biomarkers of familiarity to monitor cognitive decline and facilitate early intervention.

Topic Area: LONG-TERM MEMORY: Development & aging

B65 - Age dependent dissociation in recollection-related functional activity in the medial temporal lobe, memory performance, and non-mnemonic cognition

Ambereen Kidwai[1] (amber.kidwai@utdallas.edu), Mingzhu Hou[1], Marianne DeChastelaine[1], Michael D. Rugg[1]; [1]University of Texas at Dallas

We contrasted associations between recollection-related functional activity in the entorhinal, perirhinal and parahippocampal cortices with memory performance and offline cognitive performance, in 36 younger (aged 18-29) and 62 cognitively healthy older (aged 63-76) adults. Participants were administered a battery of neuropsychological tests from which 3 cognitive constructs (Memory, Crystalized intelligence and Fluency) were extracted. They also undertook a scanned associative recognition task that allowed estimation of fMRI recollection effects. Using manually-delineated regions of interest (ROIs), we identified robust recollection effects in each MTL region. The effects did not differ between the age groups after controlling for performance on the experimental memory test. Our primary analyses used regression models to identify whether recollection effects in the ROIs were predictive of associative recognition memory or the cognitive construct scores. In the younger adults, MTL recollection effects failed to correlate either with associative recognition performance or the Memory construct. The effects did however demonstrate a robust association with the Fluency construct ($r = .503$, $p < .005$, controlling for age), an association that remained after controlling for performance on the other two constructs and the experimental task. In contrast, MTL recollection effects in the older participants correlated positively with associative recognition performance ($r = .335$, $p < .01$, controlling for age), but no associations were identified with any cognitive construct. The findings for the older age group are consistent with those reported previously. The findings from the younger group are suggestive of a previously unappreciated role for these regions in non-mnemonic cognition.

Topic Area: LONG-TERM MEMORY: Development & aging

B66 - Intracranial neural dynamics of recognition memory in the lateral parietal cortex of the developing brain

Joseph P. Kelly[1] (josephkelly1@northwestern.edu), Adam J. O. Dede[1], Samantha M. Gray[2], Qin Yin[3,4], Parisa Vahidi[3], Eishi Asano[4], Olivia Kim McManus[5], Shifteh Sattar[5], Jack J. Lin[6], Joyce Y. Wu[1,7], Sandi K. Lam[1,7], Jeffrey S. Raskin[1,7], Stephan U. Schuele[1], Joshua M. Rosenow[1], Ammar Shaikhouni[8], Peter Brunner[9], Jarod L. Roland[9,10], Kurtis I. Auguste[11], Robert T. Knight[12], Noa Ofen[3,4], Elizabeth L. Johnson[1]; [1]Northwestern University Feinberg School of Medicine, [2]Stanford University, [3]Wayne State University, [4]University of Texas at Dallas, [5]University of California, San Diego, and UCSD Rady Children's Hospital, [6]University of California, Davis, [7]Ann & Robert H. Lurie Children's Hospital of Chicago, [8]Ohio State University and Nationwide Children's Hospital, [9]Washington University in St. Louis, [10]St. Louis Children's Hospital, [11]University of California, San Francisco, and UCSF Benioff Children's Hospital, [12]University of California, Berkeley

Lateral parietal cortex (LPC) contains functionally heterogeneous sub-regions, including interdigitated task-activated and task-deactivated sites, that support attention and memory. It is unknown how sub-regional neural dynamics support memory encoding and retrieval in children, and whether age-related variability in these dynamics corresponds with age-related variability in memory. Here, we analyzed intracranial EEG (iEEG) data from the supramarginal gyrus (SMG), angular gyrus (AG), and superior parietal cortex (SPC: superior parietal lobule, intraparietal sulcus) of 44 neurosurgical epilepsy patients aged 5-30 years (18 females) who performed an old/new scene recognition task. Trial-by-trial iEEG data from the encoding and retrieval phases of the task were analyzed as a function of retrieval success (remembered trials vs. forgotten trials). All sub-regions contained interdigitated task-activated and task-deactivated channels (% activated/deactivated: SMG=54/31, AG=59/38, SPC=46/43). Successful encoding was associated with decreased high-frequency broadband activity (HFA, 70–150 Hz) in task-activated SPC channels at stimulus onset (<0.2 s), and increased HFA in task-deactivated SMG channels late in the trial (2.6–2.7 s). Successful retrieval was associated with sustained HFA decreases in task-deactivated SPC (0–1.5 s) and AG channels (1.0–1.5 s). Importantly, memory performance improved by age ($r=.31$, $p=.04$), and initial results suggest that memory-related deactivations in AG increase with age ($r=.56$, $p=.07$). Data collection is ongoing. These results identify signatures of memory encoding and retrieval in the developing LPC, highlight the importance of task-deactivated LPC regions, and ground further developmental investigations of low-frequency dynamics, connectivity, and LPC structure as they relate to memory development.

Topic Area: LONG-TERM MEMORY: Development & aging

B67 - Salience Network Connectivity Changes Across the Lifespan Relate to Emotional Memory

Michael DiCalogero[1] (mjd499@drexel.edu), Meghan D. Caulfield[2], Irene P. Kan[3], Evangelia G. Chrysikou[1]; [1]Drexel University, [2]Seton Hall University, [3]Villanova University

Cognitive decline in aging populations often corresponds with changes in the executive-control and default-mode networks, wherein older adults show changing connectivity patterns compared to younger adults. Less studied are the changes in neural connectivity within the salience network as a function of age. Prior research indicates that within-salience network connectivity decreases with age, which may be associated with changes in cognition. This study examined how individual differences in salience network connectivity may be linked to variability in memory performance in different age cohorts. We used existing data from the Cambridge Centre for Ageing and Neuroscience (Cam-CAN) dataset which included 294 participants (18- 87 years old), who completed an emotional memory task and underwent structural and functional MRI. Age cohorts were created for Younger Adults (18-39 years old, n = 78), Middle-Aged Adults (40-64 years old, n = 121), and Older Adults (65-88 years old, n = 95). In the emotional memory task, participants saw a neutral object superimposed on a positive, negative, or neutral background, and were later tested for object recognition and background valence. Functional MRI data were pre-processed using functional connectivity toolbox (CONN) pipelines. Statistical analyses revealed that changes in within-salience network connectivity in each age cohort were associated with emotional memory performance. For Younger Adults and Older Adults, increased connectivity inversely correlated with associative memory for positive valence trials. For Middle-Aged Adults, increased connectivity correlated with better object memory for negative valence trials. We discuss the importance of examining within-salience network connectivity for memory across the lifespan.

Topic Area: LONG-TERM MEMORY: Development & aging

B68 - Do I want to know the answer? Metacognitive control in younger and older adults

Giovanna Marie Crystal Novi[1] (gmnovi25@colby.edu), Veronica McIntyre[1], Avery Lehneis[1], Alexis Lee[2], Jen Coane[1], Sharda Umanath[2]; [1]Colby College, [2]Claremont McKenna College

The importance of metacognitive judgments lies in their potential to alert the individual about the contents of their memory and to inform behavioral decisions (i.e., metacognitive control). Interestingly, issues with metacognitive control have been used to explain some of the memory deficits observed in aging. We explored whether reporting different phenomenological experiences of retrieval failure during a general knowledge test predicts people's choice to check the correct answer and their accuracy in a later memory test of the same questions. More specifically, we explored whether older and younger adults would make different behavioral decisions, and how these decisions would impact memory performance. Preliminary data showed that checking behavior changed as a function of retrieval failure. Because tip-of-the-tongue states (TOT) should naturally resolve, checking the answer when in a TOT may not be adaptive. However, TOTs were the most checked retrieval failure. We are conducting a follow-up study to explore whether curiosity influences checking behavior. Older adults checked more when expecting a recall memory test than a multiple-choice one. In contrast, younger adults did not change their checking behavior to adjust for memory test type. These findings contradict our predictions and will be followed up in a study containing manipulation checks and questions about reasons for checking. Our data also indicated that checking improves accuracy for only certain retrieval failure types, a relationship that varies with memory test type. These findings will be used to make predictions about the appropriate behavioral choices.

Topic Area: LONG-TERM MEMORY: Development & aging

B69 - Reactivation of initial associations predicts reduced proactive interference in memory for updated associations in younger and older adults

Joseph Stephens[1] (stephensj12@xavier.edu), Ashley Bruner[1], Nancy Dennis[2], Amy Overman[1]; [1]Xavier University, [2]Pennsylvania State University

The age-related associative deficit in memory (Naveh-Benjamin, 2000) is partly characterized by older adults' greater susceptibility to proactive interference when existing associations are updated with new information (Wahlheim, 2014). The current study tested the hypothesis that reactivating a previous association during the encoding of an updated association helps to protect against interference at later retrieval of the updated association. Young adults (N = 35) and older adults (N = 34) participated in an fMRI experiment that tested memory for initial and updated associations of low-imageability words paired with pictures of faces, scenes, and objects. Five scanner runs were conducted, in which each of 12 words was encoded with an initial picture associate, followed by cued recall of the initial picture and encoding of a new picture associate from a different category, and cued recall of the new picture. In a post-scanning recognition task, participants selected which of three pictures was the "new" picture for each word that had been studied. Multivariate analyses were used to quantify reactivation of neural representations for the initial pictures during cued recall and encoding of updated word-picture associations. For both age groups, post-test accuracy correlated with reactivation of the initial picture representation during the first recall and second encoding phases in the scanner. Additionally, for young adults, reactivation of the initial picture at the second recall phase correlated with post-test false alarms. The findings support the interpretation that age differences in proactive interference are linked to reductions in the reinstatement of prior information.

Topic Area: LONG-TERM MEMORY: Development & aging

B70 - Age-related changes in neural representations during memory retrieval

Cortney M. Howard[1] (cortney.howard@duke.edu), Shenyang Huang[1], Lifu Deng[2], Roberto Cabeza[1], Simon W. Davis[1]; [1]Duke University, [2]Cleveland Clinic

Recent research indicates that aging reduces the distinctiveness of visual representations in posterior occipitotemporal regions during object encoding, impairing older adults' ability to remember visual details. In contrast, semantic representations in anterior regions are enhanced, potentially compensating for visual declines. However, it remains unclear whether age-related changes in neural representations are present during memory retrieval. In this study, we applied representational similarity analyses (RSA) to assess visual and semantic representational strength in object-processing regions during conceptual and perceptual retrieval using functional magnetic resonance imaging in 33 younger and 31 older adults. Behaviorally, older adults exhibited significantly weaker perceptual memory performance and similar conceptual memory performance relative to younger adults. RSA revealed that older adults demonstrated significantly degraded visual representations during conceptual retrieval in both anterior and posterior regions, including the early visual cortex (EVC), lateral occipital cortex (LOC), fusiform gyrus (Fug), posterior and anterior inferior temporal cortices (pITC and aITC), and inferior parietal cortex (IPL). Similarly, during perceptual retrieval, age-related declines of visual representations were observed in the parahippocampal gyrus (PHG), aITG, pITG, and IPL, and older adults with weaker visual representations in the aITG exhibited stronger semantic representations in the Fug, PHG, and aITG during conceptual retrieval. Critically, semantic representation strength in the aITG positively predicts conceptual and perceptual memory performance in older adults. These findings demonstrate that visual representation degradation in posterior regions extends to anterior regions during memory retrieval and suggest a compensatory role of semantic processing in mitigating visual declines.

Topic Area: LONG-TERM MEMORY: Development & aging

B71 - Early memory retention of novel words predicts better later lexical integration: Evidence from regression-based ERP analyses of single-trial N400

LIN ZHOU[1] (zoe.zhoul@gmail.com), Charles Perfetti[2]; [1]Department of psychology, University of Pittsburgh, [2]Learning research and development center, University of Pittsburgh, [3]Center for the neural basis of cognition, University of Pittsburgh

In word learning research, memory retention of newly learned words and their integration into semantic memory (i.e., lexical integration) are often treated as distinct processes. We present an ERP study that demonstrates a causal relationship between these processes. Native English speakers learned novel written words (e.g., banara, "a dog that eats only fruits and vegetables") over an 8-day period. Memory retention was assessed using a stem completion task on Days 1, 2, 5, and 8, where participants were asked to recall the spelling of a novel word by completing it with the first two letters (e.g., ba). Lexical integration was assessed on Days 2 and 8 using a semantic priming task, with both behavioral responses and ERPs recorded. In this task, a newly learned word (e.g., banara) was preceded by either a semantically related word (e.g., cat) or an unrelated word (e.g., cup). Regression-based ERP analyses were conducted on single-trial data to examine how the N400 response to banara was influenced by the preceding word (related vs. unrelated) and the recall accuracy of banara on earlier test days. Results from 36 participants revealed that the semantic priming effect on the N400 to banara emerged on Day 8, but was observed only for words that were correctly recalled on Day 2, not for those that were recalled incorrectly. These findings demonstrate that better memory of newly learned words on early test days leads to better lexical integration later, reflecting the "rich get richer" phenomenon in word learning.

Topic Area: LONG-TERM MEMORY: Development & aging

B72 - Role of event boundaries and prior knowledge in influencing learning and memory in healthy aging and preclinical Alzheimer's disease

Dr Subbulakshmi S[1], Jennifer Park[1], Lucah Guerra[1], Hillary Vossler[1], Isha Sai[1], Dr Alexandra Trelle[1], Dr Tammy Tran[1], Dr Anamaria Lusardi[1], Dr Edward Wilson[1], Dr Elizabeth Mormino[1], Dr Anthony Wagner; [1]Stanford University

INTRODUCTION: Aging is marked by various structural and functional changes in the brain. These changes tend to have variable consequences for learning and memory. In this study, we propose to characterize cognitive and biological factors that modulate learning and memory in older adults. Young and older adults parse the continuous stream of information encountered in life into meaningful 'events' marked by event 'boundaries'. These event boundaries often represent shifts in the spatial and temporal setting (or context). Given the theorized role of event segmentation in effective learning and remembering, can we use contextually structured event boundaries, embedded in learning materials, to foster new learning in older adults and/or mitigate the effects of preclinical Alzheimer's disease (AD) on the acquisition and retention of new knowledge? We propose to investigate how age, brain connectivity, and AD pathology impact new learning and memory in older adults. Furthermore, to determine routes to fostering performance in older adults, we propose to test (a) whether relevant prior knowledge and (b) simple text-based induction of event boundaries in new learning material can mitigate age- and AD-related deficits, fostering better outcomes. PRELIMINARY RESULTS: On an initial sample of N=15, we find that the presence of event boundaries in the textual learning materials promotes new learning in CU older adults. CONCLUSIONS: Findings from this study will help inform how event segmentation is impacted in aging and disease, and how segmentation ability in turn impacts new learning and memory in older adults.

Topic Area: LONG-TERM MEMORY: Development & aging

B73 - Neural state changes during movie watching relate to episodic memory in younger and older adults

Sarah Henderson[1] (sarah.henderson@austin.utexas.edu), Djamari Oetringer[2], Linda Geerligs[2], Karen Campbell[3]; [1]University of Texas at Austin, [2]Donders Institute for Brain, Cognition and Behaviour, Radboud University, [3]Brock University

Event segmentation is a key feature underlying the ability to remember real-life occurrences. On the neural level, event boundaries have been shown to align with boundaries between neural states – stable patterns of brain activity that are maintained over time and shift at neural state boundaries. These neural states provide a valuable window into the neural underpinnings of event perception during naturalistic viewing (i.e., movie watching). The goal of the current study was to investigate how neural state boundaries relate to memory across the lifespan. We used the data-driven Greedy State Boundary Search (GSBS) method to implicitly identify neural state changes in younger and older adults' continuous electroencephalography (EEG) data during movie-watching. Memory for the movie was tested and related to 1) neural state correspondence across individuals (i.e., intersubject synchrony of state changes) and 2) the degree to which the pattern of activity changes at these boundaries (i.e., the distinctiveness of neural states). Neural state boundaries identified within each participant individually significantly aligned across people, but did not differ with age nor relate to memory. The degree of change at neural state boundaries also did not differ with age, but was positively related to memory for the movie. These findings suggest that age differences in the perception of naturalistic events may be less pronounced than previously thought, at least when measured implicitly, and that greater distinction between successive neural states relates to better subsequent memory for one's experiences regardless of age.

Topic Area: LONG-TERM MEMORY: Development & aging

B74 - Age-Dependent Oscillatory Dynamics Underpinning Theta Sequences in the Developing Hippocampus

Rafael Pedrosa[2] (rhapedrosa@gmail.com), Jake Swann[1], Laurenz Muessig[1], Thomas Wills[1], Francesca Cacucci[2]; [1]Cell and Developmental Biology, University College London, Gower Street, London WC1E 6BT, UK, [2]Neuroscience, Physiology and Pharmacology, University College London, Gower Street, London WC1E 6BT, UK

The hippocampus gradually matures during early postnatal development, supporting the emergence of cognitive functions such as spatial memory emerging from 3 weeks of age onwards. Here, we investigate the emergence of gamma oscillations and their relationship with hippocampal theta sequences in pre, post-weaning and adult rats, during spatial exploration. Using a combination of spiking, local-field potential and current source density (CSD) analysis, we demonstrate that medium gamma oscillations in CA1 increase in power and become more prominent from adolescence to adulthood. Notably, gamma-theta coupling also strengthens during this period. Furthermore, our findings suggest that the emergence of theta sequences—temporally compressed representations of spatial trajectories—may be facilitated by the maturation of medium gamma oscillations. These results shed light on the developmental dynamics of hippocampal network oscillations and their role in supporting memory consolidation and spatial coding.

Topic Area: LONG-TERM MEMORY: Development & aging

B75 - Age-related shifts in hippocampal subregion activation during recall

Nathan Chabin[1,4,5] (natechabaz@gmail.com), Molly Booth[2,4,5], Susan Bookheimer[3,4,5], Jesse Rissman[3,4,5], Dara Ghahremani[4,5]; [1]Pitzer College, [2]Scripps College, [3]UCLA Department of Psychology, [4]UCLA Department of Psychiatry & Biobehavioral Sciences, [5]UCLA Semel Institute for Neuroscience & Human Behavior

Neuroimaging studies have shown subregional differences in hippocampal activation with respect to memory encoding and retrieval. These dissociations may change with age, with potential consequences for memory performance. We examined fMRI activation during encoding and recall during a paired-associates task in 684 participants (age: 36-90 y/o, M=59.9, SD=15.4; 383 female) who participated in the Human Connectome Project Aging study. Encoding- and recall-related activation and recall performance were assessed using the FACENAME fMRI task (Zeineh et al., 2003), which includes face-name encoding blocks alternating with name recall blocks. Recall performance was verified post-scan. Hippocampal subregional segmentations (head, body, tail) were determined using Freesurfer. FMRI data were analyzed using FSL's FEAT. Parameter estimates for encoding and recall blocks were extracted from the 3 subregions from each hemisphere. Linear mixed models were used to determine subregional relationships between memory condition (i.e., encoding or recall) and age, as well as recall performance. We found a memory condition-by-age interaction [p=0.0084] in the left hippocampal body (Bonferroni corrected p-threshold = 0.008). Recall activation in this region reduced with age while encoding activation remained constant. No relationships between recall performance and fMRI activation were found. In conclusion, activation of the left hippocampal body is sensitive to age-related changes during recall. This decline in activation may underlie age-related memory performance deficits captured by other testing procedures.

Topic Area: LONG-TERM MEMORY: Development & aging

B76 - Sleep Variability Related to Reduced Neural Distinctiveness for Episodic Memory Encoding: An fMRI Study Across the Adult Lifespan

Kyoungeun Lee[1] (klee773@utexas.edu), Audrey Duarte[1], Thackery Brown[2]; [1]UT Austin, [2]Georgia Tech

Sleep is a critical lifestyle factor associated with episodic memory. While prior research has largely examined effects of acute sleep deprivation in younger adults, less is known about how habitual sleep quality, including night-to-night variability, impacts episodic memory and supporting neural activity across the adult lifespan. In this study, we investigated how sleep variability relates to the neural differentiation supporting successful episodic memory encoding, and whether this relationship differs with age. Participants aged 18 to 79 were scanned as they encoded emotional and neutral pictures. They performed an old/new recognition task one week later. Habitual sleep was monitored during this interval using actigraphy to quantify the variability of sleep duration. Representational Similarity Analysis (RSA) was applied to the fMRI data to assess neural differentiation between subsequently remembered and forgotten events, serving as a neural index of successful encoding. We hypothesized that greater neural distinctiveness (hits vs. misses) would be associated with better episodic memory performance. In addition, we predicted that greater sleep variability may hinder successful encoding, leading to reduced neural distinctiveness. Consistent with our predictions, we found that more distinctive neural representations (hits vs. misses) were associated with better memory performance, across stimulus valence and age. Furthermore, individuals with greater sleep variability showed reduced memory-specific neural representations, particularly in younger age. This suggests that inconsistent sleep duration may be negatively related to the neural mechanisms supporting episodic memory, especially in early adulthood. These findings highlight the importance of establishing stable sleep habits for cognitive health from early adulthood.

Topic Area: LONG-TERM MEMORY: Development & aging

B77 - Neuron-specific oligomerization of prion-like protein Orb2 required for long-term memory

Weijia LI[1] (wlidh@connect.ust.hk), Yukinori HIRANO[1]; [1]Hong Kong University of Science and Technology

The synapse tag hypothesis predicted the persistent memory substrate at the activated synapses, linking synaptic plasticity to behavioral memory. Orb2, a prion-like RNA-binding protein in Drosophila, is a potential candidate for the synapse tag, required for long-term memory (LTM), which represses translation in a monomeric state and converts to an oligomeric state inducing translation by neural activity. Although Orb2 oligomerization and the local translation could sustain the plastic change of synapses, the dynamic nature of Orb2 in vivo has not been explored. Here, we report that Orb2 oligomerization could occur locally within or near limited neurons in Drosophila. We conducted aversive olfactory memory assays and employed optogenetic techniques to simultaneously activate dopamine and mushroom body (MB) neurons, mimicking learning. Notably, co-expression of CsChrimson in these neurons robustly induced punctate Orb2 localization preferentially within and near one of the MB subpopulations, the MB α/β core neurons. Paradoxically, olfactory aversive LTM was not affected by Orb2-knockdown in MB α/β core neurons but was impaired by that in MB α/β surface and γ main neurons, indicating that Orb2 expressed in MB α/β surface neurons, and potentially MB γ main neurons as well, translocate and form oligomers near MB α/β core neurons, which is significant for memory consolidation. Thus, translocation of the prion-like protein Orb2 may modify the neural circuit's local design through oligomerization to operate for memory consolidation.

Topic Area: LONG-TERM MEMORY: Other

B78 - The Salience / Parietal Memory Network Responds to Salient Transients Even When They Are New Items in an Old-New Recognition Test

Xiangyu Wei[1] (xiangyu_wei@g.harvard.edu), Randy Buckner[1,2,3]; [1]Harvard University, [2]Massachusetts General Hospital, [3]Harvard Medical School

The Salience / Parietal Memory Network (SAL/PMN) is a network that has been explored through two distinct functional perspectives. Studies on the Salience Network (SAL) anchored on dorsal anterior cingulate and anterior insula, focusing on transient responses to salient, relevant stimuli (Seeley, 2019). Research on the Parietal Memory Network (PMN) focused on posterior midline regions and mid-cingulate cortex, noting responses to familiar items in old-new recognition tasks (Gilmore et al., 2015). Within-individual precision neuroimaging demonstrated these regions likely forms a single distributed network, raising questions about the relationship between saliency detection and old-new recognition processes (Du et al., 2024). To explore this, we examined the network across multiple conditions in 6 intensively scanned individuals. The SAL/PMN network was activated in an oddball paradigm (detecting an infrequent red “K”) and by old words in an old-new recognition task, reproducing both effects in the two historical lineages. In a critical oppositional contrast, old-new recognition was tested with old items as rare (10%) targets versus new items as rare targets. The full extent of SAL/PMN was activated during target detection even when those targets were new items, consistent with a response to target saliency not their mnemonic history. These findings suggest SAL/PMN responds to salient, transient events. The finding that the network can show differential responses in old-new recognition paradigms likely reflects that such decisions are asymmetrical, and the old items are treated as the targets by the participant, as the effect can be reversed by changing the relevance of the new items.

Topic Area: LONG-TERM MEMORY: Other

B79 - Memory Task Performance Following Brain Lesions and Stimulation Reveals Potential Neuromodulation Targets

Simon Kwon[1] (skwon4@bwh.harvard.edu), Joshua Siegel[2], Melissa Hebscher[3], Molly Hermiller[4], Eyre Ye[5], Michael Freedburg[6], Joshua Hendrikse[7], Gong-Jun Ji[8], Arielle Tambini[9], Jordan Grafman[10], Maurizio Corbetta[11], Joel Voss[3], Shan Siddiqi[1,12]; [1]Brigham and Women's Hospital, USA, [2]Washington University St Louis, USA, [3]University of Chicago, USA, [4]Florida State University, USA, [5]Beijing Normal University, China, [6]University of Texas, USA, [7]Monash University, Australia, [8]Anhui Medical University, China, [9]Kline Institute for Psychiatric Research, USA, [10]Northwestern University, USA, [11]University of Padua, Italy, [12]Harvard Medical School, USA

Therapeutic brain stimulation is believed to target specific brain circuits, but optimal targets for memory deficit remain debatable. For other symptoms, effective targets have been localized by mapping the connectivity of brain lesions and stimulation sites that modify respective symptoms. Here, we derived a novel neuromodulation target using lesions and stimulation sites that modify memory scores. We included data from a total of 570 individuals across three datasets, including penetrating head trauma (N = 179), ischemic stroke (N = 113) and transcranial magnetic stimulation to individualized hippocampal-cortical network targets (N = 278). Lesion and stimulation locations that selectively modified memory scores were connected to a common normative brain network across all three datasets. The peak region in this network was the temporooccipital part of left inferior temporal gyrus (ITG). Lesion and stimulation site connectivity to the ITG explained individual differences in memory scores across all datasets using a leave-one-dataset-out cross-validation. This novel ITG target may complement existing targets often used for modifying memory scores, such as the hippocampal-cortical network target and medial precuneus. Future clinical trials may systematically assess whether different patients may differentially benefit from these three targets.

Topic Area: LONG-TERM MEMORY: Other

B80 - Neural and Behavioral Rhythmicity for Retrieving Memories from More Than Four Items

Takuya Ideriha[1] (ide3.ko@keio.jp), Junichi Ushiyama[2,3]; [1]Graduate School of Media and Governance, Keio University, Fujisawa, Kanagawa, Japan, [2]Faculty of Environment and Information Studies, Keio University, Fujisawa, Kanagawa, Japan, [3]Department of Rehabilitation Medicine, Keio University School of Medicine, Keio University, Tokyo, Japan

Even under challenging conditions for memory recall, such as when we attempt to learn a large amount of information at the same time, we are still able to retrieve the target items. However, the neural processes that support such difficult memory retrieval are unclear. In this study, we report an intriguing phenomenon in which our nervous system recruits behavioral/neural rhythmicity in the theta-alpha band (4–13 Hz) to retrieve memory when the number of retained items is beyond four. Participants learned and retrieved 2–5 color/letter pairs in the experiments. Analyses of hundreds of reaction times revealed a significant tendency for memory recall to occur at discrete timings corresponding to theta–alpha cycles, but only when the number of memorized items was beyond four. Also, in data from Electroencephalography, we found significantly stronger stimulus/response-locked theta-alpha power when in the 5-pair condition compared with the 3-pair condition, supporting the consistent phase-locking of memory recall to theta-alpha neural rhythmicity. These findings suggest that neural rhythmicity supports memory retrieval under challenging situations when the number of retained items is beyond four, which is known as the "magical number," corresponding to the limit of our cognitive capacity.

Topic Area: LONG-TERM MEMORY: Other

B81 - The Impact of Targeted Memory Reactivation on Counter-attitudinal Learning

Danni Chen[1] (dnchen@connect.hku.hk), Tao Xia[1], Xiaoqing Hu[1]; [1]The University of Hong Kong

Sleep and targeted memory reactivation (TMR) consolidate various kinds of memories, influencing daytime behaviors. However, the effects of sleep and TMR on processing conflicting evaluative information and decisions remain unclear. We examined how reactivating counter-attitudinal learning during non-rapid eye movement (NREM) sleep affects evaluative decision-making. We recruited 58 college students with regular sleep patterns. Participants completed an evaluative learning task (A-B) on Day 1 evening, followed by counter-attitudinal learning (A-C) on Day 2 evening. Evaluative and counter-attitudinal learning involved pairing pharmaceutical products (A) and two distinct health outcomes of opposite valences (B vs. C): Half of the products were linked to negative outcomes on Day 1 and positive outcomes on Day 2 (negative-positive [N2P]), while the remaining products had the reverse valence order (positive-negative [P2N]). During the Day 2 nocturnal NREM sleep, TMR was employed to reactivate half of the pairs. Upon awakening, participants' evaluations were assessed using an evaluative classification task with mouse-tracking to measure attitudinal ambivalence by trajectory curvature. An item-level Bayesian Linear Mixed Model (BLMM) showed that TMR reduced post-sleep AUC in the N2P valence order. Higher cue-elicited delta power was associated with larger AUC reduction for N2P but less so for P2N. Furthermore, we measured memory integration among the A-B-C stimuli. TMR promoted memory integration in the N2P condition, wherein participants corrected recognized A-B, A-C, and B-C pairings.

Cue-elicited spindle probability was linked with A-B-C memory integration. These findings highlight TMR's potential to facilitate adaptive decision-making and memory integration, with effects varying across different valence orders.

Topic Area: LONG-TERM MEMORY: Other

B82 - Acculturation is associated with variation in ERP correlates of self-related memory strategies

Ashley Gilliam[1] (ashleygilliam@brandeis.edu), Angela Gutchess[1], Qihao Xie[1], Apoorva Uppal[1], Zhiyang Sui[1]; [1]Brandeis University

Acculturation, or cultural change in individuals through continuous contact between distinct cultural groups, is an important construct to study for understanding the mechanisms behind effects of cultural background, values, and environment on one's thoughts and behaviors. This project focuses on examining the impact of acculturation on cognitive strategy usage, demonstrating that change in acculturation is associated with change in self- and other-referencing strategies in memory among Chinese international students. Questionnaires and the memory task were administered at two time points (~7 months apart) with EEG measured during encoding at time one. The current study replicates behavioral memory effects associated with acculturation. Importantly, it also extends research by examining the relationship between acculturation and ERP components (P300, LFP, LPP) that represent processes associated with cultural memory patterns. In a sample of 56 Chinese students studying in the United States, we found that greater acculturation to the US was associated with a larger behavioral self-reference effect, contrasted by a smaller neural self-reference effect (LFP & LPP). Additionally, greater acculturation was also associated with both a smaller behavioral close other-reference effect and a smaller neural close other-reference effect (LFP & LPP). However, results provide mixed support for the predominantly proposed mechanism of depth of processing, or level of self-relevance, and instead, we posit the potential for level of effortful processing as a mechanism for culture's influence on self-related memory strategies. Future research should further explore these associations, including measuring change in EEG/ERP measures longitudinally over the course of the acculturation process.

Topic Area: LONG-TERM MEMORY: Other

B83 - Impact of Early Visual Deprivation on Grid-Like Coding during Conceptual Navigation

Roberto Bottini Università di Trento[1] (bottini.r@gmail.com), Federica Sigismondi[1]; [1]University of Trento

In humans, grid-like activity in the entorhinal cortex (EC) has been associated with the encoding of both spatial and abstract knowledge. Recently, it has been observed that the typical 6-fold symmetry associated with grid-like coding in EC was altered in early blind (EB) individuals during spatial navigation. Whether the same alteration can also be observed during conceptual navigation is still unclear. Twenty-three EB and twenty-four sighted controls (SC) were asked to navigate a sound space defined by pitch and duration. Participants performed a sound-analogy task in which they determined whether the changes in pitch and duration were identical across different sound pairs. Data were analysed using quadrature filter technique on the periodicity of interest (60˚ periodicity), to examine the presence of grid-like coding, and on control models with different rotational periodicities. Adaptation analysis was conducted to investigate the encoding of Euclidean distances between sounds across groups. We detected a significant 6-fold symmetry in the EC of SC during the navigation of the sound space but not in the EC of EB individuals, with a significant difference between the two groups. No other significant activations were detected by any of the control models tested, either in SC or EB. Interestingly, both SC and EB recruit the same fronto-parietal network to compute Euclidean distances in sound space, suggesting similar computations across groups, and limiting the differences to the entorhinal grid system. These results suggest that early visual deprivation influences the emergence of grid-like coding in humans' EC during conceptual navigation.

Topic Area: LONG-TERM MEMORY: Other

B84 - Earworms, memory consolidation, and neural replay for recently heard music

Benjamin M. Kubit[1] (b.kubit@northeastern.edu), Elizabeth H. Margulis[2], Kenneth Norman[2], Petr Janata[3]; [1]Northeastern University, [2]Princeton University, [3]University of California, Davis

Involuntary musical imagery (INMI) is a spontaneous, yet common experience, often referred to as an "earworm" or having a song "stuck in your head." Previous work demonstrated a functional role of INMI in music memory consolidation. However, the neural basis of the spontaneous mental replay of music remains unspecified, as well as whether patterns for recently heard music are replayed in the human brain. Here, we combine models of music perception, multivariate functional magnetic resonance imagining, and machine learning to (1) examine patterns of music-evoked brain activity during perception and imagery, (2) identify epochs of music memory replay during rest, and (3) relate such replay to measures of memory consolidation and self-reported INMI experienced in the scanner. We found reliable patterns of music-evoked activity distributed across sensorimotor, subcortical, and cerebellar brain regions in two sessions for all 36 participants. The same patterns were replayed during rest blocks after music exposure while subjects were not listening to music. While all neural replay did not manifest as INMI, increased replay in the scanner led to an increase in the probability of experiencing INMI later outside of the scanner. Overall, persistent neural replay during both sessions improved music memory across the 2-day delay period, but only for poorly encoded music. Capturing brain activity during INMI provides evidence for the neural underpinnings of a very common form of spontaneous thought in humans and also for the adaptive role of such spontaneous thought as a form of consolidation that can modify long-term memory.

Topic Area: LONG-TERM MEMORY: Other

B85 - Investigating implicitly formed mental representations of abstract knowledge

Irina Barnaveli[1] (barnaveli@cbs.mpg.de), Simone Viganò[1], Patrick Haggard[2], Christian F. Doeller[1,3,4,5]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]Institute of Cognitive Neuroscience, University College London, UK, [3]Kavli Institute for Systems Neuroscience, NTNU, Trondheim, Norway, [4]Wilhelm Wundt Institute of Psychology, Leipzig, Germany, [5]Department of Psychology, Technische Universität Dresden, Dresden, Germany

Understanding how humans relate abstract information is a key challenge in neuroscience. One influential framework suggests that humans create low-dimensional map-like Euclidean models for comparing and selecting among multiple items. It is unclear whether these representations emerge naturally, or result from biases in experimental designs that typically teach participants to associate items with experimentally relevant arbitrary dimensions. In contrast, in natural environments, most items consist of multi-modal associations, requiring a circumstantial learning and updating. Humans may instead systematically tend to categorize these associations into non-dimensional, hierarchically organized clusters, potentially facilitating the search for relevant knowledge. To explore this, we developed a novel paradigm where participants are taught the categorical and dimensional features of different monster stimuli. After training, participants perform similarity judgments across triplets of monsters. Next, participants complete two tasks that modulate the relevance of either categorical or dimensional features, again combined with triplet similarity judgments. With this paradigm, we aim to identify how humans prioritize dimensional vs. non-dimensional mental representations by exploring how participants implicitly structure abstract knowledge and adapt this structure based on task demands. We will apply representational similarity analysis to behavioral and eye-tracking data to investigate how the monster stimuli are implicitly organized. We expect participants to form either (i) dimensional representations, (ii) categorical hierarchical clusters, or (iii) a weighted combination of the two. To understand the fine-grained details of these representations, we will further reconstruct them from triplet similarity scores using multidimensional scaling and stochastic triplet embedding algorithms.

Topic Area: LONG-TERM MEMORY: Other

B86 - Uncovering the neural basis for two path integration homing tasks: Triangle Completion and Loop Closure

Alina S. Tu[1] (alinat2@uci.edu), Michael J. Starrett Ambrose[1], Marie Karpinska[2], Mary Hegarty[2], Elizabeth R. Chrastil[1]; [1]University of California, Irvine, [2]University of California, Santa Barbara

Path integration, the ability to continuously update one's position and orientation in space using self-motion cues, is fundamental to navigation. This ability is assessed through homing tasks like Triangle Completion and Loop Closure. In Triangle Completion, participants estimate the direction and distance back to the starting point after walking two legs of a triangle. Loop Closure involves participants identifying when they have returned to the starting point while walking in a circle. Surprisingly, preliminary findings from 194 participants revealed weak correlations between these tasks. Moreover, self-reported strategies showed task-specific differences: in Loop Closure, continuously updating the trajectory to the start location—a homing-vector strategy—was more effective, whereas in Triangle Completion, summing path segments to locate the start—a configural strategy—yielded better results. To explore these differences, we examined the neural basis of path integration, focusing on the entorhinal cortex (EC), which contains grid cells that fire to create a metric grid for environmental mapping. 69 participants completed both homing tasks in walking, immersive virtual reality before completing another path integration task while undergoing fMRI scanning to measure grid-cell-like representations in EC. Given the configural-strategy advantage in Loop, we hypothesized grid-cell-like signals would correlate more with Loop performance than Triangle, supporting the use of metric information for configural strategies. Alternatively, if EC activity supports configural strategies regardless of homing accuracy, it may correlate more with Triangle, where configural strategies were more common. By examining the neural contributions to these path integration tasks, this study advances our understanding of the cognitive processes supporting navigation.

Topic Area: LONG-TERM MEMORY: Other

B87 - Exploring the Neural Underpinnings of Eye-Blink Conditioning: Cerebellar, Hippocampal, and LC Contributions

Kaitlin McOwen[1] (kaiti.mcowen@tamu.edu), Jessica Bernard[1]; [1]Texas A&M University

Delay eye-blink conditioning is characterized by a co-termination of an unconditioned stimulus (tone) and conditioned stimulus (airpuff to the eye). By contrast, trace conditioning includes a brief interval between the termination of the unconditioned stimulus and onset of the conditioned stimulus. Successful trace conditioning requires the recruitment of the hippocampus in addition to the cerebellar involvement necessary in delay conditioning. Across forms of learning, attention and arousal are critical. Measures of pupil dilation contribute an indirect measure of norepinephrine release and in turn, locus coeruleus (LC) function. This additional measure contributes key insights regarding LC functioning and arousal in the study of classical conditioning. Here, we investigated pupil dilation during classical eyeblink conditioning in an initial pool of 78 young adults; 39 in the delay condition and 39 in the trace condition. We examined differences in pupil dilation between delay and trace forms of conditioning to explore LC contributions in

cerebellar and hippocampal reliant forms of conditioning. Additionally, we examined the interaction between sex and condition on pupil dilation to examine the role of arousal in conditioning differences between sexes.

Topic Area: LONG-TERM MEMORY: Other

B88 - Examining mechanism of memory modulation by paced breathing: Arousal or divided attention?

Brandon H. Edwards[1,2], Isabelle Dugle[1], Lilia Reihs[1], Katherine R. Mickley Steinmetz[1]; [1]Wofford College, Spartanburg, SC, [2]University of North Carolina Greensboro

Increased arousal is consistently found to be associated with increased memory. However, it is unclear whether relaxation techniques alter memory through decreased arousal or through divided attention. This study used paced breathing to manipulate arousal and compare the attention and arousal hypotheses of memory modulation. Changes in attention and memory were measured as proxies for arousal in the central nervous system, while skin conductance level (SCL) and heart rate variability (HRV) were measured as proxies for arousal in the peripheral nervous system. A sample of 170 young adults viewed a block of emotional pictures and then viewed a block of neutral pictures while breathing at a slow-pace (E-N SPB), normal pace (E-N Normal), or fast-pace (E-N FPB). Control participants viewed two sets of neutral pictures while breathing at a normal pace (N-N Normal). Participants returned four hours later for a surprise recognition memory test. Participants in both the E-N SPB and E-N FPB conditions demonstrated elevated SCL and better memory performance during Block 1 than during Block 2. However, when attentional load was controlled for, this difference was eliminated. This indicates that the attentional cost of changing breathing pace – not the change in arousal – led to decreases in memory. HRV differed by breathing pace such that it increased for slow-paced breathing and decreased for fast-paced breathing. These results support the attention hypothesis of memory modulation, suggesting that despite evoking changes in arousal, the change in breathing pace during encoding divided attention and subsequently impaired memory.

Topic Area: LONG-TERM MEMORY: Other

B89 - Abstract relational distance coding in the human brain

Michael Starrett Ambrose[1] (mjstarrett@gmail.com), You Cheng[1], Rie Davis[2], Craig Stark[1], Elizabeth Chrastil[1]; [1]University of California, Irvine, [2]University of California, Santa Barbara

The ability to perceive distances within environments is essential for navigation. However, “distance” can extend beyond spatial relationships. Research on non-spatial relational processing suggests substantial overlap with spatial processing networks (i.e., domain general), with some important distinctions (domain specific function), but the degree of overlap remains poorly understood. Moreover, no study has explicitly incorporated manipulations of a core feature of spatial representations: the distinction between self-referential (egocentric) and observer-independent (allocentric) reference frames. Here, we developed a task that directly compares distance ratings across three domains (spatial, temporal, and social) and two frames (egocentric and allocentric). Participants were cued to a domain, viewed side-by-side images of either two historical figures (allocentric) or a historical figure and the participant themself (egocentric), and rated the distance for the cued domain. Participants (N=37) completed eight fMRI runs (30 trials/run) and provided confidence ratings outside the scanner. Univariate activity revealed substantial overlap across domains and activity in the anterior hippocampus across all conditions in the relational distance task. Activity in medial prefrontal cortex, posteromedial cortex, posterior parietal cortex, and anterior hippocampus showed sensitivity to whether judgements were allocentric or egocentric. Moreover, univariate activity scaled with domain-general distance primarily along the left middle temporal gyrus and occipital fusiform gyri. These results suggest that similar brain regions support relational processing for a variety of spatial and non-spatial domains. Moreover, egocentric and allocentric reference frames appear to rely on distinct neural codes to represent these domain-general relational distances.

Topic Area: LONG-TERM MEMORY: Other

B90 - What role does depth of processing play in the picture superiority effect?

Anne T Gilman[1] (anne.gilman@gmail.com), Abigail Noyce[2]; [1]University at Albany, [2]Carnegie Mellon University

Pictures are remembered more successfully than written words (Shepard, 1967; Standing, 1973), unless retrieval demands are extensively manipulated to prioritize graphemes (see Weldon and colleagues, 1987, 1989, 1992). Ally & Budson (2007) documented the time course of the picture superiority effect using electroencephalography (EEG) and distinguished contributions of study-test congruency from this pictorial advantage. In a surprising finding from replication work in progress, some photos were recalled less successfully than written words (Gilman, Norbert, & Noyce, 2024). The specific photos had been well remembered as image stimuli (Brady, Konkle, Alvarez, & Oliva, 2008) but had not all been previously used in picture naming studies. Behavioral results with naming-tested photographs (Souza, Garrido, Saraiva, et al., 2021) did show a picture superiority effect (Gilman, Norbert, & Noyce, 2024). This juxtaposition suggests that the picture superiority effect does not solely rest on image memorability as defined by Bainbridge, Dilks, & Oliva (2017). Other EEG studies of differences in processing between words and images have shown image advantages even with monochrome line drawings that lack the perceptual richness of face and scene photographs (Curran & Doyle, 2011; Watson, Azizian, Berry, &

Squires, 2005). The picture superiority effect may differ from image memorability because of the role of conceptual as well as perceptual characteristics. We are currently piloting another behavioral replication of the picture superiority effect while omitting liking ratings typically used to boost depth of processing, and we solicit input on the potential impact of this change on our upcoming EEG replication.

Topic Area: LONG-TERM MEMORY: Other

B91 - Representations formed by procedural and declarative category learning are supported by overlapping sets of cortical areas

Dr. Priya B. Kalra[1] (pkalra7@uwo.ca), J. Paul Minda[1], Laura Batterink[1], Marc Joanisse[1]; [1]University of Western Ontario

In a previous behavioral study (Kalra et al. 2024) we demonstrated that both procedural learning and declarative learning can simultaneously contribute to response selection within a trial. We now ask whether procedural and declarative learning contribute to a shared representation of the stimulus space, or whether there are distinct procedurally-learned and declaratively-learned representations that jointly contribute to response selection. We used the same behavioral paradigm with fMRI data acquisition. Preliminary univariate analysis revealed greater activation in a fronto-parietal network (including inferior frontal gyrus, ventro-medial frontal gyrus, and inferior parietal lobule), as well as striatal areas, when procedural and declarative learning suggested opposite responses than when they suggested the same response. Preliminary representational similarity analysis (RSA) suggested that some areas were sensitive to the representations created by both procedural and declarative learning. Further analysis is expected to shed more light on the research question.

Topic Area: LONG-TERM MEMORY: Other

B92 - General Semantic, Personal Semantic and Episodic Details when Thinking about the Past and the Future in Moderate-to-Severe Traumatic Brain Injury

Natalia Rivera[1] (natalia.b.rivera@vumc.org), Suhaah Nadir[2], Sharice Clough[3], Louis Renoult[4], Melissa C. Duff[1], Annick F.N. Tanguay[1]; [1]Department of Hearing and Speech Sciences, Vanderbilt University Medical Center, Nashville, TN, United States, [2]Vanderbilt University College of Arts & Sciences, Nashville, TN, United States, [3]Multimodal Language Department, Max Planck Institute for Psycholinguistics, Nijmegen, Gelderland, The Netherlands, [4]School of Psychology, University of East Anglia, Norwich, Norfolk, United Kingdom

Relational memory supports the binding of the arbitrary relations between elements of experience to create durable representations of our lives over time, an ability that is compromised following Traumatic Brain Injury (TBI). While much of the work on relational memory in TBI comes from studies on episodic memory, recent work suggests relational memory is also recruited in support of representations of general semantics (i.e., knowledge of the world) and personal semantics (i.e., knowledge of the self). We assessed if the effect of TBI on relational memory extends beyond episodic memory to include aspects of general and personal semantics. Thirty individuals with moderate-severe TBI and 30 non-injured participants (NCs) generated narratives across life chapters (adolescence, pre-injury, post-injury, future) across three conditions: General semantics (GS), personal semantics (PS), and episodic memory (EM). A mixed effects model revealed a significant effect of group, p=.001; TBIs generated fewer details than NCs across all chapters and conditions (GS: TBI [M=24.64 , SE=1.89]; NC [M=37.76 , SE=2.99]; PS: TBI [M=56.91 , SE=4.98]; NC [M=64.62, SE=3.90]; EM: TBI [M=45.78, SE=3.64]; NC [M=68.78, SE=4.18]). The effects of TBI on relational memory extend beyond episodic memory to include aspects of semantic memory for both the past and future. Despite widespread deficits, ad hoc explorative analyses suggest PS memory may be a relative strength in TBI. Future analyses of “self” representations in TBI are warranted. These findings provide additional evidence for the role of relational memory in support of semantic memory and expands the memory deficit profile in TBI.

Topic Area: LONG-TERM MEMORY: Other

B93 - Using COVIS to investigate interactions between memory systems

Mitchell Mcturk[1] (mmcturk@uwo.ca), Priya Kalra[1], J. Paul Minda[1]; [1]Western University

Categorization is a fundamental component of higher cognition, facilitated by the brain's procedural or declarative learning systems. While these systems have been studied independently, the proposed project aims to investigate their interaction using the Competition between Verbal and Implicit Systems (COVIS) model (Ashby et al., 1998), The COVIS model posits that procedural learning, supported by the dorsal striatum, relies on implicit, trial-and-error processes. In contrast, declarative learning, supported by the hippocampus and prefrontal cortex, involves explicit, rule-based reasoning. These systems interact and compete for access to response production during category learning (Ashby & O’Brien, 2005). According to COVIS, the category decision of the system with the greatest value for confidence will be selected, regardless of whether the two systems agree or disagree. However, Kalra et al. (2024) demonstrated that reaction times were slower when the two systems disagreed and faster when they agreed, suggesting that both systems’ category decisions contribute to response production. In that study, confidence in the procedural system varied while confidence in the declarative system was fixed. In the proposed study, healthy adult participants will learn to categorize stimuli based on a declarative shape rule while simultaneously learning procedurally through colour cues, but we will systematically vary confidence in each system as well as agreement between the two systems. We hypothesize that reaction times will be slowest in disagreement trials with high confidence in both systems. These findings will expand our growing understanding of the interaction between procedural and declarative learning systems.

Topic Area: LONG-TERM MEMORY: Other

B94 - The effects of visual mental imagery and word concreteness on recognition memory

Jennifer Spalten[1], Mark Wheeler[1]; [1]Georgia Institute of Technology

The present study investigates the relationship between vividness abilities in mental visual imagery and long-term recognition of abstract versus concrete words. It was hypothesized that (a) vividness abilities for creating mental images differ from vividness abilities for recreating a previously shown image, (b) concrete words are easier to recognize than abstract words as supported by previous findings, and (c) individuals with stronger vividness abilities outperform weaker imagers on concrete word recognition. Two online experiments were performed with a total of 100 participants. The first experiment measured vividness using the Vividness of Visual Imagery Questionnaire (VVIQ) and a modified mental image recreation VVIQ, followed by a 120-trial abstract-to-concrete word encoding task, subsequent old/new recognition tests, and a “mini” list old/new recognition task. The second experiment employed a similar design but focused on mental image vividness ratings during encoding and excluded the “mini” old/new task. Recognition performance was assessed using d-prime scores, and t-tests and linear regression models were used to test the significance of all findings. Results revealed distinct distributions between vividness abilities in creation and recreation of mental images, higher recognition performance on concrete compared to abstract words, and no evidence that vivid imagers outperformed weaker imagers on the word recognition tasks. Contrary to expectations, vividness ability did not appear to influence long-term recognition for either word type. These findings motivate subsequent study on whether incentives or task demands might encourage participants to rely more heavily on mental imagery during retrieval, thereby eliciting this effect.

Topic Area: LONG-TERM MEMORY: Other

B95 - THE VISUAL TESTING EFFECT REQUIRES VISUAL PATTERN COMPLETION

Jennifer Gove[1] (jennifer.gove@colorado.edu), David E. Huber[1], Rosemary A. Cowell[1]; [1]University of Colorado Boulder

Several theories seek to explain the testing effect, in which retention is better enhanced by retrieval practice than by restudy. Some theories propose that the testing effect requires high-level semantic information; other theories are domain general, e.g., the claim that retrieval practice strengthens associations between features of the item (intra-item learning). We ran three behavioral experiments (one replicated under fMRI) to examine the visual testing effect while manipulating the level of semantic information (e.g., everyday, nameable objects versus abstract, less-nameable objects). We exploited visual occlusion to promote intra-item learning by presenting an aperture “porthole” view of a small part of the object, asking participants to recall/imagine the whole object. In Experiment 1, we found a testing effect for both nameable and abstract objects, with a numerically larger effect for abstract. In Experiment 2, we removed the intra-item learning advantage, instead pairing each object with a word and cueing recall via that paired word. Without intra-item learning, we found no testing effect for either stimulus type. In Experiment 3, we replicated Experiment 1, but replaced the abstract objects with Chinese characters, to further reduce semantic content. As in Experiment 1, we found a testing effect for both nameable objects and Chinese characters, and no interaction with stimulus type. A preliminary fMRI version of Experiment 1 replicated the behavioral findings, and BOLD data from visual cortex suggested that retrieval practice/restudy led to better visual recall at final test (i.e., better pattern completion, measured with multi-variate pattern analysis) relative to novel, unlearned items.

Topic Area: LONG-TERM MEMORY: Other

B96 - Functional connectivity in the neural systems underlying cross-education for tool-use

Sayori Takeda[1], Kouji Takano[1], Tomoaki Komatsu[1], Kimihiro Nakamura[1]; [1]Research Institute of the National Rehabilitation Center for Persons with Disabilities

Cross-education (CE) is a neurophysiological phenomenon in which motor skills trained in one hand generalize to the contralateral side via plastic changes in shared motor neural systems responsible for both hands (Ossmy, 2016). Motor learning via CE may provide a promising strategy for regaining tool-use ability with a paralyzed hand in neurocognitive rehabilitation. However, the neural basis of tool-use learning through CE remains unclear in humans. Twenty-eight right-handed participants volunteered for the study. During a 16-minute practice, half of them used their left hand to manipulate a special pair of pliers (“training”), whereas the other half only held the pliers with their left hand (“control”). For each hand, tool-use skill was assessed by measuring the time taken to move 20 small balls with the pliers (movement-time). Functional MRI data were acquired to examine practice-related changes in resting-state functional connectivity (RSFC) between the right primary motor cortex (M1) and bilateral supramarginal gyrus (SMG) and supplementary motor area (SMA). The training group performed the behavioral motor task faster than the control group for both hands. The magnitude of this movement-time reduction was correlated between the left and right hands ($p < 0.05$). Tool-use training increased RSFC between the right M1, right SMG and left SMA (FDR-$p < 0.05$). This increase in RSFC was correlated with movement-time reduction for both hands ($p < 0.05$). These results suggest that interhemispheric memory transfer via the left SMA contributes to the rapid behavioral effects of tool-use learning via CE.

Topic Area: LONG-TERM MEMORY: Skill Learning

B97 - Sleep Architecture and Speech Consolidation across Developmental Language Disorder and Typical Development

Ali Solbi[1], Rahul Gurram Thimmugari[2], Anne Van Zelst[3], F. Sayako Earle[1]; [1]University of Delaware, [2]Georgetown University, [3]Florida Atlantic University

In recent years, there has been a growing interest in how sleep helps with memory consolidation and language, and potential deficits in sleep-mediated consolidation in those with disordered language. This study investigated the relationship between sleep architecture and consolidation of speech across adults with a wide range of language skills, from those with Developmental Language Disorder (DLD) to typically developing (TD) adults. 36 monolingual English speakers aged 18-35 participated. Of these, eight were identified with DLD. Participants completed a non-native speech sound identification training, and were tested before and after a 2.5-hour post-training nap. Sleep EEG was recorded to assess sleep architecture and neural oscillatory activity. After bandpass filtering and artifact removal, EEG data was scored into stages using an automated scoring software. Slow and fast spindles were detected by applying Finite Impulse Response filters (9–12 and 12–15 Hz, respectively), and then calculating the root-mean-square (RMS) of the signal in moving windows of .2 seconds. Spindles were identified when the RMS remained above 1.5 standard deviations for .5-3 seconds. Results indicated no group-level differences in sleep architecture. Surprisingly, a negative correlation was observed between fast spindle density and learning in TD. This negative relationship is contrary to expectations from the broader memory consolidation literature. Furthermore, higher spindle density was associated with functional deficits in language (i.e. DLD). Further research with larger samples and longer sleep is needed to confirm these findings. This work may lead to potential sleep interventions to improve language outcomes in individuals with DLD.

Topic Area: LONG-TERM MEMORY: Skill Learning

B98 - Learning from our mistakes? The role of prediction errors in statistical learning: an eye-tracking study

Flóra Hann[1,2,3] (hannflora@gmail.com), Cintia Anna Nagy[2], Dezső Németh[4,5,6], Orsolya Pesthy[2,7]; [1]Doctoral School of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary, [2]Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary, [3]Institute of Experimental Medicine, HUN-REN Research Centre for Natural Sciences, Budapest, Hungary, [4]Centre de Recherche en Neurosciences de Lyon CRNL U1028 UMR5292, INSERM, CNRS, Université Claude Bernard Lyon 1, Bron, France, [5]Department of Education and Psychology, Faculty of Social Sciences, University of Atlántico Medio, Las Palmas de Gran Canaria, Spain, [6]BML-NAP Research Group, Institute of Psychology, Eötvös Loránd University and Institute of Cognitive Neuroscience and Psychology, HUN-REN Research Centre for Natural Sciences, Budapest, Hungary, [7]Institute of Cognitive Neuroscience and Psychology, HUN-REN Research Centre for Natural Sciences, Budapest, Hungary

The framework of Bayesian inference is often applied to statistical learning. It suggests that learning is driven by mismatches between predictions and outcomes (i.e., prediction errors). These errors induce the updating of representations (priors) about the underlying regularities of the environment. However, our environment is not entirely deterministic, thus, some errors reflect the presence of noise (learning-dependent errors) rather than an inaccurate representation of regularities (not-learning-dependent errors). Therefore, not all errors should be weighted equally. The role of these errors in statistical learning remains unclear, therefore we tested how their different types induce the updating of representations, and how this drives statistical learning. We used the gaze-contingent eye-tracking version of a statistical learning task, where we assessed predictions by registering anticipatory eye-movements. To distinguish between learning-dependent and not-learning-dependent predictive errors, we chose a task with a probabilistic structure. We expected the likelihood of learning-dependent errors to increase as time progressed and participants learned the regularity. We also expected not-learning-dependent errors to induce the updating of representations more than learning-dependent errors, as the former reflect inaccurate representations. Preliminary analyses of anticipatory eye-movements suggest that learning-dependent errors were the most likely compared to other anticipation types during the task. Contrary to expectations, there was no significant difference between error types in inducing updating. Thus, mechanisms behind updating need further investigation. In summary, analyzing the likelihood and updating of different types of prediction errors provides a promising tool to uncover the mechanisms underlying statistical learning.

Topic Area: LONG-TERM MEMORY: Skill Learning

B99 - Sequence-Specific and Task-General Knowledge: Parallel Learning Mechanisms Within an Implicit Perceptual-Motor Skill Learning Task

Antonio P. Santa Cruz[1] (antoniosantacruz2026@u.northwestern.edu), Paul J. Reber[1]; [1]Northwestern University

In perceptual-motor skill learning tasks, practice leads to improved performance. The Serial Interception Sequence Learning (SISL) task is a perceptual-motor memory paradigm that fosters robust implicit learning of a covertly embedded repeating sequence. In this task, participants make precisely timed interception responses to visual cues moving toward a target region. The speed of the cues is individually adjusted based on performance to maintain a consistent accuracy level. If participants make too many mistakes, the cues slow down, and if accuracy is near ceiling, the cues speed up. Sequence-specific learning is measured by a performance advantage (SSPA) reflected by increased accuracy of the trained sequence versus the non-trained sequences. Participants also exhibit learning via the adaptive cue speed (ACS) measure that gradually increases over practice. Participants practiced the SISL task over 12 240-cue blocks separated by self-terminated breaks. At block six, the covertly embedded repeating sequence switched to a novel sequence. As expected, measures of sequence-specific learning reset, reflecting a restart of the learning process. However, the task-general ACS measure continued to improve without disruption, indicating that this form of learning is general to the basic interception task and not tied to the specific sequence. This dissociation between learning measures suggests parallel mechanisms during SISL practice. In prior research, we have shown that sequence-specific measures are rigidly tied to the learning context and do not generalize well to novel conditions. In contrast, the ACS measure reflects an improving ability in the core motor task, effectively generalizing across conditions to novel sequences.

Topic Area: LONG-TERM MEMORY: Skill Learning

B100 - Exploring the Role of Aesthetic Pleasantness on Implicit Learning

Erin Hugee[1] (erinhugee2028@u.northwestern.edu), Paul J. Reber[1]; [1]Northwestern University

Implicit learning supports the broader process of skill learning by the extraction of statistical regularities during repetitive practice. This process is hypothesized to depend on the basal ganglia and dopamine-gated plasticity. Dopamine's role in the experience of reward and learning suggests that increasing subjective pleasantness during skilled practice might accelerate the implicit learning process. Here we tested this idea using a multi-modal version of the Serial Interception Sequence Learning (SISL) task where we manipulated the subjective pleasantness of auditory information paired with learning cues. In the SISL paradigm, participants made precisely timed responses to moving visual cues that covertly follow a 30-item repeating sequence, where the six possible cues were each associated with an auditory cue. Participants were randomly assigned to either high or low aesthetic pleasantness, by using auditory cues that were either harmonious, consonant tones, or grating, discordant tones. All participants showed reliable sequence-specific knowledge at the end of 60 sequence repetitions, indicating robust learning of the covertly embedded 30-item sequence. However, no evidence was observed that the more aesthetically pleasant auditory conditions accelerated the learning rate. The auditory manipulation may not have sufficiently influenced dopaminergic function to affect the implicit learning process, or the reward-related aspects of dopamine may operate independently of skill learning. Alternatively, the aesthetically unpleasant auditory cues may have inadvertently increased attention to the cues and affected learning through mechanisms unrelated to reward. We speculate that implicit skill learning cannot simply be accelerated by making the learning context more aesthetically pleasing or fun.

Topic Area: LONG-TERM MEMORY: Skill Learning

B101 - Immune Biomarkers Associated with Ethanol Consumption in Monkeys and Mice

Anna Rakowski[1] (arakowsk@macalester.edu), Jean Pateman[1], Petar Elenkov[1], Naomi Singer[1], Elizabeth McNeill[2], Allison Weiss[3], Phillip Rivera[1]; [1]Macalester College, [2]Iowa State University, [3]Oregon National Primate Research Center

Drug exposure induces inflammation based on drug type and dosage, impacting the degree of an immune response. Previously published studies suggest that ethanol (EtOH) exposure through self-administration potentially establishes rewarding drug effects and addiction-like behaviors across multiple species, with a spectrum of low to high responding individuals. However, it is unknown what specific components of the immune system are the most influential in EtOH susceptibility. Therefore, this study compares peripheral biomarkers across multiple species (mice and monkeys) examining low and high responders to EtOH self-administration in order to examine the role of immune signaling. As both species exhibit similar addiction-like behaviors, it is hypothesized that similar immune indicators of previous alcohol exposure will be present in an immune signature across species. Mice were subjected to drinking in the dark (DID), a four day paradigm that exposes them to alcohol and provides an opportunity to binge, followed by ethanol conditioned place preference (eCPP), an eight day paradigm that establishes a reward-context association, a proxy to examine reward seeking behavior. Total protein was extracted from mice and monkey blood samples, and the presence of protein in blood serum was confirmed using the automated sandwich ELISA, Ella. Concentrations of specific immune proteins were then compared across species and correlated with their initial addiction-like behaviors. This data has the potential to identify biomarkers that are essential for the process of addiction, filling in the gap of knowledge linking the immune system to reward learning.

Topic Area: LONG-TERM MEMORY: Skill Learning

B102 - Changes in task representation via association is linked to hierarchical task learning

WooTek Lee[1] (woo-tek-lee@uiowa.edu), Eliot Hazeltine[1], JIefeng Jiang[1]; [1]University of Iowa

Humans have the ability to learn complex tasks efficiently and generalize those learned tasks to new contexts adaptively. One possible mechanism underlying this ability is hierarchical task representation, which refers to the ability to use simpler tasks as building blocks for complex task learning. To investigate neural mechanisms enabling hierarchical task learning, we conducted a two-day fMRI experiment. On the first day, participants first learned four simple tasks (A, B, C, D), each requiring focus on a distinct feature of a visual stimulus. After that, participants performed two complex tasks, which can be learned by associating two simple tasks they had learned (AB, CD). On the second day, participants repeated the same simple tasks phase, and performed two types of complex tasks, one already learned (AB, CD) and the other consisting of simple tasks that were not associated on day 1. We predict that, from day 1 to day 2, neural representations of associated simple tasks will be either more similar (reflecting association) or more distinct (reflecting separation to reduce interference during multi-tasking). Our preliminary behavioral analysis supported associations between simple tasks, with faster RTs when switching between associated simple tasks on day 2 than day 1. Furthermore, representation similarity analysis (RSA) using fMRI data showed increased pattern similarity between associated simple tasks on day 2 than day 1 in orbito-frontal cortex, while medial temporal lobe showed the opposite trend. Overall, it suggests that complex task learning can be achieved by changing neural representations of constituent simple tasks.

Topic Area: LONG-TERM MEMORY: Skill Learning

B103 - Assessing Aging and Psychological Effects on Habitual Behavior Using a Novel Outcome Revaluation Task

Corinna Franco[1] (corfran001@g.ucla.edu), Barbara Knowlton[1]; [1]Department of Psychology, University of California, Los Angeles

Aging is frequently accompanied by neurocognitive changes which may impact an individual's quality of life. However, aging effects on the tendency for habitual behavioral control have not been extensively investigated. To assess these relationships, 159 adults across the lifespan (46.1 ± 17.7 years old, range = 19 - 80) completed a novel instrumental outcome revaluation task, where participants made keyboard responses to abstract stimuli to gain digital currency before completing a revaluation test where the outcome of one stimulus was negatively altered while the other retained its value. Habitual responding was measured as the proportion of responses made to revalued stimuli. Participants also provided self-report measures of psychological variables, including obsessive-compulsive behaviors and early life stress exposure. Linear regression analyses showed no effect of age on proportion of habit responses ($p = 0.379$). However, significant positive effects of obsessive-compulsive symptoms ($b = 0.004$, $p = 0.002$) and early life physical abuse ($b = 0.015$, $p = 0.031$) on increased proportion habit responses were observed. In contrast, depressive symptoms were associated with a decrease in habit responses ($b = -0.008$, $p = 0.007$). Additional analyses revealed no significant effect of age on initial learning accuracy ($p = 0.501$) but showed a significant negative effect of age on responding to the unaltered stimulus at test ($b = -0.013$, $p = 0.024$). These results support previous work showing that obsessive-compulsive symptoms and a history of early life stress are associated with increased habitual responding and that habit learning is stable across the lifespan.

Topic Area: LONG-TERM MEMORY: Skill Learning

B105 - Neural oscillations related to discomfort induced by virtual reality

Mayuka Otsuki[1], Yasufumi Nakata[1], Miki Nagai[1], Ryosuke Yamamoto[1], Minori Sakai[1], Atsushi Aoyama[1]; [1]Keio University, Fujisawa, Kanagawa, Japan

Long-term exposure to virtual reality (VR) environments often induces discomfort that leads to cybersickness. Though the discomfort has been reported to be caused by visual-vestibular discrepancy, its neural basis is not fully understood. This study thus examined the neural activity related to VR-induced discomfort, especially focusing on neural oscillations, using electroencephalography (EEG). Eighteen participants took part in a series of EEG experiments while they engaged in VR experiences of walking along a straight path with a head mounted display, where either the vertical vibration noise, rendering scale, or refresh rate of the VR content was changed independently to induce varying levels of discomfort. During the experiments, they were instructed to report real-time discomfort on a scale of four levels. Comparisons of the neural oscillations among the different discomfort levels revealed that the EEG power in the low-frequency band (1–10 Hz) increased with discomfort, while the mid-frequency band (10–20 Hz) decreased with it. Overall, the frequency of vertical vibration noise had a relatively greater impact on discomfort compared to other display factors, although the other factors also contributed to discomfort. These findings suggest that not only visual-vestibular discrepancy but also visual quality can give rise to VR-induced discomfort and that the increase in the low-frequency power and the decrease in the middle-frequency power can be the neural basis of the discomfort.

Topic Area: PERCEPTION & ACTION: Multisensory

B106 - The Impact of Mental Illness Labels and Self-Initiated Accommodation Requests on Promotion Evaluations

Yuka Hirayama[1] (hyu1114aaaaa@gmail.com), Atushi Shimotomai[1]; [1]Senshu University, School of Human Sciences

Introduction: Workplace prejudice limits employment, reintegration, and career advancement for individuals with mental illnesses (Bortel et al., 2024). Mental illness labels activate stereotypes of incompetence and unreliability (Burçak & Karaoğlu, 2022), biasing hiring decisions (Hipes et al., 2016) and performance evaluations. While workplace accommodations improve job performance (Dunstan & MacEachen, 2014), many employees hesitate to request them due to stigma (Elliott & Reuter, 2023; Follmer et al., 2024). However, little is known about how self-initiated accommodation requests shape evaluators' perceptions of promotability. This study examines how mental illness labels and accommodation requests influence promotion decisions and workplace attributions. Method: Twenty-three employed adults (18+ years) completed an online cognitive task using jsPsych. A mixed-design experiment was conducted: health information (addiction, depression, physical disability, or no disclosure) was a within-subjects factor, while self-initiated accommodation request (requested vs. not requested) was a between-subjects factor. Results: Findings revealed that individuals labeled with a disability were rated as less promotable ($p = 0.014$), with addiction eliciting the strongest bias. Self-other similarity ratings varied by condition (p

< 0.001) but were reduced when accommodation was requested (p = 0.084). For depression, actively requesting accommodation significantly influenced self-other similarity judgments (p = 0.021). Discussion: Findings suggest that accommodation requests and mental health labels shape evaluators' perceptions, influencing promotion decisions. Self-initiated requests may affect workplace bias through mechanisms beyond stereotypes. These results highlight the need for policies that mitigate bias and support equitable career advancement.

Topic Area: THINKING: Decision making

B107 - Predicting Adolescent Mental Health and Adversity from Neural Networks of Decision-making

Boluwatife Cole[1], MaryAnn Noonan[1,2], Alan Stein[1], Miriam Klein-Fluggë[1]; [1]University of Oxford, [2]University of York

The anterior cingulate cortex (ACC) is a key node in decision-making, emotion regulation and motivation. Decision-making processes are now known to be altered in sub-clinical mental health states of depression and anxiety. In addition, adverse childhood experiences (ACEs), known to be a key determinant of psychiatric disorders, are associated with structural alterations in the ACC. Given this anatomical overlap, there is a strong argument that the decision-making mechanisms mediated by the ACC may be atypical in adolescents with these mental health disorders, particularly those with ACEs. Utilising resting-state functional MRIs and behavioural data from 334 healthy adolescents in the Lifespan Human Connectome Project Development (HCP-D) database, we have explored the functional connectivity coupling between the ACC and likely cortical and subcortical target regions involved in learning and decision-making behaviour. Further, using a factor analysis and robust linear regressions, we examined the intersection between functional connectivity within these brain networks and dimensions of mental health and childhood adversity. Results suggest that while a number of connections with the ACC are associated with these dimensions, neural connections with the amygdala most strongly and reliably predict negative emotions associated with anxiety and depression. By contrast, connections between the ACC and hippocampus are most strongly predictive of adversity-associated personal loss. Interestingly, gender is a key co-variate in predicting mental health from decision-making networks. These results identify potential regions of vulnerability during adolescence, although future research must determine causality, in order to clarify whether these connections could act as biomarkers of future well-being.

Topic Area: THINKING: Decision making

B108 - Perceptual discrimination of temporal patterns in humans and monkeys

Marisol Espinoza Monroy[1] (marisol.em02@gmail.com), Karla Mercado[1], Victor de Lafuente[1]; [1]Institute of Neurobiology, National Autonomous University of Mexico

The motor system executes and controls complex movement sequences that require tight temporal constraints, such as those observed in dance, speech, and music production. However, less is known about its role in behavioral contexts that do not require immediate movement execution. We propose that internal brain simulations that arise from learning the temporal structure of sensory events might be a mechanism by which the motor system influences the perception of rhythms and other temporal patterns. To explore this, we asked humans (n=15) and trained monkeys (n=2) to discriminate sequences of brief sensory pulses interleaved with either constant or variable inter-pulse intervals. Importantly, subjects were free to determine the stimulus observation time. The behavioral results are consistent with the proposal that humans and monkeys discriminate regular from irregular temporal patterns by accumulating sensory prediction errors over time. Humans seem to follow an accumulation-to-bound strategy in which the sum of prediction errors triggers the choice and response time. Monkeys, however, seem to incorporate a deadline over the total elapsed time to determine their choice. Thus, our behavioral results suggest that humans and monkeys discriminate temporal patterns by implementing different speed-accuracy tradeoff strategies. Finally, while monkeys performed our discrimination task, we recorded neural activity in the supplementary motor area (SMA). We show that the firing rate of this node in the motor system captures temporal features of the trial and the stimulus that can help subjects solve this perceptual discrimination task.

Topic Area: THINKING: Decision making

B109 - Brain-wide neural correlates of post-error slowing

Gergo Gomori[1] (gomorigergo91@gmail.com), Aditya Gilra[2], Robert Schmidt[1]; [1]Ruhr University Bochum, Germany, [2]National Research Institute for Mathematics and Computer Science, Amsterdam, The Netherlands

When performing a sequence of familiar tasks, an unexpected mistake often triggers a more cautious approach in the subsequent movement, a behavior known as post-error slowing. This study investigates the neural mechanisms underlying this phenomenon using data from the International Brain Laboratory. In each experimental session, mice performed trials of a perceptual decision-making task, turning a steering wheel to indicate the location of a visual stimulus. Behavioral data and brain-wide in vivo electrophysiological recordings were collected throughout all sessions. To mitigate confounding effects of varying trial conditions, we first constructed regression models to predict reaction times, which helped isolate trials that exhibited genuine post-error slowing. Subsequently, we trained classifiers on neural activity from diverse brain regions during the decision-making window to distinguish post-error slowing trials from others. This allowed us to rank regions based on their discrimination performance. Our analysis revealed that while a small subset of brain regions consistently encoded post-error slowing, many regions displayed occasional involvement. Notably, post-error slowing was primarily associated with subcortical regions, with cortical areas playing a more limited role. Extending the analysis to the pre-stimulus period, we found that some regions retained a memory of the previous error to influence subsequent decisions, whereas others exhibited distinct activity only during the decision-making process. These findings highlight the distributed and dynamic nature of neural processes underlying post-error slowing, with subcortical regions taking a central role. Ongoing work seeks to further elucidate these dynamics, formalizing how this cognitive process arises from region-specific neural activity and influences decision-making.

Topic Area: THINKING: Decision making

B110 - Examining neuroanatomical correlates of win-stay, lose-shift behaviour

Matt Westerman[1,2] (matt.westerman@manchester.ac.uk), Glyn Hallam[2,3], Alex Kafkas[1], Holly D H Brown[2,4], Chris Retzler[2]; [1]School of Health Sciences, Faculty of Biology, Medicine and Health, University of Manchester, UK, [2]Centre for Cognition and Neuroscience, Department of Psychology, The University of Huddersfield, Huddersfield, UK, [3]School of Education, Language and Psychology, York St John University, York, UK, [4]School of Psychology, University of Leeds, Leeds, UK

When no optimal decision-making strategy exists, randomness is considered the most effective approach; however, individuals often rely on prior outcomes to guide their choices. This study aimed to better understand the neuroanatomical correlates of decision-making strategies, particularly focusing on win-stay and lose-shift behaviours, using voxel-based morphometry (VBM) in a large cohort of healthy adults from the Human Connectome Project. Participants engaged in a forced-choice card-guessing task designed to simulate neural responses to rewards and losses. The frequency of win-stay and lose-shift behaviour was extracted from the task for each participant and entered into the VBM analysis alongside measures of grey matter volume (GMV) and white matter volume (WMV). Our results revealed that increased lose-shift behaviour was associated with reduced GMV in key brain regions, comprising the left superior temporal gyrus, right middle temporal gyrus, and bilateral superior lateral occipital cortices. Interestingly, no significant associations were found between GMV or WMV and win-stay behaviour. These results suggest that specific regions within the temporal and occipital lobes are involved in modulating decision-making strategies following negative outcomes. Further analyses revealed increased lose-shift behaviour was associated with increased WMV in the left superior temporal gyrus. The absence of significant findings in relation to win-stay behaviour and the differential involvement of brain structures in lose-shift responses indicate that decision-making in the face of losses may involve distinct neuroanatomical mechanisms compared to decision-making following wins. This study advances our understanding of the structural brain correlates linked to decision-making strategies and highlights the complexity of brain-behaviour relationships.

Topic Area: THINKING: Decision making

B111 - The Impact of Passive Heat Stress in Virtual Simulations on Decision-Making, Situational Awareness, and Executive Functioning in Military Personnel

Frank Schilder[1] (f.p.m.schilder@umcutrecht.nl), Antoin de Weijer[2], Bastiaan Bruinsma[3], Elbert Geuze[4]; [1]UMC Utrecht, [2]Ministry of Defence

Decision-making in military occupations is vital for operational success and personnel safety and relies on situational awareness and strategic alignment of operational goals. This study examined the effects of acute operational and passive heat stress on cognitive performance in a randomized controlled trial with 68 servicemembers. Participants were assigned to low- or high-stress groups and completed two military scenarios using a simulator. Decision-making and situational awareness were scored from scenario recordings, while executive functioning was assessed through a cognitive test battery. Results revealed no significant changes in decision-making scores within groups over time or between groups overall. However, a significant interaction effect indicated improved decision-making performance in the high-stress group during the second assessment (i.e. prolonged heat exposure) compared to the low-stress group. Situational awareness, working memory, and inhibitory control remained unaffected by stress exposure. Cognitive flexibility showed significant improvements in perseverative and non-perseverative error rates and faster reaction times at follow-up across both groups. These findings suggest that the level of passive heat stress applied in this study has limited effects on cognitive performance in virtual military scenarios. While high-stress conditions seemed to enhance decision-making under specific conditions, other cognitive functions remained stable. The improvements observed in cognitive flexibility likely resulted from repeated exposure to the tasks. Passive heat stress remains a promising area for research, but its effects may only become fully apparent under more intense or physiologically demanding conditions, warranting further investigation into its potential impact on higher-order cognitive functions in military contexts.

Topic Area: THINKING: Decision making

B113 - Abstract contextual representation in the human mediodorsal thalamus

Liu Mengxing[1] (mengxing1844@gmail.com), Norman Lam[1], Michael Halassa[1], Kai Hwang[2]; [1]Tufts University, [2]The University of Iowa

Cognitive flexibility—the ability to adapt to changing environments by shifting between different thoughts and action plans, relies on mental representation of the external world (context representation) and tracking context changes. These processes organize the mapping between perceptual

inputs and their meanings, yet their neural correlates remain unclear. To address this, we collected behavioral and fMRI data from human subjects performing hierarchical decision-making tasks where the context can abruptly change. Subjects had to adjust their behavior following these abrupt context changes based on feedback. Our data revealed that the BOLD signal pattern in the mediodorsal thalamus (MD) could decode the context, a low-dimensional latent variable representing the relationship between the perceptual cue and the task rule. In contrast, the prefrontal cortex (PFC), the cortical counterpart of the MD, decoded not the latent context but concrete task variables such as the perceptual cue and task rule. To further investigate context change, a hallmark of cognitive flexibility, we developed a Bayesian-based computational model to simulate human behavior during context changes, capturing the context prediction error. When this context prediction error was used as a regressor in the analysis of BOLD signals, general linear model (GLM) identified a cluster in the MD with enhanced activity corresponding to high context prediction error. To our knowledge, this is the first dataset to demonstrate that human MD encodes contextual representations and plays a role in switching across latent cue-to-rule mappings. Our results highlight the critical role of the MD in supporting cognitive flexibility in humans.

Topic Area: THINKING: Decision making

B114 - Effects of episodic future thinking and perspective taking on climate change risk perception and action

Heather J. Gittelson[1] (heathergittelson@mail.adelphi.edu), Karolina Lempert[1]; [1]Gordon F. Derner School of Psychology, Adelphi University

Previous studies have found that pre-experiencing future climate events using episodic future thinking (EFT) can increase climate change risk perception and action. Perspective-taking (PT) with real future individuals who would be affected by climate change can also be effective. Here we tested if combining EFT and PT will be more effective than EFT alone in altering self-reported climate change risk perception and action. Climate action was defined as the amount of money participants chose to donate to a climate change charity in a modified dictator game. 259 participants recruited through Prolific were randomly assigned to one of three groups: EFT + PT, which involved reading a vignette about a young friend or relative enduring a devastating future storm; EFT only, where participants read the same vignette but about a generic person; or a control condition, where participants read climate change facts. Climate change risk perception increased overall after reading the vignettes, $F(1,255)= 9.20$, $p < .01$. Surprisingly, this difference was driven by a significant effect in the control group only, $t(98)=-3.46$; $p< .001$. There was no effect of manipulation type on the amount donated to a climate charity, $F(2, 165) = 1.16$, $p = .316$. However, in the EFT+PT group, participants who reported feeling closer to the friend or relative in the vignette donated more money, $r(75)= .309$, $p < .01$. These results suggest that perspective taking with close others may encourage climate action, even if individuals' climate change risk perception is not affected.

Topic Area: THINKING: Decision making

B115 - Differential contributions of dopamine D1- and D2-receptor-expressing neurons in the prelimbic cortex during approach-avoidance conflict in rats

Thays Brenner dos Santos[1], Vicky Chuong[1], Guillermo Aquino-Miranda[1], Fabricio H. Do-Monte[1]; [1]University of Texas Health Science Center at Houston

The prelimbic cortex (PL) is involved in resolving approach-avoidance conflict when reward- and threat-associated cues co-occur. PL neurons that express dopamine type-1 (D1R) or type-2 (D2R) receptors are implicated in motivated behaviors, but their role in approach-avoidance conflict remains unknown. To address this question, we used fiber photometry combined with a dopamine sensor (GRAB-DA) or a Ca^{2+} indicator (GCaMP7f) to record dopamine levels or D1R and D2R neuronal activity in PL. Rats previously trained to press a lever for food during audiovisual cues were exposed to the food cues in the presence of a neutral odor (reward phase) or a fear-inducing cat odor (conflict phase). The following day, food cues were presented with a neutral odor in the same context to evaluate memory-guided decision-making (contextual phase). Rats exhibited increased defensive behaviors and reduced food-seeking responses during the conflict and contextual phases compared to the reward phase. Dopamine levels and PL-D1R activity increased in response to food cues during the reward phase and in rewarded trials of the contextual phase (risk-taking trials) but not during the conflict phase or in non-rewarded trials of the contextual phase (risk-avoiding trials). In contrast, PL-D2R activity decreased in response to food cues during the reward and risk-taking trials but not during the conflict and risk-avoiding trials. Together, our results demonstrate that increased D1R and decreased D2R neuronal activity in response to food cues bias rats' behavior towards food-seeking during conflict, suggesting that PL-D1R and PL-D2R neurons contribute to risky behavior through opposing activity patterns.

Topic Area: THINKING: Decision making

B116 - Investigating Domain-General Neural Mechanisms of Decision Making Across Perception and Memory

Alice Tsvinev[1] (atsvinev@ucsc.edu), Jason Samaha[1]; [1]UC Santa Cruz

Humans frequently make decisions based on either sensory evidence from our external environment, or by accessing information held in memory. Numerous studies have identified an event-related EEG potential called the centro-parietal positivity (CPP) as a neural indicator of abstract sensory evidence accumulation in perceptual decision making tasks. However, little research has explored whether the same CPP component reflects an evidence accumulation process that also generalizes to decisions based on long-term memory retrieval. The present study aims to examine whether the CPP behaves as a neural signal of evidence accumulation across both perceptual and semantic-memory based decisions in order to better understand whether a single-domain general mechanism accumulates evidence for our decisions, regardless of the evidence source. The perceptual task requires participants to discriminate the luminance difference between two strings of alpha-numeric characters across three difficulty levels. The memory task requires participants to discriminate the population difference between two US states, chosen based on census data to come from three difficulty levels. Participants will be asked to respond to the stimuli presented on screen indicating either the brighter letter string or higher state population. Consistent with previous research, this study aims to identify a CPP-like component within the memory task that is responsive to task difficulty level, RT, and accuracy, extending electrophysiological findings in decision making into the domain of memory. The findings from this study will inform the question of whether the computations guiding our decisions are domain-general processes, reflecting similar evidence accumulation patterns across different types of decisions.

Topic Area: THINKING: Decision making

B117 - Hormonal control of the brain state achieving repetitive challenges over risks

Xinyue Hu[1] (xhubi@connect.ust.hk), Yukinori HIRANO[1]; [1]The Hong Kong University of Science and Technology

Animals often face conflicts between potential rewards and risks in their environments. Internal states and motivations for reward play a crucial role in shaping risk-taking behaviors, aligning these actions with physiological needs. Although neuromodulatory systems such as dopamine are known to affect attraction and escape, whether risk-taking behavior is determined by specific neural circuits or by broader macro mechanisms influencing the brain state is still unknown. Here we report a macroscale hormonal mechanism adopting the animals' state towards more risk-taking mode. We conducted a choice task where flies had to choose between staying hungry or exploring with electric shocks. While satiated flies showed little risk-taking, starved flies exhibited significant risk-taking, which was not further increased by the presence of food in a new environment. Furthermore, we identify a critical neuropeptide, ecdysis triggering hormone (ETH), whose suppression leads to an increase in risk-taking behavior, and its downstream juvenile hormone (JH) in corpora allata (CA) can affect the behavior directly. We also aimed to utilize an opto-calcium sensor, a technology combining optogenetics, a calcium sensor, and close-proximity labeling, designed to identify specific neurons involved in decision-making, to further investigate the temporal regulation within the neural network. Our finding reveals that hormone levels can influence risk-taking behavior via the ETH-ETHR-JH pathway, while the opto-calcium sensor effectively detects neural activity both in vitro and in vivo. Therefore, our study proposes an idea that a macroscale mechanism through hormones determines the degree of risk-taking behavior, potentially being linked to the local neural circuit activity change.

Topic Area: THINKING: Decision making

B118 - Entorhinal cortex activation during precise temporal memory retrieval is associated with temporal discounting

Chloe Ott[1], Federica Procida[2], Karolina Lempert[1]; [1]Adelphi University, [2]University "Gabriele d'Annunzio"

Previous studies have shown an association between entorhinal cortex (ERC) structural integrity and reduced temporal discounting (i.e., the tendency to prefer smaller, sooner rewards over larger, later rewards). However, the mechanism by which ERC supports more future-oriented choices is unclear. Given the finding that high temporal precision in memory for time was related to ERC activation in a previous functional magnetic resonance imaging (fMRI) study (Montchal et al. 2019), one possibility is that people who are more precise in recalling time information have lower temporal discounting rates. The current study aims to deduce whether ERC activation while retrieving accurate temporal memories is associated with temporal discounting. During fMRI scanning, participants (n = 24) watched an episode of a show they had never seen before. Later, they were asked to judge the time of occurrence of still-frames extracted from the episode on a timeline representing the movie duration. We ran a parametric modulation analysis to see where activity increased as a function of greater accuracy on the timeline task. Beta estimates for the accuracy regressor were extracted from left and right ERC. These activations were then correlated with participant's discounting rates from a standard temporal discounting task. In preliminary analyses, increased activations in the right ($r = -0.521$; $p = 0.009$), and, to a lesser extent, left ($r = -0.375$; $p = 0.071$) ERC when retrieving accurate time memories were correlated with lower discounting rates. This suggests that people who engage ERC more when retrieving time information make more patient choices.

Topic Area: THINKING: Decision making

B119 - The Confused Body: How Uncertainty Shapes Somatic Markers and Decision-Making

Mianzhi Hu[1] (rudolfhu@tamu.edu), Darrell Worthy[1]; [1]Texas A&M University

The somatic marker hypothesis suggests that decision-making is guided by bodily memories of past experiences, which predict the outcome of selecting a given option by reinvoking the physiological states associated with previous outcomes of the same option, thereby steering people towards advantageous choices and away from disadvantageous ones. However, it falls short of explaining recent evidence showing that normal individuals without neuropsychological deficits nevertheless prefer less rewarding options when these options are paired with greater certainty (e.g., higher reward frequency). We examined whether the direction and strength of somatic markers are modulated by environmental uncertainty, rather than being objectively calibrated by past outcomes. Participants completed a four-option reinforcement learning task under one of three conditions: a baseline condition with low reward variance and equal reward frequency, a frequency condition with low variance but unequal reward frequency, and a variance condition with high reward variance and equal reward frequency. Our findings revealed that when participants were comparing closely valued options, uncertainty—arising from either low reward frequency or high reward variance—nullified, if not reversed, the anticipatory Galvanic skin conductance differences between optimal and suboptimal options. Moreover, we observed that high uncertainty reduced the overall physiological responsiveness of the somatic marker. While high uncertainty typically elicited stronger anticipatory somatic markers, excessive environmental uncertainty weakened the markers' overall strength, resulting in a generally muted bodily state. These findings suggest that somatic markers may function as a bodily indicator of established preferences but are less effective in accurately reflecting past outcomes under high uncertainty.

Topic Area: THINKING: Decision making

B120 - The Impact of Ambiguity and Aging on Decision Making Across Probabilistic, Temporal and Effort Discounting

Galston Wong[1,2] (galston.wong@utdallas.edu), Amelia Bradley[1,2], Alina Ali[1,2], Kendra L. Seaman[1,2]; [1]The University of Texas at Dallas, [2]Center for Vital Longevity

Ambiguity aversion is commonly observed in many behavioral studies on risk, where people are less likely to gamble on imprecise information compared to those with clearly defined risks. However, less empirical work has examined how ambiguity impacts behavioral preferences beyond probabilistic risks, such as temporal and effort discounting. Additionally, less is known about how aging may influence these behavioral preferences under ambiguity. In our ongoing study, we are recruiting 90 adult participants (aged 25 to 85) to perform three different two-choice economic discounting tasks for hypothetical monetary gains: probability, temporal, and cognitive effort discounting. Participants indicate their preferences between a small cost-small gain option and a large cost-large gain option, where the cost is task-dependent (probabilistic, time delay or cognitive effort). Ambiguity is presented in half of the trials by masking the exact costs required to achieve the larger cost-gains; effectively presenting a range of potential costs. Computational modeling will be used to estimate participant's ambiguity attitudes, based on variations of hyperbolic discounting functions. These estimates will be used to address our two main research aims: (A) whether intra-individual ambiguity attitudes are consistently expressed across the three tasks, and (B) whether ambiguity attitudes are impacted by age differences. We predict that ambiguity aversion would be domain-specific to the cost, and that it would increase with age. These findings will hopefully shed light on potential differences in ambiguity aversion across various contexts and age groups, with the intent of motivating future studies to explain why we might observe these potential differences.

Topic Area: THINKING: Decision making

B121 - Investigating the neural basis of representation-mediated learning in humans

Xiaolin Qiao[1] (xiaolinqiao@brandeis.edu), Lauren A. Wolters[1], Liam P. McMahon[1], Jared G. Newell[1], James D. Howard[1]; [1]Brandeis University

The representation-mediated learning (RML) task has been used in rodents to demonstrate that mental representation of chemosensory stimuli can form associations with aversive stimuli, even if the chemosensory stimulus is not physically present. This behavioral effect is amplified in animal models of the positive symptoms of schizophrenia, suggesting that RML holds promise for identifying neural biomarkers of psychosis. We recently developed a human behavioral version of the RML task by showing that expected, but not delivered, odors can form associations with an aversive sound. In the current study, we aim to address the underlying brain mechanism by conducting an adapted RML task while participants undergo fMRI. Participants first learn associations between visual symbols and two distinct appetitive food odors. We then acquire pleasantness ratings for symbols and odors before and after one of the symbols is paired with an aversive sound. Preliminary results (n = 9) showed a selective decrease in pleasantness for the odor previously paired with the aversively conditioned symbol, similar to our previous study. Multivoxel pattern analysis of fMRI data indicate that mental representations of expected odors are embedded in distributed patterns of orbitofrontal cortex activity. Further planned analyses will test whether these mental representations are reactivated by the visual symbols during the aversive conditioning, and whether this predicts the propensity for odors to enter into association with the sound. Such findings may reveal novel targets for noninvasive stimulation-based treatments of psychotic symptoms.

Topic Area: THINKING: Decision making

B122 - Differences in Moral Decision-Making between Military Personnel and Civilians

Lukas van Herk[1,2] (l.vanherk@umcutrecht.nl), Frank Schilder[1,2], Antoin de Weijer[1,2], Elbert Geuze[1,2], Bastiaan Bruinsma[1,2]; [1]Brain Research and Innovation Centre, Ministry of Defence, Utrecht, The Netherlands, [2]Department of Psychiatry, University Medical Centre, Utrecht, The Netherlands

Throughout life we are faced with decisions of varying degrees of complexity, some involving moral dilemmas that may cause harm to others. When looking at high-risk professions (e.g. armed forces) in particular, decision outcomes could have great moral repercussions, as lives are at stake. Knowing how high-risk professions, such as military personnel, decide in a moral conflict what the right course of action is, might give insight in how harm could be prevented. Furthermore, it is currently unknown if military personnel might respond differently to a moral conflict compared to civilians. We investigated both military personnel (n = 256) and civilians (n = 196) in twenty-one fictional war scenarios in which participants had to decide how to end a war. Choices could be deontological, utilitarian or a compromise, characterized by how many civilian and soldier lives were sacrificed, respectively. Non-parametric tests revealed no significant differences between military personnel and civilians in the amount of utilitarian ($p = .104$) and deontological ($p = .126$) responses. However, a significant difference was found in compromise responses ($p = .025$), in which military personnel (6.52 ± 6.10 SD) seems less likely to choose a compromise response compared to civilians (7.69 ± 6.10 SD). These results suggest that military members, either from a utilitarian or deontological viewpoint, are more absolute, while civilians seem more inclined to compromise. Cognitive flexibility, empathy, stress levels, demographics, sleep quality and psychological symptoms as possible predictors of decision-making will be discussed.

Topic Area: THINKING: Decision making

B123 - Why Do Women Overinvest in a Male-Dominated World?

Lexin Liang[1] (ll5234@nyu.edu), Paul Glimcher[2]; [1]New York University

Despite significant female education advances, we continue to see substantial gender disparities in income and labor market outcomes. Women are more likely to undertake low-promotability tasks—roles that benefit the group but offer little personal career advancement. This study uses a group-based investment game to examine when and why women prioritize group welfare over personal gains. In the game, participants are placed in groups of five and face an investment decision that only one member can undertake. Critically, investing increases the group's overall earnings but leaves the investor at a relative disadvantage compared to non-investors, which mimics the payoff structure of real-life low-promotability tasks. We also systematically varied the investor's payoff and the gender composition of the group. Our findings (N=153) revealed that women overinvested and underearned significantly only when they were the only female in a 5-player group. These results indicate that women's overinvestment is shaped by gender dynamics of the group rather than fixed individual traits. Comparing empirical data to game theory models revealed distinct decision-making strategies: men's behaviors followed mixed-strategy Nash Equilibrium, while women's behaviors aligned more closely with predictions from pure-strategy models. Our findings highlight the importance of including more females in decision-making settings to reduce the undue burdens placed on women and promote more equitable task distributions.

Topic Area: THINKING: Decision making

B125 - Don't Risk It!: The Role ACEs and Depression have on Risky Behavior Choices

Emma Chacon[1] (emma.chacon@bruins.belmont.edu), Emily Stripling, Liam Fienberg, Kristie Stephens, Aram Akbari, Karlie Souder, Dara Olopade, Smyth Harper, Michael Oliver, PhD; [1]Belmont University

Adverse Childhood Experiences (ACEs) are traumatic events that happen before the age of 18 (World Health Organization). ACEs have been linked to a higher chance of experiencing depression (Campbell et al., 2016). Moreover, depression and ACEs can strongly affect decision-making, especially when it comes to taking risks. For example, individuals with ACEs or depression tend to take more risks compared to those without ACEs or depression (Follet et al., 2023). Although previous research on ACEs and depression have independently been associated with risk-taking, little investigation has been done to understand how they work together to influence risky decision-making. In the present study, 36 participants completed the Balloon Analog Risk Task (BART), a computerized task designed to assess risk-taking behavior (Lejuez et al., 2002). Administered on E-Prime, participants were asked to pump up a virtual balloon to earn points but lost everything if the balloon popped. Performance on the BART has been shown to correlate well with real-world risk behavior. In addition to the BART, participants completed the Beck Depression Inventory and an ACEs questionnaire. Consistent with previous literature, results revealed that men were greater risk-takers than women. However, there was no association between ACEs, depression, and risk-taking overall. Interestingly, women with ACEs took more risks than men. It is possible that the experience of ACEs resonated with women and resulted in altered behavior compared to men. Findings underscore the importance of tailored interventions for those with ACEs, as women may be more susceptible to risk-taking behaviors as a coping mechanism.

Topic Area: THINKING: Decision making

B126 - The Effects of Positive Feedback and Self-Efficacy on Electrophysiology and Behavior

Karlie Souder[1], Kristie Stephens, Aram Akbari, Emily Stripling, Dara Olopade, Emma Chacon, Liam Feinberg, Smyth Harper, Michael Oliver, PhD; [1]Belmont University

Receiving feedback while executing a task may impact performance. However, there are different types of feedback such as positive or negative and ability or effort-based, that may differentially affect performance as well. Moreover, the relationship between feedback and performance may be impacted by one's belief in their ability to perform a task well, or self-efficacy. The current study examines whether different types of positive feedback, namely ability-based and effort-based, impacts cortical processing speed (latency) and behavioral performance (accuracy) when executing a task while brain activity was measured simultaneously via electroencephalography (EEG). Further, we examined if self-efficacy affected this relationship.

Participants were divided into three groups: no feedback, ability feedback, or effort feedback before completing the Stop-Signal Task, which was used to measure impulse control. Feedback statements were presented as computerized feedback during the Stop-Signal Task. Upon completion, participants completed the General Self-Efficacy Scale. Results revealed quicker behavioral response times in those receiving no feedback compared to those receiving positive feedback ($p=0.015$), but no significant difference between feedback types or processing speed, suggesting that receiving feedback may slow responses as individuals process the feedback, whereas those without feedback may focus on task completion. Further, higher self-efficacy correlated with faster processing speed ($r=-0.433$, $p=0.034$) suggesting increased confidence in decision–making abilities and reduced cognitive load in those with high self-efficacy. Findings suggest that although feedback may be beneficial post-task, it may impede tasks at hand. Those with higher beliefs in their abilities may be less impacted by feedback due to intrinsic motivators.

Topic Area: THINKING: Decision making

B127 - Dopamine tone influences strategic learning in humans: a pharmacological PET study

Jacinda Taggett[1] (jacinda.taggett@gmail.com), Nienhsuan Su[1,2], Julia Bertolero[1,2], Joshua Warren[4], William Jagust[1], Andrew Kayser[1,2,3], Ming Hsu[1]; [1]UC Berkeley, [2]UC San Francisco, [3]San Francisco VA Health Care System, [4]Yale University

Competitive social interactions are critical in determining access to resources and status. Previous work has demonstrated that competitive decisions require agents to behave strategically, learning not only about the reward structure of their environment but also about the actions of others competing for those same rewards. While these studies have begun to reveal the behavioral and neural correlates of this form of social learning, its neurochemical bases, especially those related to dopaminergic functioning, have largely relied on indirect inferences. Here, we used a strategic learning framework that incorporates participants' beliefs about others' actions in order to model performance in a competitive social game, the patent race. Subjects performed the task twice in counterbalanced fashion, after receiving either the catechol-O-methyltransferase (COMT) inhibitor tolcapone, which enhances cortical dopamine tone, or placebo. In addition, we used 11-C raclopride PET to obtain measures of D2/3 receptor availability and dopamine release. We hypothesized that parameters sensitive to reward history and beliefs in competitive social learning would be similarly influenced by dopaminergic tone. Utilizing the experience-weighted attraction model to parameterize learning, we find that participants more strongly weigh recent outcomes on tolcapone versus placebo, and that this effect is enhanced in the context of greater baseline dopamine release. However, we see no main effects of baseline D2/3 receptor availability on the parameters for strategic learning. Together these results support models in which dopamine tone supports strategic social learning, and they suggest the importance of ongoing work to directly evaluate neuromodulatory influences on social function.

Topic Area: THINKING: Decision making

B128 - Brain Healthy: Empowering High School Students through Brain Health and Wellness Investigations

Cate Schultz[1] (schultcg@bc.edu), Ido Davidesco[1], Wendy Suzuki[2]; [1]Boston College, [2]New York University

"Brain Healthy" is a new high school program designed to empower students to make data-informed decisions to improve their brain health and wellness. In this program, students learn about brain plasticity and how positive (e.g., physical exercise) and negative (e.g., chronic stress) life experiences impact their brains. Students use data collected from fitness trackers, surveys, and computerized tasks to explore how brief periods of meditation and physical exercise affect their heart rate, stress, mood, and cognitive performance. Students then design data-driven investigations utilizing a de-identified community science database collected across all participating schools. Using this database, students explore questions of interest, such as how fitness level relates to cognitive performance and how sleep duration relates to mood. Currently, data is being collected at four implementing schools, with over 20 schools projected to participate in the program in the next three years. The effectiveness of the program is assessed using a mixed-methods design, which consists of surveys, students interviews, and classroom observations. Project findings will inform future neuroscience-related curriculum development and generate an extensive community-based database on adolescent health and wellness.

Topic Area: THINKING: Decision making

B129 - Real-Time Modulation of Reinforcement Learning Using Closed-Loop TMS-EEG

Yifan Gao[1] (yifangao97@gmail.com), Malte Güth[2], Drew Headley[1], Daniel Robles[1], Emily Zhang[1], Travis Baker[1]; [1]Center for Molecular and Behavioral Neuroscience, Rutgers University – Newark, [2]Department of Biomedical Engineering, University of Minneapolis, Minnesota

Background: While the link between frontal-midline theta (FMT) power, reward prediction errors, and behavioral adaption is well established, little is known about the role of FMT phase dynamics in reinforcement learning. Here, we developed a novel closed-loop system capable of tracking FMT in real-time and tested whether precisely triggering TMS synchronized with the peak or trough of FMT following feedback would impact the electrophysiological and behavioral correlates of reinforcement learning. Methods: Thirty-four participants were randomly assigned to either peak or trough closed-loop stimulation, and completed two sessions (active and sham). For each session, participants completed two decision-making tasks and received peak or trough stimulation following positive and negative feedback. The T-maze task assessed phase effects on neural responses to feedback (ERPs), while the Probabilistic Selection Task (PST) evaluated the effects on learning. Results: Relative to sham (M=2.48μV), trough stimulation diminished the reward positivity (M=0.79μV, t[16]=-2.42, p=0.028), an ERP component associated with reward processing. While the ability to generalize learning to novel pairing was spared across TMS conditions, the accuracy of learned stimulus-response mappings was impaired by peak stimulation (M=0.76) relative to sham (M=0.87, t[16]=-2.43, p=0.028). Further, trough stimulation slowed reaction time (M=979ms) compared to sham (M=877ms, t[16]=2.31, p=0.035). Discussion: These findings highlight the impact of phase-specific FMT stimulation on neural reward responses and stimulus-response associations, providing new insights into the function of FMT phase dynamics in reinforcement learning, as well as a therapeutic TMS target for cognitive impairments in conditions like substance use disorders, schizophrenia, ADHD, and traumatic brain injury.

Topic Area: THINKING: Decision making

B130 - Defining the optimal form for subjective value encoding by the brain, a numerical approach

Shreya Sinha[1] (ss14468@nyu.edu), Agnieszka Tymula[2], Paul Glimcher[1]; [1]Grossman School of Medicine, New York University, [2]School of Economics, University of Sydney

While early studies hypothesized that internal value representations should be linear or logarithmic transformations of objective value, empirical evidence from recordings in monkeys show sigmoidal functions. Building on efficient coding theory, our groups have proposed a divisive normalization-style representation, which is optimal for Pareto III environments. Rather than relying on empirical observations to infer efficiency, here we invert this approach by explicitly defining the nervous system's objective as maximizing long-run reward rates. We then use a mixture of analytical and numerical methods to answer: What specific encoding function is reward maximizing? (Parallel investigation explores error-minimizing functions.) Our findings reveal that for a near-perfect encoder (as noise goes to zero in the limit) a linear encoding function is always optimal, but as encoding noise increases, sigmoidal and curved functions emerge as reward-maximizing. Additionally, as the number of drawn options increases, the optimal functions exhibit a rightward shift. An optimal encoder at any given (non-zero) noise level changes with the distribution of rewards in the environment and the number of options drawn from that environment that the nervous system faces. These results suggest that the sigmoidal value functions, like those of Kahneman and Tversky, are optimal for mid-noise systems facing uniformly distributed rewards, while logarithmic encoding suits exponentially distributed environments like the one studied by Bernoulli. Our research unveils a striking resemblance between derived and biological utility functions in the brain, hinting at optimality under specific constraints. It also offers deeper insights into the mechanisms underlying human choice behavior.

Topic Area: THINKING: Decision making

B131 - Adolescent Decision-Making Efficiency Maintains Despite Sleep Quality Variation: A Drift Diffusion Model Analysis.

Belkairys Taveras Tapia[1,2], Yue Zhang[4], Alexander S. Weigard[4], Edward Huntley[5], Colter Mitchell[5], Luke W. Hyde[4,5], Christopher S. Monk[3,4,5]; [1]Hunter College, CUNY, New York, NY, [2]BP-ENDURE Program Hunter College CUNY, New York, NY, [3]Neuroscience Graduate Program, University of Michigan, Ann Arbor, MI, [4]University of Michigan, Ann Arbor, MI, [5]Survey Research Center of the Institute for Social Research, University of Michigan, Ann Arbor, MI,

Poor sleep has been associated with slower information processing in adolescence, leading to impaired decision-making and difficulties in evaluation tasks. However, little is known about the impact of poor sleep quality on the underlying cognitive decision-making processes, particularly under emotionally-salient conditions. Here, we analyzed decision-making beyond reaction time and accuracy using the Drift Diffusion Model (DDM), a computational framework characterized by underlying decision-making processes. Participants (n = 126; ages 15-17; 76.9% Black; 57.1% female) from the Future of Families and Child Wellbeing Study, a population-based longitudinal cohort study with a representation of marginalized youths, completed an emotional face-gender identification task during functional MRI scanning. Reaction time and accuracy data from the task was modeled in the DDM with the Dynamic Model of Choice package in R. Parameters estimated from the DDM included drift rate, response boundary, starting point, and non-decision time. Sleep quality of the month before data collection was measured using the Pittsburgh Sleep Quality Index (PSQI). We hypothesized that poor sleep quality would be negatively associated to decision-making as suggested by low drift rate, increased boundary separation, and slower non-decision time while expecting no changes in bias. Age, sex, and race were included as covariates in analyses. Zero-order correlations showed no significant association between sleep quality and decision-making based on the DDM parameters (ps > .387). This could be due to limitations in sample size and when sleep quality was assessed. This work contributes to our understanding of how sleep influences information processing under affective contexts in adolescents.

Topic Area: THINKING: Decision making

B132 - Brain signal variability predicts age-related shift in Believer-vs-Empiricist auditory decision style

Niels Kloosterman[1] (n.kloosterman@uni-luebeck.de), Mohsen Alavash[1], Malte Wöstmann[1], Jonas Obleser[1]; [1]Universität zu Lübeck

Introduction: As a corollary of the predictive coding framework, individuals might emphasize either prior beliefs or empirical evidence when making decisions. This potentially results in more stubborn ("Believer") versus more perception-oriented ("Empiricist") decision styles, respectively. Recent evidence suggests an Empiricist-to-Believer shift during ageing, in line with commonly observed age-related reductions in cognitive performance and brain signal variability. Here, we asked whether decision-making style can be directly linked to ageing and brain signal variability. Methods: During electroencephalography (EEG), 32 young (18-32 years) and 34 older adults (52-74 years) performed an auditory discrimination task in which they decided whether a to-be-attended two-tone sequence ascended or descended in pitch. Participants also indicated confidence, allowing decision style assessment through signal-detection-theoretic (SDT) measures of metacognitive sensitivity (Type-II d') and metacognitive bias (Type-II criterion). For younger adults, we predicted higher metacognitive sensitivity and less metacognitive bias. For older adults, we predicted the opposite. We quantified brain signal variability using time-resolved, multi-scale entropy. Results: Young, but not older adults indeed showed metacognitive sensitivity (Type-II d'=0.71 vs. –0.02), whereas only the older group showed a strong metacognitive bias (Type-II criterion=–4.1 vs. 0.58; Age-SDT interaction $F(1,64)=19.1$, $p<0.001$, two-way ANOVA). This confirms an age-related Empiricist-to-Believer shift. The young group showed overall higher EEG entropy. Young participants with increased entropy during tone presentation in lateral frontal regions showed better metacognition, and increased entropy in both groups predicted reductions in metacognitive bias. Conclusion: Increased brain signal variability in older age might contribute to preserving an Empiricist decision style.

Topic Area: THINKING: Decision making

B133 - Behavioral and neural methods for comparing dynamic, subjective experiences

Runxuan Niu[1] (niu_rx@pku.edu.cn), Lusha Zhu[1], Zhihao Zhang[2], Andrew Kayser[3,4], Mark Bartholomew[5], Ming Hsu[3]; [1]Peking University, [2]University of Virginia, [3]University of California, Berkeley, [4]University of California, San Francisco, [5]State University of New York at Buffalo

Characterizing and comparing human aesthetic experiences from the perspective of the average, or ordinary, person is central to legal decision-making, including legal subject areas like copyright law. However, there is little consensus on how it can even be done empirically and scientifically, because of the presumed challenge for people to reflect on and report their own subjective experiences with complex stimuli that unfold over time. To address these challenges, we developed an empirical framework to evaluate music copyright infringement by systematically manipulating song elements, thereby establishing an integrative approach combining behavioral and neural methods to derive an average group opinion. Specifically, due to the legal requirement for plaintiffs to prove that the allegedly infringing element is both similar to the original and central to the defendant's work, we created modified versions of songs by removing or replacing certain musical elements. We then asked participants to evaluate the subjective distances of these variants from the defendant's original song (N = 151). Our method was first tested on a historical case with a resolved legal judgment, where the behavioral judgments from our approach matched the historical ruling, and it was then applied to a recent, highly controversial case. In both instances, the perceived distances measured behaviorally were consistent with neural distances characterized by cross-brain alpha coherence during a separate EEG passive listening task (N = 43). Taken together, these results demonstrate a practical behavioral framework, supported by neural evidence, for evaluating music infringement, thereby informing legal debates with empirically grounded insights.

Topic Area: THINKING: Decision making

B134 - Neural representations of metacognitive processes in the medial prefrontal cortex

Yoshinori Nanjo[1] (yoshinori.nyanjo@gmail.com); [1]RIKEN Center for Brain Science, Japan

Self-monitoring in decision-making is fundamental to self-improvement in cognitive processes. To enhance outcomes in future decisions, individuals must accurately assess the correctness of prior choices and apply the information to control subsequent decisions. Although metacognition encompasses monitoring and control functions, the neural mechanisms underlying these processes and their interactions remain poorly understood. While the prefrontal cortex (PFC) is implicated in both functions, their distinct neural substrates and interrelations require further elucidation. In this study, we employed a sequential perceptual decision-making task involving confidence ratings to examine how initial confidence influences subsequent decisions while recording neural activity using functional magnetic resonance imaging. Subjects performed size discrimination tasks and rated their decision confidence. Behavioral results revealed that subjects were more likely to change their initial choices in subsequent decisions, independently of perceptual evidence. A neural signature of initial confidence was represented in the anterior medial PFC (amPFC), whereas the dorsal anterior cingulate cortex (dACC) exhibited heightened activity when subjects changed their choices. Notably, the pregenual ACC (pgACC) was involved in both confidence representation and changes of mind, showing functional connectivity with the amPFC and dACC. These findings highlight the integrative role of the medial PFC in linking metacognitive monitoring to subsequent control processes during sequential decision-making. Our results provide novel insights into the neural mechanisms supporting metacognitive processes, advancing our understanding of how confidence assessments guide adaptive decision-making.

Topic Area: THINKING: Decision making

B135 - Neuron Type Specific Contributions to Dynamic Coding During Flexible Sensorimotor Decisions in Frontoparietal Cortex

Hamidreza Abdoljabbari[1] (h.abdoljabbari@gmail.com), Fatemeh Balapour[1], Scott L. Brincat[2], Constantin von Nicolai[3,4], Markus Siegel[3,4], Earl K. Miller[2], Mohammad Reza Daliri[1]; [1]Neuroscience and Neuroengineering Research Laboratory, Biomedical Engineering Department, School of Electrical Engineering, Iran University of Science and Technology (IUST), Iran, [2]The Picower Institute for Learning and Memory and Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology, [3]Department of Neural Dynamics and Magnetoencephalography, Hertie Institute for Clinical Brain Research, University of Tübingen, [4]Centre for Integrative Neuroscience, University of Tübingen

Neocortical circuits consist of multiple neuronal cell types, each likely playing distinct roles in flexible behavior. However, studies of decision-making have often overlooked these cell types, limiting our understanding of their specific contributions to local circuit functions. To address this, we simultaneously recorded neuronal activity from the frontal eye field (FEF), lateral prefrontal cortex (PFC), and lateral intraparietal area (LIP) in a macaque monkey performing a visuomotor decision-making task. We used extracellular spike waveforms to reliably identify two functional classes of neurons: broad-spiking (BS) putative pyramidal cells and narrow-spiking (NS) putative interneurons. These cell types exhibited distinct response dynamics and choice-related information encoding across cortical regions. NS neurons in LIP and PFC showed higher choice-related activity and contributed to early, stable coding of decisions, while in FEF, NS neurons demonstrated strongly dynamic encoding patterns, with both BS and NS neurons exhibiting time-varying activity. Our findings reveal that choice information is represented differently across cell types and cortical regions, with NS neurons favoring early, static population coding and BS neurons exhibiting more flexible, dynamic encoding. This heterogeneous coding strategy suggests that decision-related dynamics in the frontoparietal network are shaped by interactions between these distinct neuronal populations. The results provide new insights into cortical circuit dynamics and cell-type specific contributions to decision-making.

Topic Area: THINKING: Decision making

B136 - A Cognitive Map of a Subjective Value Space During Risky Decision-Making

Jake Blumwald[1] (jblumwald@ucdavis.edu), Mark A. Orloff[1], Seongmin A. Park[2], Phillipe Domenech[3,4,5], Erie D. Boorman[1]; [1]University of California Davis, [2]Virginia Tech, [3]Paris Brain Institute, [4]INSERM, [5]CNRS

Individuals make decisions according to subjective valuations of options, integrating multiple attributes into a subjective value signal thought to be encoded by a value coding system. How the brain transforms option attributes into subjective values remains poorly understood. We hypothesize the cognitive mapping system, comprising grid cell representations in the entorhinal cortex (EC) & medial prefrontal cortex (mPFC), may mediate this process when when decisions rely on a cognitive map. We developed a novel risky decision-making task & use computational modeling combined with fMRI to test if grid-like representations of a 2D 'value-space' (comprised of reward amount and probability) are utilized during the decision-making process. Using computational modeling to account for individuals' subjective valuation of options based on cumulative prospect theory, we estimated a distorted 'subjective value' space per individual, and tested for key signatures of the cognitive mapping system for an objectively and subjectively defined cognitive map. FMRI results demonstrate a grid-like representation of decision vectors in individuals' subjective value space of probability and amount in both EC & mPFC. Using representational similarity analysis, we further identify a 2D positional code for individuals' subjective value spaces, again in EC & mPFC. Furthermore, we show that the strength of grid-like representation in EC is correlated with the strength of subjective value representations in two regions, ventromedial prefrontal cortex & posterior cingulate cortex, suggesting the cognitive mapping and value coding system work in tandem. These findings suggest a potential novel mechanism by which individuals construct and compare subjective values for choices.

Topic Area: THINKING: Decision making

B137 - The information geometry of flexible decision making

Anne Marazita[1] (anne.marazita@pennmedicine.upenn.edu), Lowell W. Thompson[1], Juvenal Bosulu[1], Jean Zweigle[1], Joshua I. Gold[1]; [1]University of Pennsylvania

Adaptive behavior depends on the flexible use of new information. This flexibility involves balancing two seemingly contradictory goals: 1) increasing the certainty of our beliefs by prioritizing information that reinforces those beliefs, and 2) increasing the accuracy of our beliefs by prioritizing novel and potentially contradictory information. Here, we present a new theoretical framework showing that this balance arises naturally from information geometry and apply the framework to understand how the brain uses new information to guide behavior on a flexible decision-making task. We trained two monkeys to decide which of two visual targets will be rewarded, based on: (1) a partially predictive visual cue; and (2) a learned expectation about the rate at which the rewarded target switched from trial to trial. In low switch-rate blocks (P(switch)=0.05), visual cues were most useful when they indicated a switch. In high switch-rate blocks (P(switch)=0.5), visual cues were most useful when they established new, strong beliefs. We recorded from individual neurons in the dorsolateral prefrontal cortex (dlPFC) of one monkey (N = 95) performing the task. The monkeys flexibly balanced observations and expectations depending on the switch rate. This flexibility was reflected in the dlPFC at the single-neuron and population level. Consistent with theoretical predictions, visual-evoked responses were stronger in the high-switch condition. Conversely, visual-evoked responses were lower, and delay-period activity was higher, in the low-switch condition. These findings provide new insights into how the brain makes flexible use of information to update beliefs that guide behavior.

Topic Area: THINKING: Decision making

B138 - Evaluation Strategies Modulate the Distractor Effect in Multi-Attribute Decision Making

Kaicheng Yan[1,2] (kaicheng.yan@mail.mcgill.ca), Lesley Fellows[1,2]; [1]McGill University, [2]Montreal Neurological Institute-Hospital

Humans frequently make irrational choices in the presence of irrelevant distractor options. However, there is ongoing debate regarding whether a highly rewarding distractor facilitates or impairs value-based decision-making. To reconcile conflicting findings, we propose that evaluation strategy plays a critical role in shaping distractor effects, with elemental and configural strategies influencing decision outcomes in distinct ways. Under an elemental strategy, individuals evaluate each attribute of an option separately, whereas under a configural strategy, options are assessed holistically, rendering individual attributes non-informative in isolation. We hypothesize that a highly rewarding distractor impairs choice accuracy under an elemental strategy but has a weaker detrimental effect—or may even enhance accuracy—under a configural strategy. To test this, 32 participants first learned the values of multi-attribute pseudo-objects (fribbles) under each evaluation strategy and then made two-alternative forced choices while an unavailable distractor was present. Preliminary analysis using a generalized linear mixed-effects model revealed a significant negative effect of distractor value on choice accuracy across evaluation strategies. Critically, a significant interaction between distractor value and evaluation strategy emerged, indicating that the negative effect of a highly rewarding distractor on accuracy was pronounced under elemental evaluation but attenuated under configural evaluation. These findings suggest that the effect of distractors on value-based decision-making depends on how option values are constructed. Ongoing analyses will refine these findings by fitting a Drift Diffusion Model to estimate drift rate and decision thresholds, providing a mechanistic account of how distractor value influences option discriminability and cautiousness in decision-making.

Topic Area: THINKING: Decision making

B139 - When your side quest becomes your main one: choice reinstatement revealing model-based credit assignment

Lindsay Rondot[1] (ljrondot@ucdavis.edu), Erie Boorman[1]; [1]Center for Mind and Brain, Dept. of Psychology, University of California, Davis, USA

Credit-assignment is the attribution of outcomes to the actions that led to them, enabling goal-directed agents to adapt in complex environments. Most research focuses on single-step contingencies between choices and outcomes. However, real-life goals require multi-step planning, where intermediate actions may not directly cause outcomes but are essential for achieving goals. To address this, we modified the two-step task (Daw, 2011), requiring participants (N=28) to make decisions in an MRI scanner. They selected between two options, each leading to one of two destinations 70% of the time. Then, they chose one of two objects to obtain a token. In 10% of trials, tokens were reallocated, disrupting contingencies and requiring strategy adaptation under model-based decision-making. Behavioral analysis confirmed model-based strategies: participants aimed for the same destination in stable trials and adapted following reallocations. To test our hypothesis concerning model-based credit-assignment following reallocations, we used multivoxel pattern analysis to decode the first stage chosen and unchosen stimuli identities when the token is received. Following a common transition, the chosen stimulus was reinstated in the lateral OFC ($t=3.44$, $p<.005$), likely updating contingencies. The unchosen stimulus was reinstated in the lateral FP ($t=3.16$, $p<.005$), consistent with prospective memory theory as subject are remembering which stimuli to select in the future. Following rare transitions, the chosen stimulus was reinstated in the medial PFC ($t=4.57$, $p<.005$), while the unchosen stimulus was reinstated in the anterior ($t=3.57$, $p<.005$) and posterior ($t=4.53$, $p<.005$) hippocampus, extending into the amygdala ($t=5.19$, $p<.005$). These findings reveal reinstatement mechanisms in model-based learning.

Topic Area: THINKING: Decision making

B140 - Wikipedia Exploration Over Time: Conceptualizing Age-Related Changes in Curiosity

Michelle E. Hirsch[1] (michellehirsch8@gmail.com), Andrée-Ann Cyr[2], Buddhika Bellana[2,3]; [1]York University, [2]York University, Glendon Campus, [3]Rotman Research Institute, Baycrest Health Sciences

Curiosity, the intrinsic drive to seek information, is critical to well-being in old age. While past research shows age-related declines in self-reported curiosity, objective measures suggest older adults indeed express curiosity; however, the information-seeking styles underlying its expression may differ. Decision-making and memory literature findings show that older adults tend to display a more exploitative style (reliance on prior knowledge), whereas younger adults display a more exploratory style (preference for novelty). While considerable work exists on curiosity, few paradigms have examined curiosity alongside its consequences on real-world information-seeking. To address this gap, we propose an information-foraging task where participants freely browse Wikipedia (Lydon-Staley et al., 2021). Exploitative and explorative information-seeking patterns can be operationalized through the semantic relatedness between visited pages (i.e., higher semantic relatedness in exploitative information-seeking). To assess the utility of this approach, we simulated data (i.e., Wikipedia URLs) for either information-seeking pattern (exploitative: $n = 72$; explorative: $n = 72$) using ChatGPT. Extracted texts per URL were then transformed into a numerical vector (via tf-idf), and semantic similarity between URLs was estimated using cosine similarity, alongside graph theoretic and trajectory-based metrics. Analysis of effect sizes (Cohen's d) indicated that all metrics had very large effects (> 0.8) and aligned with exploitative and explorative groups in the predicted directions, suggesting feasibility. As such, our work may be an effective paradigm for enhancing our understanding of the relationship between curiosity and aging in the context of real-world information-seeking – with potential downstream implications for curiosity-based interventions in old age.

Topic Area: THINKING: Development & aging

B141 - Developmental differences in the neural organization of knowledge

Alexander W. D. McArthur[1] (alex.mcarthur@mail.utoronto.ca), Sagana Vijayarajah[1], Margaret L. Schlichting[1]; [1]University of Toronto

Prior work mapping the neural organization of knowledge in adults has demonstrated that semantic (i.e., meaning-based) and perceptual similarity are coded in overlapping regions of temporal and occipital cortices, with additional distinct contributions from prefrontal regions and parietal regions. However, little is known about how this organization emerges over childhood, and the relatively earlier development of regions involved in perceptual processing suggests that developmental differences in the neural coding of semantic similarity may be particularly pronounced. Here, we had children (N=51; 6-7 years) and adults (N=36) passively view a sequence of items during fMRI scanning. Items were semantically or perceptually related to others in the set. Using pattern similarity searchlights, we identified brain regions in each age group that showed stronger coding for semantically or perceptually related items relative to unrelated items. Both age groups coded perceptual similarity in occipital cortex, such that perceptually related items were more similar than unrelated and semantically related items. Children also showed perceptual coding in posterior hippocampus, and adults in lateral prefrontal, parietal, and temporal regions. Semantic coding was relatively weak across age groups, with no clusters in children or adults showing stronger coding of semantic similarity than unrelated and perceptual similarity. Interestingly, both children and adults de-emphasized semantic similarity in medial prefrontal regions, such that semantically related items were less similar than unrelated items. Thus, contrary to expectations, the findings suggest that despite the relatively early development of perceptual systems, there are substantial shifts in the coding of perceptual similarity across development.

Topic Area: THINKING: Development & aging

B142 - The Impact of Prenatal Alcohol Exposure on Addiction Behavior in Young Adults and Dams

Jean Pateman[1] (jpateman@macalester.edu), Anna Rakowski, Petar Elenkov, Naomi Singer, Phillip Rivera; [1]Macalester College

Postpartum depression (PPD) is experienced by 1 in 7 women and a recent study suggests that maternal alcohol consumption can increase the likelihood of developing PPD. There is a dearth of information on how addiction affects the postpartum period. In order to better understand these behaviors, mouse dams were subjected to drinking in the dark (DID), a four day paradigm that assess likelihood to binge on alcohol. This occurred during the human equivalent of the first trimester (embryonic day 0.5-10). A second DID took place during the PPD period (PND 21-28). We hypothesized that during the second binge, dams would binge more alcohol than water control dams. Water control dams will receive alcohol during the second binge. In order to further understand the impact of a previous in utero alcohol exposure, adolescent offspring went through DID (PND45). Based on preliminary results we expect that female adolescents exposed to alcohol during gestation would binge more than their male counterparts, and all water control offspring. In order to understand how this exposure impacts development of the immune system, blood and brain tissue was analyzed. Through cytokine analysis and immunohistochemistry we expected to find differences in both the circulating and central nervous system with pups who were exposed to alcohol from a young age exhibiting immune suppression. In conclusion, a better understanding of how alcohol exposure during gestation influences addiction behavior during the postpartum period will help develop better treatment plans for mothers and young adults who suffer from substance abuse disorders.

Topic Area: THINKING: Development & aging

B143 - Exploring brain system segregation as a neural mechanism of cognitive reserve in bilingualism.

Tyler M. Call[1] (tylercall@cmail.carleton.ca), John G. Grundy[2], John A.E. Anderson[1]; [1]Carleton University, [2]Iowa State University

Bilingualism is associated with a delay in the onset of Alzheimer's dementia symptoms of approximately four years. Thus, it is hypothesized that bilingualism provides reserve, i.e., resilience to age-related and pathological brain degeneration. While bilingualism does have significant effects on brain structure, these measures do not fully explain individual differences in cognitive performance. The construct of cognitive reserve is intended to capture this unexplained variance. Recently, the search for neural mechanisms of cognitive reserve has focused on the connectivity of functional brain networks. One functional connectivity metric, brain system segregation, has been shown to predict cognitive performance independent of age. Brain system segregation also declines with age, and this change is strongly correlated with age-related cognitive decline. One recent study has demonstrated two intriguing findings: first, that higher levels of education are associated with preserved brain system segregation longitudinally; and second, that preserved brain system segregation predicts clinical dementia outcomes over and above structural and pathological measures. However, brain system segregation has not been used to investigate the neural mechanisms of cognitive reserve in bilingualism. In this poster, we explore the relationships between bilingualism, brain system segregation, and cognitive outcomes using data from the Alzheimer's Disease Research Initiative.

Bilingualism is assessed in terms of self-reported proficiency and usage data, and brain system segregation metrics are derived from resting-state functional magnetic resonance imaging data.

Topic Area: THINKING: Development & aging

B144 - Age-Related Changes in Curiosity: The Influence of Locus Coeruleus on Information-Seeking Behavior

Hsiang-Yu Chen[1] (hsiangyuchen@brandeis.edu), Emma Lepore Carlson[1], Johanna L. Matulonis[1], McKenna S. Costello[1], Katherine E. O'Malley[1], Heidi I. L. Jacobs[2], Jacob M. Hooker[2], Anne S. Berry[1]; [1]Brandeis University, [2]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital

Curiosity is a fundamental motivation that enhances learning and memory and has been linked to the function of the locus coeruleus (LC), which undergoes age-related structural decline. To investigate how aging affects curiosity and its influence on information-seeking, we developed the Photographic Art Storytelling Task (PAST). In this task, participants were shown photographs and told that each image was associated with a secret "story". For each photograph, participants rated their initial curiosity and then read a subset of these stories, which were designed by experimenters to be either interesting (rich in historical or contextual detail) or boring (simple descriptions). Participants then reappraised their curiosity to assess subsequent information-seeking behavior. This design allowed us to distinguish between intrinsic motivation- versus story content-driven information-seeking. A "story bias" metric quantified how much curiosity reappraisal was influenced by the story outcomes. A total of 59 older and 48 younger adults participated, with 26 older and 36 younger adults undergoing structural MRI scans of the LC. Results indicated that initial curiosity influenced the perception of story outcomes and subsequent information-seeking, such that "high curiosity" photographs remained of high interest (low story bias) even if the story behind the photograph was revealed to be boring and devoid of rich contextual detail. Individuals with greater LC structural integrity exhibited lower story bias, highlighting the LC's role in regulating curiosity. This effect was more pronounced in younger adults, suggesting that age-related changes in LC function may alter curiosity-driven information-seeking.

Topic Area: THINKING: Development & aging

B145 - Developing a conscious mind: from error-monitoring at 12 months to self-awareness at 18 months?

Cécile Gal[1] (cgg@psy.ku.dk), Katarina Begus[1]; [1]Centre for Early Childhood Cognition, University of Copenhagen, Denmark

The human adult mind boasts a remarkably complex thinking machinery relying on multiple levels reflection, from local error-monitoring to higher information integration and conscious thinking. Yet, how these functions develop and build on each other in a developing brain remains unknown. Here, we investigated the link between error-detection and behavioural adaptation in 124 12-month-old infants with a novel match-to-sample task using EEG and gaze-contingent eye-tracking, and mirror self-recognition six months later. Infants controlled the stimulus presentation. They first viewed three cards (two visible and one face-down), then revealed the third card by looking at it, and matched it with one of the initial cards. Match-difficulty varied across four levels. Our results replicate a finding that 12-month-olds show metacognitive monitoring (Goupil & Kouider, 2016): their brain activity exhibits an Error-Related Negativity (ERN) after incorrect responses ($p = 0.015$). Moreover, infants showed metacognitive control: they adapted their behaviour and explored more before deciding on difficult trials ($p = 0.043$), and (for high-performing infants) following errors ($p = 0.027$). Importantly, we found a connection between early metacognition and later self-awareness: infants who passed the mirror self-recognition test at 18 months showed a significant ERN at 12 months ($p = 0.008$), while those who failed didn't. Metacognitive abilities therefore appear already functional at 12 months both for monitoring errors and adapting behaviour and may contribute to the development of self-awareness. This suggests conscious awareness could stem from an early error-detection core function, gradually leading to various capacities such as self-awareness (Oudeyer & Kaplan, 2007).

Topic Area: THINKING: Development & aging

B146 - Examining the neural bases of spontaneous mental experiences with real-time fMRI

Tiara Bounyarith[1] (tb3344@drexel.edu), David Braun[1], Aaron Kucyi[1]; [1]Drexel University

There is growing scientific interest in understanding how the brain spontaneously generates unprompted, inner mental experiences. The neural representation of mind-wandering has typically been studied using random-onset experience sampling during functional neuroimaging. However, random sampling imprecisely estimates brain activity as it is not tied to the onset of mind-wandering events. To address this limitation, we developed a method, real-time fMRI-triggered experience sampling (rt-fMRI-ES), in which thought probes are triggered based on real-time estimates of spontaneous blood-oxygenation-level-dependent (BOLD) activity. In our ongoing peer-reviewed pre-registered study, rt-fMRI-ES targeted BOLD activation in two typically-anticorrelated regions: (1) the dorsal anterior insular cortex (daIC), which is theorized to underlie subjective arousal, and (2) the posteromedial cortex (PMC), implicated in domain-general stimulus-independent thought. By targeting typically-anticorrelated regions, we could potentially validate the rt-fMRI-ES technique's ability to capture neural events that are separately time-locked to distinct mental experiences. In our current sample (n=29 of our target 60), we aimed to preliminarily test (H1) whether ratings of subjective arousal time-locked to daIC-triggered thought probes were higher than ratings not time-locked to daIC-activation, and (H2) if ratings of externally-focused attention time-locked to PMC-triggered thought probes were lower than ratings not time-locked to PMC-activation. On average, arousal was higher during daIC-activation trials compared to non-daIC-activation trials, but this relationship did not reach significance (p=0.25). There was no difference between attention ratings during PMC-activation trials versus non-PMC-activation trials (p=0.63). Support for our hypotheses after applying more rigorous statistical models once data collection has been completed could potentially validate the rt-fMRI-ES method.

Topic Area: THINKING: Other

B147 - State-anxiety modulates the relationship between interoception and spontaneous fluctuations in subjective arousal

David Braun[1] (db3566@drexel.edu), Lotus Shareef-Trudeau[1], Swetha Rao[1], Christine Chesebrough[2], Julia Kam[3], Aaron Kucyi[1]; [1]Drexel University, [2]Feinstein Institutes for Medical Research, [3]University of Calgary

Spontaneous thoughts have been associated with a variety of neural correlates, but the relationship between distinct features of ongoing mental experience and the brain's sensitivity to bodily signals (i.e., interoception) remains largely unexplored. Given interoception's key role in emotion, investigating its relationship to spontaneous thoughts may provide important insight into how subjective experiences like arousal and anxiety are regulated. We used EEG and ECG to measure the heartbeat evoked potential (HEP), a dynamic index of interoceptive processing, while 51 participants visually fixated on a static cross image and let their minds wander freely. At pseudo-random intervals, participants were asked to rate their level of arousal in the moment. This measure of subjective arousal was highly variable within and between individuals but was statistically unrelated to several markers of physiological arousal, including heart rate, heart rate variability, time on task, and EEG alpha power at posterior electrodes. A cluster-based permutation analysis revealed that the HEP magnitude was increased during high relative to low subjective arousal in a set of frontal electrodes during the 0.328 s – 0.364 s window after heartbeat onset ($p = .016$; cluster-forming threshold of $p = .01$; 1000 permutations). This effect was amplified in participants who scored higher in state anxiety ($r = .36$, $p = .04$). These HEP effects may reflect an adaptive mechanism whereby the brain responds to anxiety by modulating sensitivity to bodily signals to regulate the momentary, spontaneous experience of subjective arousal—a mechanism that may operate independently of fluctuations in physiological arousal.

Topic Area: THINKING: Other

B148 - Linking cognitive domains to static and dynamic models of brain network controllability

Justin Ng[1,2] (jwk.ng@mail.utoronto.ca), Jamie Feusner[1,2,3], Colin Hawco[1,2]; [1]Centre for Addiction and Mental Health, [2]University of Toronto, [3]Karolinska Institutet

Fundamental cognitive domains essential for academic and professional success, including fluid (gF; novel reasoning) and crystallized intelligence (gC; knowledge application), are hypothesized to relate to characteristics of brain-wide connectivity. Borrowing from network control theory, "modal controllability," reflecting the capacity to drive the brain into high-energy states, may align with gF - assembling novel representations with high cognitive effort. Conversely, "average controllability," reflecting the capacity to drive the brain into low-energy states, may align with gC - retrieving established representations with low cognitive effort. gF and gC are comprised of general intelligence (g; shared variance across all tests) and domain-specific components (gF-g and gC-g). Brain connectivity can be modelled using structural connectivity (SC; white matter estimate), static functional connectivity (sFC; time-averaged), and dynamic functional connectivity (dFC; time-varying). Using diffusion and resting-state functional MRI data from the Human Connectome Project (n=945), we applied kernel ridge regression to examine associations between gF, gC, and their components (g, gF-g, gC-g), and controllability measured using SC, sFC, and dFC. We found that modal and average controllability predicted each cognitive domain with similar accuracy, g exhibited the strongest relationship with controllability, and dFC-based controllability demonstrated the strongest predictive power across cognitive domains. These findings reveal that controllability may primarily relate to g, and controllability based on time-varying connectivity models like dFC may offer greater cognitive relevance than static connectivity models like SC and sFC. Importantly however, the hypothesized distinction between modal and average controllability in predicting gF and gC was not strongly supported by our results.

Topic Area: THINKING: Other

B149 - Linking Targeted, Spontaneous Thoughts to Verbal Labels: Implications for Clinical Interventions

Ariel Huh[1], Ezequiel Morsella[1,2], Sarah Brauer[1]; [1]San Francisco State University, [2]University of California, San Francisco

Can a stimulus activate more than one mental association in the stream of consciousness? Can spontaneous thoughts activate such associations systematically? To address these questions, in a task that will be amenable to neuroimaging, we will first train participants (n > 45) to associate a nonsense word with a nonsense shape and with a nonsense sound (a nonstandard chord). The order of presentation of the shape training and the chord training will be counterbalanced across participants. Afterward, participants will be instructed to think of the nonsense word (the "lead associate") whenever they experience, in response to external stimuli, a certain type of autobiographical memory (one having a "family/recreational" context). Half of the eighty stimuli will be line drawings of objects that are associated with a "family/recreational" context, and the other half of the stimuli will be associated with an "academic/professional" context. Stimuli will be presented one at a time, in random order. We will also measure, on a trial-by-trial

basis, whether the participant happened to think of the shape and chord. Our task, which may illuminate the limits of the mental associations that can be activated by a stimulus, will be designed to be amenable to neuroimaging technologies that can identify the neural correlates of the different kinds of mental associations (e.g., visual-based representations versus auditory-based representations). Our research has implications for interventions such as cognitive behavioral therapy, in which clients must monitor, and respond mentally in some way to, (e.g., "reframing") the occurrence of certain spontaneous thoughts (e.g., ruminations).

Topic Area: THINKING: Other

B150 - Dynamics of neural recruitment surrounding thought reports during breath-focused meditation

Andre Zamani[1] (azamani@psych.ubc.ca), Douglas Forrest[1], Jennifer Burrell[1], Kalina Christoff Hadjiilieva[1]; [1]University of British Columbia

Spontaneous thoughts are pervasive in conscious experience; however, it remains difficult to study the neural mechanisms supporting their initial generation given the challenge of self-reporting their conscious onset. Past research has shown that mindfulness meditation experience can enhance detection for subtle mental events, suggesting a potential synergy with neuroimaging to investigate neural activations in the time leading up to spontaneous thought self-reports (i.e., putatively during preconscious thought generation). Here, we performed fMRI scanning on experienced mindfulness meditators (n = 17) reporting on the conscious arising of spontaneous thoughts during breath-focused meditation. Whole-brain task-evoked brain networks extracted using finite impulse response models with principal component analysis reveal Default Network BOLD signal increases prior to spontaneous thought reports that is not exhibited by other functional networks. To better understand the temporal order of BOLD increases within the Default Network, individual finite impulse responses models were extracted from native space grey matter ROIs throughout the network. These findings illustrate how the Default Network crucially underlies spontaneous thought generation. Future work will adapt the paradigm to precision fMRI to measure BOLD signal changes at the level of person-specific network parcellations.

Topic Area: THINKING: Other

B151 - Neural and experiential correlates of subsequent memory during movie-watching

Raven Wallace[1] (18rsw@queensu.ca), Samyogita Hardikar[1], Louis Chitiz[1], Ian Goodall-Halliwell[1], Jeremy I Skipper[2], Robert Leech[3], Jonathan Smallwood[1]; [1]Queen's University, [2]University College London, [3]King's College London

Movie-watching is a unique paradigm that allows the opportunity to record brain activity in contexts that closely resemble real-world situations. During movie-watching, our brains coordinate between processing sensory, narrative, and emotional information. Yet, the specific neural mechanisms that uphold and sustain the focus required to support effective memory for events in a film remain unclear. One potential explanation is that regions in association cortex, such as the frontoparietal network (FPN), which are believed to facilitate cognitive control, play a significant role in sustaining our focus during movie-watching (Duncan, J. (2013), Neuron). The current study addresses this possibility using a novel approach where thoughts are mapped using multi-dimensional experience sampling (mDES) in one group of participants (Sample 1) onto the brain activity of another set of participants (Sample 2) who watched the same films. We also recorded comprehension performance in our experience sample (Sample 1) to examine whether the brain states of individuals in Sample 2 were predictive of the experience and comprehension reported by Sample 1. Our research suggests that states of reduced distraction are linked to improved memory performance for information in a given film clip, and this occurs when brain activity shows greater activation of the FPN. Our results suggest that regions in association cortex, particularly the FPN, are crucial during our experience for maintaining focus during movie-watching and help ensure that information about the film can be accurately retrieved.

Topic Area: THINKING: Other

B152 - BOLD Variability as a Biomarker of Concussion in College Athletes

Doug Schultz[1], Bethany Barnwell[1], Heather Bouchard[1], Aron Barbey[1]; [1]University of Nebraska-Lincoln

Concussion poses a significant public health challenge, with considerable variability in clinical outcomes and neuroimaging results. Traditional studies comparing post-concussion data to healthy controls overlook individual baseline differences, which limits their ability to precisely assess concussion-related changes. By studying individuals before and after concussion, we can control for these baseline factors and obtain a clearer understanding of the effect of the injury. Recent research suggests that BOLD signal variability may be a more sensitive marker of concussion-related brain alterations than traditional measures. This variability could reflect underlying changes in brain function, such as altered cerebral perfusion or microvascular reactivity, that are not captured by average signal measures. We aimed to investigate how concussion affects BOLD variability and its relationship to cognitive deficits. We collected resting-state fMRI data from 54 NCAA Division I college athletes at baseline and within 48 hours of concussion diagnosis, alongside self-reported symptoms and neurological assessments. BOLD variability was quantified using mean square successive differences and analyzed across brain networks. We observed significant reductions in BOLD variability in the somatomotor and language networks following concussion. Greater decreases in somatomotor variability were associated with more severe cognitive symptoms. These findings suggest that reduced BOLD variability may reflect underlying changes in brain function contributing to cognitive impairments. Importantly, these relationships were evident only when comparing concussion data to baseline, underscoring the value of baseline brain imaging measures. These findings illustrate how baseline neuroimaging measures can improve our understanding of concussion-related brain changes and their impact on cognitive function.

Topic Area: THINKING: Other

B153 - Stability in self-reported task-focus relates to activation of the multiple-demand network

Louis Chitiz[1] (17lssc@queensu.ca), Raven Wallace[1], Ian Goodall-Halliwell[2], Bridget Mulholland[1], Ting Xu[3], Michael Milham[3], Elizabeth Jefferies[4], Robert Leech[5], Jonathan Smallwood[1]; [1]Queen's University, [2]McGill University, [3]Child Mind Institute, [4]University of York, [5]King's College London

Ongoing thought varies by person and context, but how situations impact its stability remains unclear. In our study we sought to better understand both how different dimensions of ongoing thought become more or less stable in different task situations and the neural systems that underlie those changes in stability. Participants rated their recent thoughts on 16 dimensions across 14 cognitive tasks. Using PCA, we identified 'thought patterns' comprising dimensions that covaried across tasks. To calculate thought stability we computed the intraclass correlation coefficient (ICC) associated with each thought pattern in each task, such that a higher ICC associated with more consistent responses between probes for that task. Using existing fMRI data for each task, we mapped tasks according to whole-brain similarity and examined their association with stability in ongoing thought. We first found that when subjects' thoughts tended to be more deliberate and task-focused, their probes became more stable. Notably, stability in deliberate task-focus associated with activation in a set of regions that significantly overlapped with the multiple-demand network - a set of areas known to activate when individuals engage in complex tasks. On the other hand, as participants' thoughts became more distracting and intrusive, their probe scores became less consistent, which significantly associated with easier tasks that activated more sensorimotor than association cortex (e.g., 0-back task). Altogether, our analysis suggested that changes in the stability of different types of thought are influenced by changing task demands and reflected in patterns of whole-brain activation.

Topic Area: THINKING: Other

B154 - Higher Thinking: The Influence of Cannabis on Thought Content and Dynamics

Jen Burrell[1] (jenbur@psych.ubc.ca), Kailey Baxstrome[1], Shreya Kakachery[1], Kalina Christoff Hadjiilieva[1]; [1]University of British Columbia

Nearly one-third of Canadians used cannabis in 2022, with 50% of young adults aged 20-24 reporting having tried cannabis in the previous year. The frequent use of recreational cannabis highlights the importance of understanding the neurocognitive mechanisms underlying cannabis use. To date, cannabis research has largely focused on its adverse effects on executive functioning and memory. However, no research has directly examined the conscious experience of cannabis intoxication. In other words, we lack a basic scientific understanding of the altered state of consciousness engendered by cannabis consumption. To investigate the alterations in conscious experience elicited by cannabis, we measured the dynamics of participants' thought streams during the Think Aloud paradigm, which were audio-recorded as they spoke aloud the contents of their conscious experience for 12 minutes. Participants identified as regular cannabis users, having used cannabis at least once a month over the prior three months, completed two 60-minute remote experimental sessions following the Naturalistic Cannabis Administration Protocol, one sober and one immediately following the inhalation of cannabis. Using a Linguistic Inquiry and Word Count style analysis, we investigated how acute cannabis use altered thought content, valence, and temporality. We found these metrics covaried with responses from experience sampling, allowing us to understand what changes are occurring in the stream of thought due to cannabis, and the perception of these changes from the perspective of the users. These findings begin to elucidate how cannabis acutely alters the way people think

Topic Area: THINKING: Other

B155 - Greater flexibility in complex behaviour is linked to greater activity in primary systems.

Samyogita Hardikar[1], Raven Wallace[1], Louis Chitiz[1], Bridget Mullholland[1], Beth Jefferies[2], Robert Leech[3], Jonathan Smallwood[1]; [1]Department of Psychology, Queens University, Kingston, ON, Canada, [2]Department of Psychology, University of York, York, UK, [3]Centre for Neuroimaging Science, King's College London, London, UK

Intelligence supports complex behavior and consists of two key components: fluid intelligence, reflecting problem-solving and adaptability, and crystallized intelligence, involving learned procedures and knowledge. While both forms are crucial, their differential brain-wide underpinnings remain unclear. To address this gap, we analyzed task-fMRI data from the Human Connectome Project (HCP, s1200 release, N=986) using a "state-space" approach. We projected individual task-evoked brain activity onto a common "state-space" by calculating the similarity between 13 un-thresholded first-level contrast maps from seven diverse cognitive tasks and the first three latent dimensions of resting-state functional connectivity described by Margulies et. al., (2016): (1) primary vs. association cortex, (2) visual vs. somatosensory systems, and (3) default mode network (DMN) vs. fronto-parietal systems. In a multiple regression analysis we used the state-space locations as outcome, and task condition, fluid and crystallized intelligence, and their interaction terms as predictor variables, with subject and family as random effects. We found that high fluid intelligence was linked to greater association cortex engagement during high-demand tasks (e.g., 2-back working memory), while high crystallized intelligence showed reduced association cortex engagement during lower-demand tasks (e.g., 0-back). Fluid intelligence was associated with greater sensory and motor activity during visual and motor tasks respectively, while crystallized intelligence was linked to greater visual system engagement during high-demand tasks (e.g., 2-back). Together these results suggest that there are multiple routes to complex intelligent behaviour with greater flexibility linked to greater activity within primary systems.

Topic Area: THINKING: Other

B156 - Exploring the Stream of Consciousness: Using Precision fMRI to Investigate the Dynamics of Thought

Desmond Wood-Anderson[1] (dwoodanderson@psych.ubc.ca), Andre Zamani[1], Nicholas Zhu[1], Kalina Christoff Hadjiilieva[1]; [1]University of British Columbia

The dynamic features of thought (how mental states change over time) are important for distinguishing between different forms of thought, such as goal-directed thought, rumination, and mind-wandering. The dynamic framework of thought (DFT) outlines two categories of constraints on thought; deliberate constraints, based on cognitive control mechanisms, and automatic constraints, based on mechanisms such as emotional salience and mental habits. The DFT predicts that these constraints rely on differential recruitment of large-scale functional networks, especially the default network (DN), frontoparietal control network (FPCN), and salience network (SN). This study aims to test the DFT's predictions using a neurophenomenological approach. Participants were probed at pseudo-random intervals ranging from 45 to 70 seconds (mean = 54s) to report the degree to which their thoughts were 'freely moving' or 'actively directed,' using a 1- 6 scale (1 = not at all, 6 = very much), while resting in the MRI scanner. We used these questions to infer the presence of deliberate or automatic constraints on thought, and conversely, the relative absence of constraints (spontaneous thought). We employed a precision fMRI approach, densely sampling subjects to identify large-scale networks at the individual level. Results indicate that FC within key networks in the 10s window leading up to the probes distinguishes between thought dynamics: freely moving thought is associated with greater FC within the DN than constrained thought, while FC within FPCN is greater when thoughts are directed.

Topic Area: THINKING: Other

B157 - Mindfulness Without Imagery: Mindfulness Interventions for Individuals with Aphantasia

Madison Lindsey[1], Alexandra Roach; [1]University of South Carolina Aiken

Aphantasia, the inability to voluntarily conjure mental imagery, poses unique challenges for therapeutic and cognitive interventions that rely on visual or guided imagery. This study specifically examines the effects of mindfulness interventions on individuals with aphantasia. Using a between-subjects remote survey design, the research compares the efficacy of guided imagery mindfulness exercises and sound frequency mindfulness exercises in enhancing mindfulness, emotional regulation, and perceived stress levels. Participants were recruited through online platforms and screened for aphantasia using the Vividness of Visual Imagery Questionnaire (VVIQ). Eligible participants were then randomized into one of two conditions: guided imagery mindfulness or sound frequency mindfulness exercises. Each participant completed baseline assessments of mood and perceived stress using the PHQ-9 and GAD-7, which were repeated after the intervention to measure changes. Independent t-tests on pilot data for depression and anxiety scores before and after the intervention suggest a trend towards an advantage of sound frequency mindfulness exercises over guided imagery exercises. Literature shows that those with a low VVIQ scored higher in a video exercise as opposed to a guided imagery audio. This study contributes to the growing body of literature on the cognitive and therapeutic implications of aphantasia, highlighting the need for inclusivity in the design of mindfulness interventions, especially for therapeutic applications.

Topic Area: THINKING: Other

B158 - EEG microstates covary with ongoing spontaneous thought

Anthony Zanesco[1] (apza225@uky.edu), Shirley Pandya[2], Ekaterina Denkova[2], Amishi Jha[2]; [1]University of Kentucky, [2]University of Miami

Understanding the functional relevance of intrinsic brain activity requires examining the link between ongoing brain dynamics during rest and different patterns of spontaneous thought. The large-scale electrophysiological events known as electroencephalographic (EEG) microstates provide an important window into the activity of neuronal networks at the millisecond time scale, and sequences of microstates are thought to reflect cognitive and perceptual states. Yet, attempts to link momentary thoughts to the dynamics of microstates through more temporally precise experience sampling methods have been limited. We address this gap by asking participants (N = 64) to report on the content and quality of their spontaneous thought across nine experiential dimensions by answering questions adapted from the Amsterdam Resting-State Questionnaire (ARSQ) after eight separate 2-minute periods of eyes-closed rest. We found that individuals' thought content varied substantially from one moment to the next and was coupled with the dynamics of microstates. While all nine dimensions were associated with features of microstate dynamics, there were several notable patterns. Specifically, the prevalence, duration, and rates of occurrence of microstate C were positively associated with self-oriented thought, whereas microstate E was negatively associated with self-oriented thought but positively associated with more directed patterns of thought involved in future-oriented planning and problem solving. Together, these findings elucidate the functional relevance of microstates by linking their dynamics to distinct dimensions of spontaneous thought and demonstrate the utility of more temporally precise experience sampling approaches to capture thoughts in individuals at rest.

Topic Area: THINKING: Other

B159 - A Game Theoretic Foundation for the Psychophysical Study of Social Interactions

Vered Kurtz-David[1] (kurtzv02@nyu.edu), Adam Brandenburger[2,3,4], Paul Glimcher[1,5]; [1]NYU Grossman School of Medicine, [2]Stern School of Business, NYU, [3]NYU, Tandon School of Engineering, [4]NYU Shanghai, [5]Center for Neural Science, New York University

Finite cognitive capacity limits social cognition. However, how do specific cognitive resources interact and limit social reasoning? Here, we investigate how humans reason in social encounters when forced to integrate across distinct cognitive domains. Combining cognitive neuroscience with paradigms from game theory we created an experimental protocol that decomposed each interaction into social and non-social cognitive demands. We used this separation to develop a new psychophysical model that rests on economic definitions of production functions. We posit that when one increases the cognitive demands in a social encounter, they incur a cognitive cost that is distributed amongst multiple domains. We recognize that individuals have distinct innate capacities in each of these domains, and allow for these capacities to trade-off against each other within an individual. We tested this approach in two studies. In the first, we presented subjects with an array of social interactions, which varied parametrically in their social and arithmetic cognitive demands. In the second, we manipulated the total cognitive resources available to subjects by varying processing times. Both social and arithmetic demands were revealed as contextual factors that determine the depth of the social analysis. Subjects traded-off these capacities in a constrained manner – with a great heterogeneity across individuals – as task demands varied. Our results extend classical psychophysics and theories of individual decision-making into the domain of social reasoning. We are currently applying this framework to a recently collected neuroimaging dataset, aiming for a network-level mapping of subjects' utilization of social and non-social cortical resources.

Topic Area: THINKING: Reasoning

B160 - Behavioral and Neural Correlates of Learning Predictable Rules Intermixed with Random Reinforcement

Leo Yuhao Jin[1] (yj2525@columbia.edu), Greg Jensen[2], Jacqueline Gottlieb[1], Vincent Ferrera[1]; [1]Columbia University, [2]Reed College

Animals are constantly learning novel predictable relationships to better adapt to their environment. However, such "learnable" associations are often intermixed with coincidental stimulus-outcome pairings that are "unlearnable". It is advantageous for organisms to differentiate these scenarios so that cognitive effort is not wasted on unlearnable relationships. Here, we ask whether animals are capable of making this distinction and how neural activity in dorsal anterior cingulate (dACC) supports this behavior, We exposed monkeys (N=2) to two pictorial sets: a "learnable" set in which the stimuli were implicitly ordered and the rule was always to choose the higher-rank stimulus, and an "unlearnable" set in which stimuli were unordered and feedback was random regardless of the choice. Monkeys learned the ordered list. However, their responses to the unlearnable set were clearly divided into two categories: they either showed a consistent, non-random subjective preference ordering or they responded randomly. To investigate the neural basis of this behavior, we recorded neural activity from dorsal anterior cingulate (N=921) using multi-channel electrodes. GLM models and population decoding showed that dACC activity was strongly modulated by learnability, reward, and their interactions, as well as behavioral choices. Furthermore, the encoding strength correlated with behavior such that when monkeys differentiated learnable and unlearnable lists, the learnability-related modulation of the reward response increased and the modulation by subjective ordering of the unlearnable list decreased. Our results demonstrate that dACC activity is involved with learnability detection and monitoring, which deepens understanding of multi-rule learning and the formation of persistent superstitious biases.

Topic Area: THINKING: Reasoning

B161 - Tracking the temporal dynamics of conceptual learning during a STEM lecture

Yeongji Lee[1] (yeongji.lee.gr@dartmouth.edu), David Kraemer[1]; [1]Dartmouth College

During a science lecture, successful understanding emerges as individual pieces of information are revisited, interconnected, and integrated into a unified network during the course of the lecture. In this fMRI study, participants watched a video lecture on Newtonian physics concepts and then verbally recalled what they remembered and learned from the lesson while still inside the scanner. Using the embedding space of a large language model (LLM), we first used representational similarity analysis (RSA) to identify brain regions where patterns of neural activity reflected the semantic network structure of the lecture, supporting successful comprehension as measured by verbal recall performance. In a separate analysis, we then used a voxelwise forward encoding model to predict the degree to which participants understand each underlying concept as they are built up over time throughout the lecture. We fitted a linear mapping to predict neural responses from LLM-derived semantic features, and then this mapping was aligned again with human-labeled individual concepts. Whereas the RSA approach reveals where in the brain neural patterns reflect the overall semantic organization of concepts discussed during the whole lecture, the voxelwise timecourse analysis enabled us to quantify understanding of specific concepts at given time points during the lecture, and then to compare these estimates with post-lecture quiz scores and verbal recall performance. The findings demonstrate that mapping the timecourse of neural representations with a large language model provides a powerful tool to characterize individual differences in conceptual understanding by revealing the temporal dynamics of abstract knowledge construction during learning.

Topic Area: THINKING: Reasoning

B162 - Causal knowledge is embedded in semantic networks

Miriam Hauptman[1] (mhauptm1@jhu.edu), Marina Bedny[1]; [1]Johns Hopkins University

When reading something like, "Sam attended a busy conference. Now he has COVID," we naturally infer a causal relationship between crowded spaces and the invisible transmission of illness. What neural mechanisms support such automatic causal inferences? We tested the pre-registered hypothesis that causal knowledge is embedded within distinct high-level semantic networks. Prior work suggests that thinking about living things (people, animals) and inanimate objects depends on partially distinct networks (e.g., Warrington & Shallice, 1984). The precuneus has been implicated in high-level representations of living things (e.g., Fairhall & Caramazza, 2013). Participants (n=32) undergoing fMRI read causal vignettes that encouraged biological inferences about illness (e.g., cancer, flu) or encouraged mechanical inferences about objects breaking down (e.g., teapots, houses). Non-causal control vignettes contained the same sentences but were not causally connected. All vignettes were about people and contained similar grammatical structure and lexical items. The same participants performed localizer tasks: theory of mind, language, and logical reasoning. Univariate and multivariate analyses revealed that biological causal inferences selectively recruit the precuneus. Within the precuneus, responses to biological inferences were ventral to individually localized responses to mental states, pointing to a neural distinction between causal inferences about the body and the mind. Visual regions in lateral ventral occipitotemporal cortex involved in the perception of living things did not exhibit sensitivity to biological causal inferences. Mechanical causal inferences recruited a distinct set of areas implicated in intuitive physics and place concepts. Together, these findings suggest that causal knowledge is distributed across distinct high-level semantic networks.

Topic Area: THINKING: Reasoning

B163 - Decoding Abstract Concepts: A Neuroimaging Study on the Representational Structure of Relational Categories

Anthony Dunn[1] (anthony.t.dunn.gr@dartmouth.edu), Katherine Alfred[1], Nick Ichien[3], Brianna Aubrey[1], Sophia Baia[2], Silvia Bunge[2], David Kraemer[1]; [1]Dartmouth College, [2]University of California, Berkeley, [3]University of Pennsylvania

The ability to infer relations between seemingly disparate concepts is essential for learning and creativity. Revealing how the representational structure of conceptual knowledge in the brain supports the understanding of analogies between concepts is key to explaining how humans derive generalizable knowledge about the world. Despite previous work associating brain regions with the process of analogical reasoning, little is known about how abstract relations themselves are encoded in the brain. To investigate this question, we collected fMRI data from a task in which participants judged whether two words were semantically related. Each word pair belonged to one of three categories describing their abstract relation (whole:part, place:thing, category:exemplar). These relational categories were orthogonal to the task objective, enabling analysis of their representation independent of task demands or individual word semantics. To this end, we are currently analyzing two sources of data: (1) response times to test for priming effects of successive word pairs belonging to the same relational category and (2) neural data for evidence of representational structure corresponding to abstract relations. Specifically, we will use representational similarity analysis (RSA) to determine whether patterns of neural activity elicited by word pairs within the same relational category are more similar than neural activity patterns elicited by word pairs belonging to different relational categories. To ensure that our results are not driven by semantic representations, we will use a word2vec embedding model as a control. Results will address whether abstract relations are represented in the brain beyond the semantic concepts that comprise them.

Topic Area: THINKING: Reasoning

Poster Session C

Sunday, March 30, 2025, 5:00 – 7:00 pm, Back Bay Ballroom/Republic Ballroom

C1 - Sex differences in episodic memory reinstatement: An fMRI study

Hallie Liu[1], Sricharana Rajagopal[1], Gabriela Vélez Largo[1], Natasha M. Rajah[1,2]; [1]Toronto Metropolitan University, [2]McGill University

Introduction: Episodic recollection of contextual details has been associated with successful reinstatement (or reactivation) of neural activity patterns observed at encoding, at the time of retrieval. However, past work has not examined if the same patterns of reinstatement support context retrieval in males and females despite the large body of evidence for sex differences in episodic memory. Methods: The current fMRI study sought to fill this knowledge gap by testing for sex differences in reinstatement. Twenty-four females (age 22-38) and 24 males (age 21-36) completed a spatial context memory task during an fMRI scan. During the encoding phase of the task, faces were presented individually in one of four quadrants. In the retrieval phase, participants had to recall which quadrant each face was previously presented in. To ensure sex differences were not driven by behavioral differences, female and male subjects were matched on memory accuracy scores. Using conjunction analysis, we examined reinstatement by analyzing the encoding-retrieval activity overlap in subjects, and compared brain regions that showed activity overlap between females and males. Results: Both sexes showed similar encoding-retrieval activity overlap, specifically in the occipital cortex and paracingulate gyrus. However, female subjects showed more extensive overlap in the middle frontal gyrus and fusiform gyrus, while male subjects showed more extensive overlap in the parietal cortex. Conclusions: Overall there were sex similarities in the observed reinstatement patterns. However, some sex differences were also observed, suggesting that certain regions may contribute to episodic recollection to different degrees in females and males.

Topic Area: LONG-TERM MEMORY: Episodic

C2 - Investigating the time course of retrieval state initiation.

Subin Han[1], Nicole M. Long[1]; [1]University of Virginia

Engagement of a retrieval state (or mode) is theorized to be a precursor to successful retrieval, but precisely when the retrieval state is engaged is unclear. Our aim in the present study is to determine the time course of retrieval state initiation. We hypothesize that the retrieval state is reactionary rather than preparatory, whereby the retrieval state is engaged following – rather than preceding – a stimulus. We collected scalp electroencephalography data during a mnemonic state task in which we explicitly biased participants to engage in either retrieval or encoding states, and in which we manipulated the stimulus onset asynchrony (SOA) between the instruction and the stimulus onsets. Our general expectation is that selective engagement of the retrieval state will only occur after stimulus presentation and thus be unaffected by the SOA. Our behavioral results show that regardless of the SOA, a bias to retrieval compared to encoding leads to worse memory for object stimuli. Using multivariate pattern analyses, we find robust engagement of the retrieval state approximately 500 ms following stimulus onset and no evidence for selective retrieval state engagement during the instruction interval. Together, these findings suggest that retrieval state engagement is reactionary.

Topic Area: LONG-TERM MEMORY: Episodic

C3 - Neural signature of emotional context

Chantelle Cocquyt[1] (ccocquyt@psych.ubc.ca), Isabel Wilson[1], Daniela Palombo[1]; [1]University of British Columbia

Emotions shape episodic memories, with emotional context—the affective quality or "hue" of an experience—persisting as part of these events in memory, scaffolding connections between events and guiding impressions of our environment. We suggest that events encoded in a similar emotional context also share similar patterns of brain activation during retrieval. To explore this idea, we scanned 33 participants using functional magnetic resonance imaging as they completed a two-phase episodic memory task. In the encoding phase, participants viewed trial-unique pairs of images, each of which included a neutral object presented alongside a complex picture that evoked a negative or neutral emotional context. Across conditions, images were tightly matched on low-level perceptual features. During the retrieval phase, participants were shown only the neutral objects again and rated their pleasantness, implicitly recalling their emotional context. To determine whether there is a neural signature that reflects salient emotional contexts, we used trial-level representational similarity analyses, focusing on three brain areas previously linked to emotional memory retrieval: the ventromedial prefrontal cortex (vmPFC), hippocampus, and ventral visual stream. Results suggest that the ventral visual stream (bilaterally) represents emotional context, recapitulating patterns of encoding activation and reflecting a common signature of emotional context across retrieval trials. Meanwhile, the vmPFC and hippocampus appear to have a more nuanced role in representing emotional context. These findings reveal that content with a shared emotional context evokes patterns of brain activity that capture the gist of their emotional history, highlighting the brain's flexible ability to integrate affective content into mnemonic representations.

Topic Area: LONG-TERM MEMORY: Episodic

C4 - Musical Context Facilitates Event Segmentation and Sequential Learning Through Interconnected Neural Networks and Strengthened Hippocampal Encoding

Yiren Ren[1], Vishwadeep Ahluwalia[2], Claire Arthur[3], Thackery Brown[1]; [1]School of Psychology, Georgia Institute of Technology, [2]Center for Advanced Brain Imaging, GSU/GT, [3]School of Music, Georgia Institute of Technology

While music often serves as a potent memory cue, its potential to scaffold the learning of non-musical temporal sequences remains poorly understood. We investigated how familiar music modulates neural mechanisms supporting visual sequence learning using fMRI. Participants learned probabilistic sequences of images paired with either familiar music compositions or silence. During continuous image presentation, participants performed event segmentation while learning sequential relationships, followed by retrieval practice after each learning block. Behaviorally, at encoding music enhanced boundary detection ($F(1,1007)=18.742$, $p<.001$, $\eta p^2=.02$), as well as subsequent sequence recall accuracy ($t(86)=-2.292$, $p=.024$) and retrieval practice performance when the music was no longer present ($F(1,517)=9.522$, $p=.002$, $\eta p^2=.02$). Whole-brain analyses revealed reduced prefrontal activation during music-accompanied learning, with enhanced engagement of subcortical regions (amygdala, thalamus) at sequence boundaries. The hippocampus and IFG exhibited earlier and stronger responses to sequence boundaries in the music condition, with their boundary-related activity uniquely predicting subsequent memory performance. Functional connectivity analyses revealed that music strengthened hippocampal-vmPFC coupling while reducing frontal-parietal connectivity associated with effortful sequence learning. Representational similarity analysis showed that music enhanced pattern similarity for within-sequence items in hippocampal subfields while reducing pattern separation demands for cross-boundary items. Furthermore, classification analysis demonstrated more distinct positional coding of visual sequence items in the hippocampus during music-accompanied learning. These findings suggest music facilitates sequence learning by providing clearer event boundaries, engaging schema-based learning through enhanced hippocampal-vmPFC connectivity, and promoting more efficient hippocampal representations of temporal order. This work reveals how structured auditory contexts can scaffold visual sequence learning.

Topic Area: LONG-TERM MEMORY: Episodic

C5 - Temporal Distortions During Narrative Recall

Nathaniel Allen[1] (nallen25@jh.edu), Chris Honey[1], Janice Chen[1]; [1]Johns Hopkins University

Estimating and reasoning about time is crucial to understanding our complex and dynamic world. When we estimate how long our friend has taken running errands, or how long we've waited for our food to cool, we reason about time on the scale of minutes. Many situations can alter our perception of time in disorienting or surprising ways. We have observed a powerful bias in human time estimation on the scale of minutes during recall. As people gradually recall and describe the scenes of a recently viewed movie, they dramatically underestimate how much time they spent recalling. What causes such dramatic degradations in people's ability to estimate elapsed time? Our hypothesis is that regions responsible for tracking shifting mental context through time are also involved in the reinstatement of those prior mental contexts; thus, when these neural systems are engaged in a demanding reinstatement task like narrative recall, this interferes with their ability to track the passage of time. In a developing study, we will present participants with a 50 minute movie, after which they will either engage in spoken recall of the movie or read series of unrelated sentences aloud for a length of time yoked to a participant in the recall condition. We predict participants engaged in recall will significantly underestimate elapsed time compared both to veridical time and the estimates made by control participants, behaviorally reflecting the hypothesized neural interference within regions that participate in memory reinstatement, such as the default mode network and medial temporal lobe cortex.

Topic Area: LONG-TERM MEMORY: Episodic

C6 - Aging and the Effects of Prior Knowledge on Neural Representations of Scene Images

Yuju Hong[1], Kana Kimura[1], Caitlin R. Bowman[1]; [1]University of Wisconsin-Milwaukee

In healthy aging, the detail and specificity of episodic memory declines, but general knowledge remains relatively intact. There is mixed evidence about whether older adults can leverage their robust knowledge base to minimize age deficits in episodic memory, and little is known about how prior knowledge affects neural representations during encoding and retrieval. The present study tested age differences in neural pattern classification and encoding-retrieval representational similarity based on whether participants were likely to have prior knowledge of the memoranda. Young (18-30 years old) and older adults (60-80 years old) underwent fMRI scanning while viewing scene images depicting famous and non-famous locations and while vividly recalling the images from memory. Later, they completed a recognition test to objectively measure memory. Behavioral results revealed that older adults' recognition memory performance did not differ for famous versus non-famous scenes. Imaging data also showed little difference based on prior knowledge in either age group for decoding the scene category (natural vs. manmade). However, both age groups showed stronger encoding-retrieval similarity for non-famous than famous images in several visual regions (inferotemporal cortex, lateral occipital cortex, and posterior fusiform cortex), but not in medial temporal regions (hippocampus, parahippocampal cortex). Taken together, we do not find that older adults benefit from using prior knowledge when learning scene images, and that both young and older adults show signs of higher fidelity recall when they have less semantic knowledge about the locations.

Topic Area: LONG-TERM MEMORY: Episodic

C7 - Adaptive control of episodic memory retrieval during story listening

Cody V Dong[1] (codydong@princeton.edu), Samuel A Nastase[1], Kenneth A Norman[1]; [1]Princeton University

Prior work has shown that people use episodic memory to predict upcoming words when listening to familiar stories. Can people adaptively stop making memory-based predictions in environments where memory is misleading? In the first fMRI session, participants listen to 78 short stories. In the second session, we manipulate the predictability of the stories between subjects: In the high predictability condition, participants hear the exact same stories from the first session. In the low predictability condition, the stories start the same but always branch off to different endings, so participants who use episodic memory to predict the ending will predict incorrectly; to avoid these prediction errors, we hypothesize that participants in this condition will learn to suppress episodic memory retrieval during the repeated, pre-branch part of the story. To measure episodic memory retrieval, we first train subject-specific encoding models to predict brain activity from story embeddings. Then, we compare encoding performance during the second session using embeddings that are informed by memory for the complete original story, compared to regular embeddings that only reflect current information. We operationalize neural recall as the difference in encoding performance between memory-informed embeddings vs. regular embeddings. In keeping with our hypothesis, in a pilot sample of 4 participants, we find preliminary evidence that participants in the low predictability condition show a lower degree of neural recall compared to high predictability participants, suggesting that people modulate memory retrieval based on the predictability of the environment.

Topic Area: LONG-TERM MEMORY: Episodic

C8 - Musical Training Impacts Hippocampal Connectivity Patterns Underlying Complex Event Encoding

Mikaila Tombe[1], Rebecca Scheurich[1], Jamie Snytte[1], Caroline Palmer[1], Signy Sheldon[1]; [1]McGill University

Behavioural research has suggested that musical training enhances one's ability to engage in mental imagery, particularly when that imagery is auditory in nature. Given that encoding complex events, from autobiographical experiences to narrated stories, relies on imagery, we reasoned that musicians should encode such events differently than their non-musician counterparts. Based on prior work indicating that musicianship alters the integrity of the hippocampus, the central brain structure for encoding memories, we tested whether musicians engage different hippocampal connectivity patterns as they encode complex events. We further aimed to understand if musician-specific hippocampal connectivity patterns would present differently for events that relied on distinct forms of imagery (i.e. visual, auditory) or conceptual information. In an MRI scanner, musician (N=20) and non-musician (N=17) participants encoded three narrated events that were described to induce either conceptual, visual, or auditory-based images. We extracted anterior and posterior hippocampal connectivity patterns for each narration condition and compared these as a function of group (musician, non-musician) with mean-centered task PLS analysis. The results indicated reliable differences between the groups in both anterior and posterior hippocampal subregion connectivity patterns, but as a function of narration condition. There was one pattern that distinguished between the groups across the conceptual and visually described narrations, while another hippocampal connectivity pattern distinguished between these groups uniquely for the auditory narration condition. Thus, musicianship impacts how the hippocampus is functionally engaged when encoding complex events, and uniquely so for events that may evoke auditory imagery.

Topic Area: LONG-TERM MEMORY: Episodic

C9 - Framing the Past, Shaping the Future: The Power of Political Identity and Media Bias in Collective Memories and Future Thoughts

Nawel Cheriet[1,2,3] (nawel.cheriet@uliege.be), Christine Bastin[1,2,3]; [1]GIGA Research, CRC Human imaging, University of Liège, Belgium, [2]Psychology and Cognitive Neuroscience, University of Liège, Belgium, [3]F.R.S.-Fonds National de la Recherche Scientifique, Bruxelles, Belgium

Political identity plays a pivotal role in shaping how individuals perceive, process, and remember information. It also influences media consumption, guiding people toward sources that align with their beliefs. While its impact on media engagement is well-documented, less is understood about its role in shaping shared memories and collective future thoughts, especially when individuals encounter media that either supports or challenges their perspectives. This study examined how political identity and media congruence affect the similarity of shared memories and future projections. Seventy-five American participants, grouped by left- or right-leaning political views, were exposed to the same public event news from either CNN or FOX, creating congruent or incongruent conditions with their beliefs. Participants then recalled the news content and envisioned future scenarios related to the topic. Using natural language processing techniques to assess narrative similarity, the study revealed that memories were more consistent than future projections across all participants. Interestingly, participants exposed to incongruent media displayed greater memory similarity than those exposed to congruent media, suggesting that conflicting information encourages deeper cognitive engagement. Right-leaning participants exhibited less similarity in future projections than left-leaning participants, particularly in incongruent media conditions. These findings highlight the intricate relationship between political identity, media exposure, and cognitive processing. They illustrate how exposure to conflicting information can shape both collective memory and future thinking, offering fresh insights into the dynamic processes that govern how people recall the past and envision the future in polarized environments.

Topic Area: LONG-TERM MEMORY: Episodic

C10 - Neural substrate for emotional memory schemas in individuals with childhood adversity

Xiang-Shen Liu[1] (xiangshen.liu@donders.ru.nl), Janna N. Vrijsen[2,3], Indira Tendolkar[2,4], Guillén Fernández[1], Nils Kohn[1]; [1]Radboud University Medical Centre, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, The Netherlands, [2]Radboud University Medical Centre, Donders Institute for Brain, Cognition and Behaviour, Department of Psychiatry, Nijmegen, The Netherlands, [3]Pro Persona Mental Health Care, Depression Expertise Center, Nijmegen, The Netherlands, [4]LVR-University Hospital Essen, Department of Psychiatry and Psychotherapy, Medical Faculty, University of Duisburg-Essen, Essen, Germany

Negative memory bias plays an important role in the onset and persistence of depression. Beck's influential Cognitive Model of Depression posits that 'depressive schemas', shaped by childhood adversity, contribute to the development of negative memory bias. Studies in human memory unveiled interactions between the medial prefrontal cortex and the medial temporal lobe as possible neural mechanisms underlying schema memory effects, providing new perspectives to explore Beck's model. Our project aims to investigate whether schema-related neural activity contributes to negative memory bias and how this relates to childhood adversity. Our ongoing MRI study intends to include 100 participants (healthy and subclinical populations) with diverse levels of childhood adversity and depressive symptoms. During scanning, participants are first exposed to either sad music, designed to activate negative schemas through mood induction, or neutral music as a control condition, followed by the encoding of 180 emotional pictures; memory is assessed through a recognition test 24 hours after each encoding session. Preliminary analysis of 64 participants shows schema activation effectively elicits negative emotions. Analysis of the memory data via linear mixed models indicate that childhood adversity negatively predicts positive and neutral memory but not negative memory. Data collection will be finalized in December 2024, allowing us to present findings for the full sample, with a focus on neuroimaging data, at the CNS conference. Through this project, we hope to deepen theoretical insights into schema-based emotional memory and their underlying neural mechanisms, which could have potential applications in clinical fields.

Topic Area: LONG-TERM MEMORY: Episodic

C11 - Tracking the traces of forgotten memories over six months with 7 Tesla high-resolution fMRI

Konstantinos Ioannis Zervas[1] (konstantinos.zervas2@unibe.ch), Tom Willems[1], Katharina Henke[1]; [1]University of Bern, Switzerland

Forgetting naturally kicks in following episodic learning, with most forgetting occurring within the first 24 hours. We hypothesize that the traces (engrams) of forgotten information remain implemented in the episodic memory system of the human brain. Therefore, we examined the fate of 96 newly formed face-object associations over six months in 40 young, healthy participants. We tracked these memory traces using 7T whole-brain fMRI and multivariate analyses. fMRI data were collected during encoding and repeated retrieval at 30 minutes, 24 hours, one week, and six months. For each retrieval trial, participants indicated their confidence. Guess responses were considered ‘forgotten’ memories. At 30 minutes, 29% of the learned associations were forgotten, at 24 hours 35%, at one week 43%, and at six months 56%. Although guessing retrieval accuracy was at chance for each study-test interval, the underlying memory traces persisted in the episodic memory network within hippocampal and prefrontal areas. Their reactivation correlated with guessing retrieval accuracy. Memory traces of forgotten associations corresponded in locations and shape to memory traces underlying consciously accessible memories but were thinner and exhibited significant changes over time, while traces underlying accessible memories remained stable. We conclude that putatively forgotten memories remain implemented in the brain but escaped conscious access.

Topic Area: LONG-TERM MEMORY: Episodic

C12 - On a roll: Subjective recollection primes the brain to successfully retrieve unrelated memories via dopaminergic mechanisms

Matthew Dougherty[1] (matthew.dougherty@mail.utoronto.ca), Anuya Patil[1], Katherine Duncan[1]; [1]University of Toronto

Which brain states prepare us to successfully retrieve memories? Animal models suggest that slowly changing concentrations of neuromodulators-specifically acetylcholine, dopamine, and norepinephrine- may shape retrieval. Inline with this possibility, our group previously found that novelty–a form of stimulus salience associated with neuromodulator release–decreased associative retrieval ability for multiple seconds (Patil & Duncan, 2018). Here, we test whether these novelty-evoked neuromodulators drove this finding by evaluating their relationship to neural reinstatement of memories. We used functional magnetic resonance imaging (fMRI, n=29) to test whether novelty-evoked neuromodulatory nuclei activity mediates neural reinstatement, indexed with encoding-retrieval similarity (ERS). Inline with previous research, participants recalled fewer places and faces associated with words when novel objects preceded these words ($b=-0.2864$, $p<0.001$). Compared to novel objects, preceding familiar objects also boosted ERS in regions throughout the ventral stream (all $p<0.05$). While the task only required participants to reinstate stimulus categories, preceding familiar objects specifically boosted trial-specific content reinstatement in the ventral stream. Contrary to expectations from prior literature, neuromodulatory centers did not signal novelty in this task. Surprisingly, we found that dopaminergic and cholinergic nuclei responded more to familiarity. The response in dopaminergic regions significantly predicted subsequent ERS in the lateral prefrontal cortex ($b=0.007$, $p<0.01$) and mediated the effect of preceding familiarity on subsequent ERS in the medial temporal lobe cortex (indirect effect (ab)=0.0004, $p<0.05$). Our findings point to dopamine’s lingering influence over retrieval, expanding the landscape of mechanisms that prepare us to remember.

Topic Area: LONG-TERM MEMORY: Episodic

C13 - Cortical thickness and volume differences in individuals with Severely-Deficient Autobiographical Memory

Shikang Peng[1,2] (speng@research.baycrest.org), Brian Levine[1,2]; [1]Rotman Research Institute, Baycrest Health Sciences, [2]University of Toronto

Humans have a unique ability to recall vivid personal past experiences, known as episodic autobiographical memory (AM). However, individuals with Severely Deficient Autobiographical Memory (SDAM), identified in 2015, lack this capacity for reliving past experiences. Despite this, they function normally in everyday life and have comparable performance on memory tasks, indicating possible compensatory mechanisms. Recent work using deep learning and neuroimaging revealed that individuals with SDAM show reduced neural communication between the early visual cortex and posterior hippocampus, suggesting reliance on semantic details. Furthermore, whereas normative samples show an R>L asymmetry in hippocampal volumes, people with SDAM show either no asymmetry or L > R. These findings suggest enhanced verbal-semantic processing in SDAM, which corresponds to their subjective reports of low or absent visual imagery. Here, we conducted a data-driven analysis on cortical thickness and volume data in a larger SDAM group with matched healthy controls, employing FreeSurfer to preprocess and parcellate the brain using the 68-ROI DK atlas. Overall, cortical thickness and volumes in SDAM were comparable to healthy controls, but there was subtle evidence of greater cortical thickness and volume in regions linked to semantic memory, including orbitofrontal and medial temporal areas in the SDAM group, who again showed greater or more balanced left-right hemisphere compared to healthy controls. This analysis suggests that inter-individual variation as expressed in SDAM may extend beyond functional properties, affecting trajectories of structural variation on a developmental basis.

Topic Area: LONG-TERM MEMORY: Episodic

C14 - Deconstructing the regional contributions within the Posterior Medial Episodic Network to vivid memory recollection.

Kasia M Mojescik[1] (k.mojescik@sussex.ac.uk), Atusa J Saeipour[1], Jessica Daly[1], Annabel Rowney-Smith[1], Alberto Mariola[1], Sam C Berens[1], Flavia De Luca[1], Jon S Simons[2], Maureen Ritchey[3], Chris M Bird[1]; [1]University of Sussex, UK, [2]University of Cambridge, UK, [3]Boston College, USA

The Posterior Medial Episodic Network (PM) is critically implicated in episodic recollection. However, episodic recollection is inherently multi-dimensional and the specific contributions of individual regions within this network to distinct components of episodic memory remain poorly understood. Such components include the degree to which recollection is narrative-, emotion-, or detail-focused, and whether recall is accompanied by rich sensory imagery. We aim to deconstruct the PM network by exploring the relationship between individual differences in brain activity and behaviour. We collected a rich set of cognitive and neuroimaging data from 150 healthy young adult participants. The dataset includes: 1. An fMRI memory task employing audiovisual stimuli depicting everyday social interactions between individuals, including encoding, retrieval and vividness of recall ratings. 2. Verbal recall scored in terms of central and spatial, emotional, visual, and temporal peripheral details. 3. Ratings of each video stimulus in terms of emotionality, relatability, interest and vividness. 4. Object-location precision memory task. 5. Questionnaires of sensory imagery, autobiographical memory, sleep quality, empathy, affect and autism traits. 6. Neuropsychological tests of memory, verbal and semantic fluency, digit span, and abstract reasoning. Planned analyses include testing whether high vividness ratings correlate with increased activity in the precuneus, posterior cingulate cortex and angular gyrus, which are associated with memory elaboration. Additionally, we will use representational similarity analyses to examine whether individuals with highly vivid memories exhibit greater neural reinstatement in these regions, reflecting stable individual differences. We are planning to make this dataset freely available in the future.

Topic Area: LONG-TERM MEMORY: Episodic

C15 - Effects of aging on semantic and episodic contributions to false memory

Isabelle Moore[1] (ilm5fp@virginia.edu), Nicole Long[1]; [1]University of Virginia

Healthy older adults experience more false memories than young adults. Traditional false memory paradigms leverage semantic overlap, shared meaning, to induce false memories, but experiences can also overlap temporally meaning that they occur close together in time. Prior work shows that older adults have impaired episodic memory, memory for events within a spatiotemporal context, corresponding to an overall shift toward semantic memory and away from episodic memory across the lifespan. We hypothesize that compared to young adults, older adults rely more heavily on semantic versus temporal information, which promotes false memory. We collected behavioral and electroencephalographic data in young and older adults performing an old/new recognition memory task in which we manipulated the degree of semantic and temporal overlap between study words and included critical lures, unstudied words that semantically overlap with studied words. For both age groups, false memory rates increased for strongly compared to weakly semantically overlapping critical lures, with no effect of temporal overlap strength. However, hit rates differed such that older adults showed a significant dissociation between weakly temporally overlapping targets on the basis of semantic overlap, but young adults did not. These findings suggest that young and older adults differentially leverage semantic information. When events overlap both temporally and semantically, young and older adults rely more heavily on semantic versus temporal information, leading to increased false memory susceptibility. When events overlap semantically, but not temporally, older adults rely more heavily on semantic information than young adults to recognize targets.

Topic Area: LONG-TERM MEMORY: Episodic

C16 - Coupled sleep rhythms in the human hippocampus support memory consolidation

Manqi Sha[1] (manqi.sha@psy.ox.ac.uk), Pin-Chun Chen[1], Yvonne Y. Chen[2], Kathryn A. Davis[2], H. Isaac Chen[2], Brett.L Foster[2], Bernhard P. Staresina[1]; [1]University of Oxford, [2]University of Pennsylvania

Sleep plays an active role in memory consolidation. This process is thought to be facilitated by characteristic neural oscillations during non-rapid eye movement (NREM) sleep, including slow oscillations (SOs, <1 Hz), spindles (12–16 Hz), and ripples (80–120 Hz). Previous invasive recordings from the human hippocampus have shown that rather than operating independently, these oscillations are temporally coordinated. However, whether coupled sleep rhythms in the hippocampus contribute to memory consolidation has remained unknown. To address this question, we analysed intracranial EEG (iEEG) recordings from the hippocampus of 12 participants undergoing invasive monitoring for epilepsy surgery. Each participant underwent one or two sessions, consisting of overnight sleep and pre- and post-sleep memory tasks. In each session, participants learned 100 verb-image pairs, with immediate recall before sleep testing 50% of the pairs and delayed recall after sleep testing the remaining pairs. Behavioural results confirmed that longer NREM sleep is associated with better memory retention. Consistent with prior research, we observed specific temporal dynamics of hippocampal sleep rhythms: spindles were preferentially nested within SO up-states, and ripples aligned with the waxing phase of spindles. Crucially, the precision of SO-spindle coupling in the hippocampus predicted overnight memory retention, with stronger spindle coupling to the SO up-states linked to improved memory performance. These findings highlight the intricate role of coupled hippocampal oscillations in supporting memory consolidation, offering insights into the neural mechanisms underlying sleep-dependent memory processes.

Topic Area: LONG-TERM MEMORY: Episodic

C17 - False memory and Individual Differences in Generalization and Specificity

Cheyna Warner[1] (cheyna@uoregon.edu), Lainey Costa[1], Dagmar Zeithamova[1]; [1]University of Oregon

The Deese, Roediger, and McDermott (DRM) paradigm is used to induce false memory in the laboratory. In the task, participants study and recall lists of related words (e.g., bed, dream, pillow). False memory manifests by recall of critical lures: words that are semantically related to the list items but never presented (e.g., sleep). False memory in the DRM is thought to rely on the extraction of a gist across the related information. But what processes underlie gist? Two main theories state that gist reflects either a lack of specificity in memory trace or an adaptive generalization process. We address this question by testing how individual differences in DRM false recall relate to the ability to remember differentiating details versus the ability to apply learned information to new scenarios. Participants completed the DRM paradigm along with measures of memory specificity and generalization. Results show that DRM false alarm rates are negatively related to specificity measures and unrelated to generalization measures. These findings indicate that DRM false alarms are driven by a lack of specificity in the memory trace rather than a adaptive generalization process.

Topic Area: LONG-TERM MEMORY: Episodic

C19 - Vividness of mental imagery and its relationship with resilience to misinformation in young adults

Kennedy King[1] (contactkennedyk@gmail.com), Himanshu Chaudhary[2], Ayanna Thomas[3], Elizabeth Race[4]; [1]Tufts University

Exposure to misleading information after a witnessed event leads to memory distortion for that event (misinformation effect). Prior research has demonstrated that the misinformation effect involves faulty reconstructive processes during memory retrieval whereby misleading information is remembered as part of an original event. Vividness of retrieved information is one factor that has been shown to be important for the accuracy of memory (Foville, 2020; Cooper et al., 2019). The current study investigated whether individual differences in visual mental imagery ability can prevent one from making memory errors in the face of misinformation. One hundred participants viewed a silent crime video (the original event) and then listened to an audio narrative describing the crime. Importantly, some details in the audio narrative were modified to be misleading. After the audio narrative, participants took a forced-choice memory test about the details of the original event and filled out the Vividness of Visual Imagery Questionnaire (VVIQ) as a measure of trait visual imagery ability. Participants demonstrated a robust misinformation effect in which they incorporated misleading details into their memory, but the magnitude of this effect did not correlate with their VVIQ score. However, there was a significant correlation between VVIQ and general memory accuracy in young adults. These findings suggest that while trait visual imagery ability can positively benefit memory performance in the absence of conflicting information in memory, it does not reduce memory errors in the face of misinformation.

Topic Area: LONG-TERM MEMORY: Episodic

C20 - An EEG examination of the timing of neural recapitulation during retrieval of positive, negative, and neutral images

Allison F. Cline[1] (clinaf52@westminster.edu), Luvada R. Mayle[1], Holly J. Bowen[2], Elizabeth A. Kensinger[3], Eric C. Fields[1]; [1]Westminster College, [2]Southern Methodist University, [3]Boston College

The feeling of re-experiencing an event is a defining feature of episodic memory and is supported by the recapitulation of patterns of neural activity generated when originally experiencing the event. Previous research suggests that negative memories are more vivid and are associated with greater neural recapitulation. The current study uses EEG to investigate the timing of these valence effects on recapitulation. Specifically, we examine whether valence effects reflect a post-retrieval phenomenon or whether they emerge during retrieval (and may affect the retrieval process). Participants complete an encoding task where an abstract line-drawing of an image is followed by the full-color image. In a memory test, participants are shown the line drawing and asked to recall the full image. Analyses will examine representational similarity of the neural response when viewing the full image at encoding and when recalling it at retrieval. We will examine how this similarity changes over time during retrieval (i.e., the time course of

recapitulation). Based on results of previous studies, we expect that recapitulation will be greater in the negative than the positive or neutral condition. The key question is whether this difference emerges early in retrieval or is primarily a post-retrieval effect.

Topic Area: LONG-TERM MEMORY: Episodic

C21 - Children's but not adults' CA2,3/DG differentiates same-category information in memory

Sagana Vijayarajah[1] (sagana.vijayarajah@mail.utoronto.ca), Margaret Schlichting[1]; [1]University of Toronto

Hippocampal subfields may demonstrate different representational schemes in the mature brain: Work in adults has shown that combined cornu ammonis 2,3 and dentate gyrus (CA2,3/DG) forms sparse, pattern separated representations in comparison to CA1 which instead forms relatively broader representations. Whether such codes exist throughout development remains unclear. The protracted development of CA2,3/DG versus CA1 connections might suggest that CA1's ability to form broad representations matures earlier than CA2,3/DG 's ability to form sparse ones. Children (N=42; 7-9 years) and adults (N=42) studied a series of photographs depicting 12 different scene categories and then performed a recognition test with new scenes that were either visually similar (matched lures) or dissimilar yet from the same category (same-category lures). We characterized how subfields represented memories by comparing neural patterns between studied scenes and similar scenes (matched lures and same-category lures); comparisons to unrelated scenes served as the baseline. In CA1, studied scenes were more similar to matched lures than same-category lures and baseline scenes across age groups, reflecting the subfield's early emerging role in forming broad representations that emphasize perceptual overlap. CA2,3/DG representations instead varied by age group: While adults showed no differences in similarity to similar and baseline scenes, children actively separated studied scenes from same-category lures, making them less similar than other similar (matched lures) and baseline scenes. These results suggest how CA2,3/DG forms sparse representations changes over development, with children differentiating category-level overlap among experiences. The earlier maturation of broad subfield codes may scaffold the development of sparse representations.

Topic Area: LONG-TERM MEMORY: Episodic

C23 - Neural activities in left angular gyrus and the hippocampus are predictive of memory precision

Mingzhu Hou[1] (mingzhu.hou@utdallas.edu), Luke R. Pezanko[1], Ayse N. Z. Aktas[1], Paul F. Hill[2], Arne D. Ekstrom[2], Michael D. Rugg[1]; [1]Center for Vital Longevity, The University of Texas at Dallas, [2]Department of Psychology, The University of Arizona

Prior fMRI studies examining the neural mechanisms of retrieval success and precision have reported inconsistent results. Here, we examined the neural correlates of success and precision with a memory task that assessed precision for spatial location. In two studies that employed similar experimental procedures, 47 healthy young adults (mean age 23 yrs, 24 female) underwent functional magnetic resonance imaging scanning during a single study–test cycle. At study, participants viewed a series of object images, each placed at a randomly selected location on an imaginary circle. At test, studied images were intermixed with new images and presented to the participants. The requirement was to move a cursor to the location of the studied image, guessing if necessary. Participants then signaled whether the presented image had been studied. Memory precision was quantified as the angular difference between the studied location and the location selected by the participant. Across experiments, a precision effect was evident in the left angular gyrus (AG), where BOLD activity covaried with location accuracy. In addition, multivoxel pattern analysis revealed a significant item-level reinstatement effect in the angular gyrus for high-precision trials. The reinstatement effect was stronger for high- than for low-precision judgments. Linear mixed regression analyses revealed that BOLD activity in both AG and the hippocampus was predictive of trial-wise memory precision. There was no evidence of a retrieval success effect in either region. These findings are partially consistent with prior evidence that success and precision are dissociable features of memory retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

C24 - Learning and sleep reshape the representational geometry of visual experiences

Xianhui He[1] (xianhui.he@psy.ox.ac.uk), Philipp K. Büchel[1], Simon Faghel-Soubeyrand[1], Marcel S. Kehl[1], Bernhard P. Staresina[1]; [1]University of Oxford

Neural and cognitive representations of the external world dynamically evolve over time. While research has suggested that new experiences undergo some transformation during memory consolidation, the mechanisms by which relationships among experiences are shaped remain poorly understood, including the role of sleep in this process. The present study used high-density electroencephalogram (EEG) recordings in 26 participants to elucidate potential changes in the representational geometry of visual stimuli as a function of learning and sleep. Prior to learning, participants performed a 'localiser' task (1-back) on 50 unique images from five categories (objects, faces, scenes, pseudowords, body parts). Participants then performed the 'Memory Arena' task in which the 50 images were presented in a specific spatial and temporal arrangement. Participants learned the sequence of the 50 images to criterion, followed by a ~2-hour nap. After the nap, they completed the localiser task again. We then used the first (pre-learning) localiser to train image-specific decoders based on multivariate EEG patterns and applied these decoders to the second (post-sleep) localiser. Interestingly, we found that during image processing in the second localiser, the image's sequential successor from the learning task could be reliably decoded. This suggests that sequential representations persisted even when such information was not task-relevant. Importantly, our results further revealed that better learning performance and longer slow-wave (stage N3) sleep duration predicted the extent of incorporating successor representations across participants. Overall, our findings indicate that learning new inter-item relationships induces lasting changes in neural representational geometry, with N3 sleep strengthening these changes.

Topic Area: LONG-TERM MEMORY: Episodic

C25 - Language models capture efficient information compression in human memory

Jianing Mu[1], Alexander G. Huth[1], Alison R. Preston[1]; [1]the Univeristy of Texas at Austin

We experience a continuous stream of information, but we do not remember everything equally well. To explain non-uniform memory, current theories suggest that humans selectively encode surprising moments (e.g. event boundaries), a costly strategy that overlooks the online extraction of the central meaning of the experience, a crucial ability of our memory system. Instead, we propose an efficient strategy where humans uniformly sample incoming information at periodic intervals. By leveraging knowledge of the stimulus structure, this strategy simultaneously encodes specific moments and the gist of our experience: moments tied to the rest of the experience are better remembered than standalone ones. We tested this hypothesis using data from 413 participants who listened to narrative stories while segmenting the stories into events. Participants then verbally recalled the stories immediately after they ended. Using large language models (LLMs), we quantified the stimuli's information structure and participants' recall quality. Across eight stories, our incremental uniform sampling model effectively predicted participants' recall beyond alternative models such as event surprise. We further showed that event boundaries are better remembered because they share more information with the rest of the story, rather than having higher surprise. Moreover, by adjusting the sampling rate, one can flexibly recall at varying levels of detail. By changing how LLMs retrieve information from the story, we found that frequent sampling produces more detailed recall, while relying on existing knowledge yields more gist-like recalls. Overall, these results show that knowing the informational structure of natural experiences enables efficient memory encoding and retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

C26 - Does the hippocampus contribute to the online construction of mental simulations?

Elizabeth Race[1] (elizabeth.race@tufts.edu), Bridget Logan[2], Caroline Strang[2], Mieke Verfaellie[2]; [1]Tufts University, [2]VA Boston Healthcare System and Boston University School of Medicine

Amnesic patients with hippocampal damage have difficulty reconstructing events from the past as well as constructing scenarios about the future. Such observations have supported the proposal that the role of the hippocampus extends beyond the domain of memory to imagination and mental simulation. An important outstanding question is whether the hippocampus also supports the spontaneous use of imagery during the online construction of mental simulations. The current study tested this hypothesis in the domain of language comprehension. Amnesic patients with hippocampal damage and healthy controls performed a sentence-picture verification task in which they read sentences describing an object in a certain location (Experiment 1) or in a certain lighting (Experiment 2). Following presentation of the sentence, an object was presented and participants judged whether it had been mentioned in the sentence. Objects mentioned in the sentence were shown with their appearance (i.e., its shape in Experiment 1 or coloring in Experiment 2) matching or mismatching the meaning implied by the sentence. Results of linear mixed modeling indicated that in both experiments, responses were faster when the pictured object's shape/coloring matched the shape/coloring implied by the sentence compared to when it mismatched, suggesting that participants mentally simulate the representation implied by the sentence. Importantly, this response time facilitation did not differ between patients and controls. These results suggest that the hippocampus is not necessary for the online construction of mental simulations during language comprehension.

Topic Area: LONG-TERM MEMORY: Episodic

C27 - Rapid context changes at encoding disrupt hippocampal autocorrelation and reduce temporal clustering of free recall

Lindsay I. Rait[1], Guo Wanjia[1], Zhifang Ye[1], Sarah DuBrow, Brice A. Kuhl[1]; [1]University of Oregon

The hippocampus is essential for linking memories of past experiences to rich contextual details—memory for 'where' or 'when' an event took place. In humans, context representations are thought to powerfully shape how memories are organized. This has been demonstrated by studies of free recall which show that individuals are more likely to successively recall items that were studied closer together in time (i.e., temporal clustering). At present, however, there is limited evidence linking context representations in the hippocampus and temporal clustering in free recall. In an fMRI experiment (n=38), we manipulated the rate of context change during memory encoding to test whether this influenced the stability of hippocampal representations (measured by autocorrelation) as well as the degree of temporal clustering during subsequent recall. Context was manipulated by alternating background scenes at different switch rates (low, medium, high) as a list of words was encoded. Afterwards, subjects freely recalled as many words as possible. While context switch rate had no effect on the total number of words recalled, it significantly influenced the degree of temporal clustering. Specifically, a higher context switch rate was associated with less temporal clustering. Strikingly, this pattern of data was mirrored by autocorrelation in the hippocampus: autocorrelation significantly decreased when switch rate increased. Most importantly, hippocampal autocorrelation during encoding was positively correlated with temporal clustering during free recall. Collectively, these findings establish a critical link between context representations in the hippocampus and temporal clustering in free recall.

Topic Area: LONG-TERM MEMORY: Episodic

C28 - The reasons we remember: Characterizing the impact of social and accuracy goals on the way complex events are encoded

Christiane Marie Canillo[1] (christianecan@gmail.com), Kailin Summers[1], Can Fenerci[1], Signy Sheldon[1]; [1]McGill University

Events from our lives are complex, containing a variety of details to attend to and encode into memory. The details that are included in event memories are thought to depend on the reason for which we are forming that memory. Two main functions of event memory are to fulfill social goals, which are thought to rely on forming more conceptual, gist-like memories, and directive goals, which are thought to rely on forming accurate, specific recollections. Here we tested the impact of these two goals on the way event memories are encoded. In a between-subject behavioural experiment, young participants encoded a short movie clip ("Bang! You're Dead") with a social goal (to entertain friends) or an accuracy goal (describe exactly what occurred) in mind. After a short delay, both groups freely recalled the movie clip in as much detail as possible. The recollections were scored using natural language processing measures. After a 24-hour delay, the groups completed two recognition memory tests, one that probed for the narrative content and another that probed for the perceptual details of the encoded event. Results from the natural language processing analysis indicate that different content was recalled after encoding with a social or accuracy goal in mind. The recognition memory test results revealed that the social goal group had more gist-based memory of the movie clip than the accuracy goal group. These findings provide insight into how two functions of retrieval shift the details that are prioritized when encoding complex events.

Topic Area: LONG-TERM MEMORY: Episodic

C29 - Freediving as a natural human model to study hippocampal adaptability to hypoxia and episodic memory

Julia Micaux[1], Clément Poiret[1], Jingwen Zhao[1], Aya El Hajj[3], Moragne Tillenon[4], Franck Mauconduit[2], Fawzi Boumezbeur[2], Catherine Chiron[1], Marion Noulhiane[1]; [1]UNIACT, InDev 1141, NeuroSpin, CEA-SACLAY F-91191, Gif-sur-Yvette, France, [2]BAOBAB, NeuroSpin, CNRS, CEA-SACLAY F-91191, Gif-sur-Yvette, France, [3]Sport Sciences Department, Univ Rouen Normandie, CETAPS, Rouen, France, [4]Paris Brain Institute, Centre d'Investigation Clinique ; APHP, Département des Maladies du Système nerveux, Hôpital Pitié-Salpêtrière, F-75013, Paris, France

Accidental hypoxia has detrimental effects on the brain, particularly on the hippocampal subfields (HS), which is highly sensitive to oxygen deprivation and play a crucial role for episodic memory. This raises the question: can freediving, which involves prolonged breath-holding, cause anatomical changes in the HS and impair memory? The aim was to clarify the impact of freediving on HS anatomy and memory. Seventeen freedivers were assessed before and after seven months of training, alongside a control group of twenty non-freedivers. An MRI segmentation tool HSF(c) was used to measure HS volumes; and a pattern separation task – which required distinguishing between identical, similar, and new items –assessed episodic memory. Our results showed no significant differences in HS volumes or memory performance between the two groups, both pre- and post-training. Additionally, our results confirmed that freedivers performed similarly to controls in the PS task. Both groups were more accurate with identical items than with similar ones ($p<0.001$) and were less accurate with similar items compared to new ones ($p<0.001$), reflecting the cognitive demands of distinguishing similar items. Overall, our findings suggest that repeated voluntary hypoxic exposure during freediving does not impair hippocampal anatomy or memory. Freedivers maintained comparable memory performance to the control group, indicating no adverse effects. Moreover, this study highlight the potential benefits of regular physical activity, even in hypoxic conditions, for promoting hippocampal adaptability. In summary, freediving offers a valuable model for investigating how repeated voluntary hypoxia induces cerebral adaptability in healthy individuals.

Topic Area: LONG-TERM MEMORY: Episodic

C30 - Complexity compression and the when of memory in virtual reality, an EEG study

Matthew Logie[1] (matthewrlogie@gmail.com), Virginie van Wassenhove[1]; [1]CEA/DRF/Inst. Koliot, Neurospin; INSERM, Cognitive Neuroimaging Unit; Université Paris Saclay, Gif/Yvette, 91191 France

Memory for the temporal distance between items depends on the structure of events. Events depend on contextual drift, which 'resets' when experiencing event boundaries. Boundaries are traditionally defined in terms of prediction error. An event is constructed within working memory along with predictions for what comes next. Prediction errors act as anchors for the compression and encoding of events into longer-lasting memory and clear the contents of working memory in preparation for the next event. The construction of an event can also be described in terms of an accumulation of information. Here we take an information theoretic approach and aim to explore the construction, compression and encoding of events in terms of an accumulation of information. We conducted an EEG study employing a novel virtual reality environment to provide segmented sequences of images with transitions between virtual locations providing boundaries to 'reset' the accumulation of information. From this perspective, we expect to discover a waxing and waning in measures of complexity and entropy based on event structure. Preliminary findings suggest that the level of entropy will influence the compression of information, which will drive temporal displacement errors in behavioural judgements of when an image appeared. We aim to establish links between the processing of information and the when of memory. Keywords: Virtual reality, EEG, Events, Context drift, Complexity

Topic Area: LONG-TERM MEMORY: Episodic

C31 - Modified Signal Detection Models of Context Memory and Feature Memory Account for Age Differences

Ashley, C. Steinkrauss[1] (steinkas@bc.edu), Haley, A. Fritch[2], Chad S. Dodson[3], Scott, D. Slotnick[1]; [1]Boston College, [2]Broad Institute, Massachusetts Institute of Technology & Harvard University, [3]University of Virginia

Memory is influenced by age-related changes in cognitive processes. This study employed receiver operating characteristic (ROC) analyses to distinguish between continuous and threshold models of memory by evaluating five models: the two-high threshold model (2HT), the classic unequal variance model (UEV), a new UEV model with forgetting (UEVFG), the UEV model with source misattribution (UEVSM), and the UEV with both source misattribution and forgetting (UEVMF). Four hundred and sixty-three (243 younger, 220 older) participants completed tasks involving color context recall or feature recall. Participants studied objects with either a green or orange background (context) or a green or orange internal color (feature). At test, they were presented with old and new items and classified each as “green”, “orange”, or “new.” Context memory and feature memory ROCs were generated for younger and older participants, and model parameter values were adjusted using maximum likelihood estimation. For younger adults, the UEVFG model provided the best fit, suggesting that forgetting is a primary factor influencing memory performance for this group. For older adults, the UEVSM model provided the best fit, replicating previous results and indicating that aging increases the likelihood of source confusion. These findings highlight age-related differences in memory processes, with younger adults’ memory performance primarily influenced by forgetting and older adults’ memory performance primarily influenced by source misattribution. The results underscore the importance of using modified models of memory to capture age-specific nuances. The observed differential cognitive processing of younger and older adults are expected to inform the interpretation of neuroimaging results.

Topic Area: LONG-TERM MEMORY: Episodic

C32 - Consistent alignment of saccades and alpha oscillations supports the neural representation and memory encoding of visual objects

Graham Flick[1,2] (gflick@research.baycrest.org), Jed Meltzer[1,2], Jennifer D. Ryan[1,2], Rosanna K. Olsen[1,2]; [1]Baycrest Centre, [2]University of Toronto

Visual memories rest upon input from saccades and gaze fixations. Prior work has highlighted a functional link between neural oscillations in visual cortex and the timing of eye movements for memory encoding: saccades synchronized to consistent phases of alpha oscillations are associated with better memory for visual scenes (Staudigl et al., 2017, PLOS Biol). Here, we tested the hypothesis that saccade-alpha phase alignment improves perceptual representations, which may facilitate the memory benefit. Simultaneous magnetoencephalography (MEG) and eye-tracking were recorded in 32 participants. On each trial, participants maintained central fixation before saccading to an object in the periphery. After a delay, recognition memory was tested for 250 viewed objects. Matching past work, saccades to subsequently remembered objects were preceded by greater phase alignment in alpha oscillations (8-12 Hz, -215-0ms) over visual cortex, compared to objects that would be forgotten. Representational similarity analysis of MEG responses time-locked to eye movements revealed that visual representations, defined from a deep convolutional neural network model, emerged in brain activity before the initial saccade (-100-0ms), whereas both visual and semantic representations, the latter defined from semantic property norms, emerged afterwards (0-300ms). Compared to later-forgotten items, saccades onto subsequently remembered objects elicited stronger visual, but not semantic, representations in MEG responses (0-100ms, $p = 0.002$). Critically, memory-related differences in the strength of these representations were positively associated with differences in pre-saccade alpha phase alignment ($r = 0.39$, $p = 0.048$). Altogether, this suggests that alignment between saccades and neural oscillations leads to perceptual enhancement, supporting memory encoding.

Topic Area: LONG-TERM MEMORY: Episodic

C33 - The effects of concept familiarity on event memory in healthy aging

Jamie Snytte[1] (jamie.snytte@mail.mcgill.ca), Can Fenerci[1], Matthew D. Grilli[2], Mary A. Peterson[2], M. Natasha Rajah[3], Signy Sheldon[1]; [1]McGill University, [2]University of Arizona, [3]Toronto Metropolitan University

When encoding events in the real world, we often rely on our familiarity with the concepts present in an event to help construct an episodic memory. There are indications that older adults (OA) use their concept familiarity more readily than young adults (YA), possibly as a means to offset episodic memory deficits. However, other work has suggested that an overreliance on concept familiarity that comes with age results in the formation of more gist-like, or less specific memories. To test these ideas in the context of event memory, we conducted two pre-registered experiments in which YA and OA groups encoded two sets of video clips: one set depicted scenarios containing concepts more familiar to the YA group, and one set depicted scenarios containing concepts more familiar to the OA group. For both sets of videos, memory was tested 24-hours later with two recognition memory tasks, assessing memory for narrative and perceptual information. For the narrative task, results revealed that age-matched concept familiarity enhanced memory accuracy for both the OA and YA groups. For the perceptual recognition task, however, only the YA group showed enhanced memory accuracy for their age-matched video clip. Together, these experiments suggest that concept familiarity can offset typical age-related declines in the ability to recall specific details, but only when probing narrative information.

Topic Area: LONG-TERM MEMORY: Episodic

C34 - Image Memorability Shapes the Temporal Structure of Memory

Marianna Lamprou Kokolaki[1] (lkmarian@hotmail.com), Virginie van Wassenhove[1]; [1]CEA/DRF/Inst. Joliot, NeuroSpin; INSERM, Cognitive Neuroimaging Unit; Université Paris Saclay, Gif/Yvette, France

Image memorability is an intrinsic property of visual stimuli that correlates with the likelihood of an image being remembered. The memorability and the perceived duration of an image are both experiential aspects of stimuli that have recently been shown to be interrelated (Ma et al., 2024). To retain the temporal structure of episodes in memory, detailed information about event sequences—such as temporal distances between items—must be preserved. The general context in which items are embedded acts as a scaffold that aids in the encoding, organization, and retrieval of specific events. Stimulus properties, such as memorability, may also play a crucial role in shaping this temporal structure of episodes in memory. In an online study (n=33), participants actively viewed sequences of either memorable or forgettable images, followed by a judgment of the temporal distance between pairs of images from each sequence using a Visual Analog Scale. Our findings reveal that memorability influences temporal memory: highly memorable images are perceived as temporally closer in memory than forgettable ones. Moreover, shifts in memorability within a sequence (e.g., transitioning from low to high memorability) serve as boundaries, segmenting the sequence into distinct events. These boundaries alter temporal distance judgments for items both within and across these groups, with pairs spanning memorability groups perceived as farther apart compared to pairs within the same group. Our results demonstrate that changes in stimulus properties influencing internal processing, such as memorability, can structure the temporal organization of episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

C35 - Modulating declarative memory with direct human amygdala stimulation

Martina Hollearn[1] (martina.hollearn@psych.utah.edu), Joseph Manns[2], Lou Blanpain[2], Stephan Hamann[2], Kelly Bijanki[3], Robert Gross[2], Daniel Drane[2], Krista Wahlstrom[1], Justin Campbell[1], Griffin Light[1], Aydin Tasevac[1], Zack Wilson[1], Jon Willie[4], Cory Inman[1]; [1]University of Utah, SLC, UT, [2]Emory University, Atlanta, GA, [3]Baylor College of Medicine, Houston, TX, [4]Washington University, St. Louis, St. Louis, MI

We previously demonstrated that brief electrical stimulation to the basolateral amygdala (BLA) enhances declarative memory in humans after a one-day delay without triggering an emotional response. Retrieval-based neural signals, like increased gamma (~50 Hz) power in the perirhinal cortex, have been observed as an "echo" of prior BLA stimulation for remembered objects. This study builds on those findings by increasing the sample size and examining retrieval-based neural signals across medial temporal lobe (MTL) regions. We recruited 31 drug-resistant epilepsy patients undergoing stereotactic EEG surgery, with depth electrodes implanted in various MTL regions. Participants were presented with images of neutral objects during continuous intracranial EEG recording. Brief BLA stimulation (8 trains of 50-Hz pulses at 0.5 mA) was delivered before, during, or after image presentation, with varying durations to optimize memory enhancement. Stimulated objects were recognized more accurately at the one-day delay compared to non-stimulated objects ($t(30) = 2.90$, $p = .007$, $d = .44$). A comprehensive linear mixed effects model revealed theta and gamma power increases in MTL regions (e.g., hippocampus, BLA, entorhinal, perirhinal, and parahippocampal cortices) for remembered objects. Furthermore, the relationship between BLA stimulation and memory enhancement was non-linearly influenced by baseline long-term memory capacity. These findings indicate that brief BLA stimulation can enhance item-specific memory for neutral objects without awareness, highlighting the amygdala's critical role in prioritizing experiences for long-term storage. Future research in humans and animals is necessary to optimize amygdala-mediated memory enhancement strategies.

Topic Area: LONG-TERM MEMORY: Episodic

C36 - Memory under the microscope: investigating episodic memory as a multi-dimensional cognitive process

Soroush Mirjalili[1] (soroushmirjalili@utexas.edu), Audrey Duarte; [1]University of Texas at Austin, [2]University of Oregon

Why do we remember some events but forget others? Understanding this question is important not only for basic science but also for potential interventions that improve learning in real time in a variety of populations and real-world settings such as the workplace or classroom. Previous studies attempting to decode successful vs. unsuccessful brain states to investigate this question have met with limited success, potentially due, in part, to assessing episodic memory as a unidimensional process, despite evidence that multiple domains contribute to episodic encoding. Using a novel machine learning algorithm known as "transfer learning", we leveraged visual perception, sustained attention, and selective attention brain states to better predict episodic memory performance from trial-to-trial encoding electroencephalography (EEG) activity. We found that: 1) this multidimensional assessment of the underlying cognitive functions engaged during episodic encoding improved prediction of successful vs. unsuccessful encoding brain states relative to the traditional approach of evaluating episodic encoding as a unidimensional process, and every previously published memory decoding study; 2) visual perception, sustained attention, and selective attention explained unique variance in decoding of successful encoding- related neural activity; 3) trials for which levels of visual perception, sustained attention, and selective attention are high and preceded by a history of high (as opposed to low) levels of these functions are more likely to be successfully remembered. Importantly, this approach could be applied to cognitive domains outside of memory. Overall, this study provides critical insight into the underlying reasons why some events are remembered while others are not.

Topic Area: LONG-TERM MEMORY: Episodic

C37 - Neural basis of information seeking and learning during naturalistic web browsing

Haowen Su[1] (su390@purdue.edu), Coralie Knight[1], Yoolim Hong[1], Taylor Korn[1], Hongmi Lee[1]; [1]Department of Psychological Sciences, Purdue University, West Lafayette, IN 47907, USA

Curiosity-driven, self-guided information seeking plays a crucial role in real-world learning and knowledge acquisition, yet its neural underpinnings remain largely unexplored in naturalistic settings. To address this gap, we conducted an fMRI study using a novel, unconstrained web browsing paradigm in which participants freely explored real-world web content and later verbally recalled their browsing experiences. We focused on the natural moment-to-moment fluctuations of two independent motivations underlying information seeking, the liking and wanting of information (Litman, 2005), which participants retrospectively rated while watching recordings of their own web browsing sessions. We found that the two motivational dimensions were associated with both distinct and overlapping patterns of brain activation during web browsing. Specifically, higher liking was linked to increased activation in the amygdala and visual cortex and decreased activation in the anterior insula. In contrast, higher wanting was associated with greater activation in the lateral prefrontal cortex. Both high liking and high wanting activated parietal and temporal subregions of the default mode network. Additionally, the two motivational dimensions independently influenced memory formation during web browsing. Higher liking predicted successful recall of browsing events, regardless of wanting levels. Conversely, lower wanting predicted better recall, due to the significant mnemonic advantages of unexpectedly enjoyable content. Together, these findings highlight the distinct roles of the motivational dimensions of liking and wanting in shaping neural activity and memory formation during naturalistic information seeking.

Topic Area: LONG-TERM MEMORY: Episodic

C38 - Hippocampal – control network functional connectivity differentially predicts memory in young and older adults

Troy Houser[1] (thouser@uoregon.edu), Caitlin R. Bowman, Dagmar Zeithamova; [1]University of Oregon, [2]University of Wisconsin-Milwaukee, [3]1

The executive control network in the brain has been hypothesized to serve as a compensatory mechanism for impaired memory in older adults. Here, we tested the extent to which control network's resting state connectivity with the hippocampus, a central hub for memory, predicts memory ability in young and older adults. Participants completed category learning and recognition tasks using the same stimuli, providing measures of memory specificity and generalization ability. We found that hippocampal connectivity with the control network predicted memory specificity in both young and older adults. In contrast, hippocampal-control network connectivity predicted generalization ability in older adults only. The results open new avenues for inquiry about how hippocampal interactions at the network level support multiple memory functions in older adults.

Topic Area: LONG-TERM MEMORY: Episodic

C39 - Memory Effects of Event Boundaries Caused by Spatial Change

Lainey Costa[1] (laineyc@uoregon.edu), Troy Houser[2], J. Benjamin Hutchinson[3], Dagmar Zeithamova[4]; [1]University of Oregon

Life is experienced continuously, but our memories are separated into distinct events. This is thought to result from spatial and temporal changes within our environment, experienced as event boundaries. Prior research on event segmentation showed increased errors in temporal order memory and subjective distance ratings for items experienced across context changes, but how contextual changes affect associative memory has received less attention. Here, subjects watched a controlled video of a person encountering objects while passing through several background environments that transitioned gradually. Afterward, temporal order memory and subjective temporal distance ratings were collected for pairs of objects. In addition to these typical measures, we tested associative memory by asking participants to pair an item to its spatial context. Results found no boundary effect on temporal order memory and a distance effect on perceived distance. However, there was reduced associative memory for items adjacent to the boundary. This contributes to our understanding of how context shifts affect memory representations.

Topic Area: LONG-TERM MEMORY: Episodic

C40 - Changes in hippocampal connectivity after category learning predict recognition and generalization performance

Kyla Brannigan[1] (kylabran@uoregon.edu), Lea Frank[1], Dagmar Zeithamova[1]; [1]University of Oregon

The hippocampus is a key contributor to our ability to remember both specific experiences and extract common information from these experiences to generate new knowledge. Hippocampus is thought to support each of these processes through interactions with distinct cortical regions, but specificity and generalization are typically studied using distinct tasks and stimuli. Here we investigate whether hippocampal connectivity changes as a function of category learning, and whether these changes can separately track individual differences in recognition and generalization based on the same experiences. Participants underwent two fMRI scans while passively viewing face stimuli. Between the scans they learned to sort faces into categories. After scanning, they were tested both on their recognition of the training faces as well as their ability to generalize the previously learned categories onto new faces. We found that changes in background hippocampal connectivity from pre- to post-category learning were differentially predictive of performance on later measures of recognition and category generalization abilities. Hippocampal connectivity with lateral occipital and salience network regions predicted recognition ability while connectivity with sensorimotor network regions predicted categorization ability. These results demonstrate how hippocampal interactions with distinct regions support separate aspects of our memory.

Topic Area: LONG-TERM MEMORY: Episodic

C41 - Memory for an event-scrambled story unscrambles over time

William Fisher[1] (fishermwilliam@gmail.com), Andrée-Ann Cyr[1], Buddhika Bellana[1,2]; [1]York University; Glendon Campus, [2]Rotman Research Institute; Baycrest

Our memory for an event reflects a combination of both episodic and schematic contributions (Renoult et al., 2019), which change in different ways over time. Episodic details tend to be more susceptible to rapid forgetting than schematic details (Sacripante et al., 2022), and memories are often characterized as becoming less episodic and more schematic over time (Wiltgen & Silva, 2007). We propose a new and efficient experimental paradigm to quantify changes in episodic and schematic contributions to event memory over time. Participants read a short story with the order of events randomly scrambled. After a delay (0hr, 24hr, 48hr, 72hr, or 1-week), participants were asked to reorder brief descriptions of each story event from memory. If schematic contributions increase over time, the remembered order of events should increasingly reflect participants' understanding of how stories tend to unfold (i.e., schematic), rather than the order in which the events were presented (i.e., episodic). We computed two indices: (i) schematic signal -- Spearman correlation between the order of participants' recalled events and the original order of events before scrambling; (ii) episodic signal – Spearman correlation between participant recall and the scrambled order in which the events were presented. We found: episodic signal decreased over time, in line with forgetting; schematic signal was above-chance at all delays; and schematic signal significantly increased over longer delays. Overall, when reading a scrambled sequence of events, human memory not only records, but increasingly unscrambles, event sequences over time – highlighting an intimate link between remembering and understanding.

Topic Area: LONG-TERM MEMORY: Episodic

C42 - Hippocampal neural timescales during movie watching are related to gist memory and to age

Nichole R. Bouffard[1], Angelique I. Delarazan[1], Jeffrey M. Zacks[1], Zachariah M. Reagh[1]; [1]Washington University in Saint Louis

Older adults' memories are more gist-like, with fewer fine-grained details, compared to those of younger adults'. It has been proposed that neural signal gradients in the hippocampus support coarse-to-fine representations in memory. However, it is unknown whether this neural gradient changes with age, and how it might relate to the shift towards gist-like memory. Here, we applied a new fMRI analytic technique that measured the neural timescale of single voxels in the hippocampus. We computed the temporal autocorrelation window–the area under the autocorrelation function curve–to measure length of the neural timescales in the hippocampus while younger and older adults watched a movie. After movie-watching, participants recalled the entire movie, and their recall was scored for gist and detail memory. We found that older adults had more gist-like recall compared to younger adults. In both younger and older adults, longer neural timescales in the hippocampus during movie watching were related to more gist-like recall of the movie. In line with prior studies, younger adults had a gradient of neural timescales from anterior-medial (longer) to posterior-lateral (shorter) hippocampus. However, this gradient was absent in older adults, suggesting a dedifferentiation of signals throughout the hippocampus. These findings reveal gradients in neural timescales to be a novel means of studying age-related differences in hippocampal function. Furthermore, these hippocampal timescales might underlie gist-biases in older adults' memories.

Topic Area: LONG-TERM MEMORY: Episodic

C43 - Memory overlap modulates hippocampal integration and differentiation differently in adolescents and young adults

Merron Woodbury[1] (merron.woodbury@mail.utoronto.ca), Sagana Vijayarajah[1], Margaret L. Schlichting[1]; [1]University of Toronto

The mature hippocampus is thought to store both specifics and regularities across related experiences by forming differentiated and integrated representations, respectively. Here, we investigated how the degree of overlap among experiences may bias different hippocampal subregions towards integration or differentiation. Moreover, we asked whether the hippocampus resolves overlap differently during early adolescence, given its prolonged maturation. Adults (N=36) and adolescents (N=35; 12-13 years old) learned object pairs that overlapped with one another to varying degrees ("high" or “low”). We then identified which regions within the hippocampus showed either higher (integration) or lower (differentiation) similarity among overlapping than non-overlapping pairs, and moreover where this differed by degree of overlap and/or development, using a functional magnetic resonance imaging (fMRI) searchlight. We found a region in the hippocampal head where adults integrated high overlap pairs but differentiated those with lower overlap. By contrast, adults differentiated high but not low overlap pairs in the hippocampal body. Adolescents showed neither integration nor differentiation in the head and instead formed integrated representations only for highly overlapping pairs in the body. Our results are consistent with the idea that memory co-activation, manipulated here through overlap, influences how related experiences are represented in the hippocampus. Moreover, the relationship between overlap and representation varies along the hippocampal long axis in adulthood in a manner not yet mature in early adolescence. Together, our results demonstrate that overlapping experiences are stored differently in the adolescent and adult hippocampus.

Topic Area: LONG-TERM MEMORY: Episodic

C44 - Category-selective functional connectivity increases with parts of the fronto-parietal control network during episodic memory retrieval

Sarah Monier[1] (sxm200026@utdallas.edu), Sabina Srokova[2], Michael D. Rugg[1]; [1]The University of Texas at Dallas, [2]The University of Arizona

Episodic memory retrieval engages both content-selective and ‘core’ recollection regions. Prior research has examined functional connectivity between core regions during successful memory retrieval, but less is known about how content-selective regions functionally connect with other brain regions during retrieval, or how connectivity effects vary with age. Using psychophysiological interaction analyses, we investigated functional connectivity during a source memory task in which 24 younger (18-30 years) and 27 older adults (65-75 years) encoded concrete words paired with scenes or objects, and later identified studied words and their associated image category. Seed regions were identified by locating the maxima of category-selective ‘reinstatement effects’, and included scene-selective (parahippocampal and medial place areas) and object-selective [lateral occipital complex (LOC)] regions. Additional seeds included bilateral anterior and posterior hippocampus. During successful scene recollection, scene-selective regions demonstrated increased connectivity with both left prefrontal cortex, particularly left inferior frontal gyrus (IFG), and the left intraparietal sulcus (IPS). Analogously, the object-selective LOC demonstrated enhanced connectivity with left IFG and IPS during successful object recollection. Inclusive masking revealed that, in each hemisphere, the two scene selective regions demonstrated enhanced connectivity with a common left IFG cluster and, for the left hemisphere, with left IPS also. Anterior hippocampus also demonstrated recollection-related connectivity enhancement with IFG and IPS for scene recollection. These results extend prior findings to suggest that successful recollection is associated with elevated connectivity between content-selective cortical regions and parts of the fronto-parietal control network. None of the effects were moderated by age group.

Topic Area: LONG-TERM MEMORY: Episodic

C45 - Inducing Amnesia via Suppressing Default Network Activity through Focused External Perceptual Attention

Akul Satish[1], Justin Hulbert[2], Michael Anderson[1]; [1]MRC Cognition and Brain Sciences Unit, University of Cambridge, UK, [2]Program in Neuroscience, Bates College, USA

A new theory proposes that functionally suppressing hippocampal activity induces amnesia in healthy adults. Amnesia has been observed for events presented or reactivated around times when participants were cued to suppress retrieval of unrelated memories—which downregulates the hippocampus, a central region in the posterior-medial episodic memory network. The hippocampus is also part of the default network, itself known to be downregulated during challenging perceptual tasks. Given this overlap, we tested whether focused external perceptual attention could similarly induce an amnesic shadow. Specifically, we predicted that memories that were encoded or reactivated between challenging perceptual tasks would be relatively more vulnerable to forgetting. In the first experiment, we found greater forgetting of object-scene pairs encoded between difficult visual discrimination trials (independently associated with default-network suppression) than those encoded between easier discrimination trials (independently associated with default-network activation). In the second experiment, participants encoded object-scene pairs before we examined the impact of simply reactivating already encoded memories in between easy or difficult perceptual discrimination tasks. We found greater forgetting of unpleasant scenes that were reactivated between difficult perceptual tasks compared to baseline scenes that were not reactivated at all. Crucially, this forgetting persisted even when scene memory was tested via independent cues that were not presented during the perceptual tasks, indicating degradation of the memory trace itself. Together, these findings indicate that memories encoded or reactivated around periods of intense perceptual focus are more likely to be forgotten, providing evidence for a novel mechanism of forgetting: mnemonic process inhibition via default-network modulation.

Topic Area: LONG-TERM MEMORY: Episodic

C46 - Repetition learning produces stronger and faster recollection during recognition

Chong Zhao[1] (chongzhao@uchicago.edu), Edward K. Vogel[1]; [1]University of Chicago

When people repeatedly study materials for a test, their memories often feel stronger and easier to recall. However, the neural mechanisms underlying repetition learning are not well understood. To explore this, we had participants study lists of 32 real-world objects five times. After each study exposure, we gave them a recognition memory test while we recorded their brain activity using EEG. We found that brain signals related to recollection (the parietal old-new effect) became stronger and faster with more repetitions. However, signals related to familiarity (FN400) showed no such changes after the first repetition. Behaviorally, participants performed exceptionally well, reaching 98% accuracy after five repetitions, which is similar to how people perform in simple working memory tasks involving just one item. To test whether these well-learned long-term memories resembled working memory in the brain, we trained a computer model to distinguish between patterns for working memory (a single-item list) and long-term memory (a full list of 32 items). Even after repeated testing, the brain patterns for long-term memory still looked more like initial long-term memory than working memory. Our findings show that repetition boosts memory strength by enhancing recollection signals in the brain, while familiarity remains unchanged. Despite similarities in performance, the brain's representation of these well-practiced long-term memories stays distinct from working memory.

Topic Area: LONG-TERM MEMORY: Episodic

C47 - Rethinking Vividness: Semantic moreso than perceptual features drive the recall vividness of complex pictures

Ricardo Morales-Torres[1] (ricardo.morales.torres@duke.edu), Simon W. Davis[1], Roberto Cabeza[1]; [1]Duke University

Humans have an astonishing capacity to generate mental images about past events. Moreover, people can easily report whether what appears in their "mind's eye" is clear and detailed or vague and sketchy. Although this is a ubiquitous experience, the cognitive mechanisms underlying these differences are not well understood. To investigate this issue, in Experiment 1, we examined how the subjective feeling of memory vividness relates to the perceptual (i.e., color and brightness) and semantic (i.e., the category of a stimulus) properties of naturalistic images. Surprisingly, our findings showed that while perceptual properties moderately contribute to the vividness of visual memories, the primary drivers of memory vividness are semantic properties. To further test this finding, in Experiment 2, we employed several Deep Neural Networks to construct representational spaces (geometric planes where similar stimuli are closer together) for our stimuli based on their perceptual or semantic features. Our results showed that semantic, but not perceptual, representations drive vividness ratings: more semantically distinctive stimuli were more vividly recalled. Our results shed light, at multiple levels of inference, on the influence of semantic properties in driving the vividness of mental representations of past events. These findings suggest that a vivid mental experience is shaped by what we know about the world, not just by how the world looks to us.

Topic Area: LONG-TERM MEMORY: Episodic

C48 - Ripples facilitate human memory consolidation by driving reactivation of learning-related neurons

Marcel S. Kehl[1], Florian Mormann[2], Bernhard P. Staresina[1]; [1]University of Oxford, [2]University Hospital Bonn

Sleep is fundamental for stabilizing newly formed memory traces, yet the neural mechanisms underlying this process remain elusive in humans. In rodents, hippocampal ripples drive consolidation of spatial information through coordinated reactivation of navigation-specific cells (e.g., place cells). However, the processes that support human memory consolidation remain poorly understood, particularly at the cellular level. Are neurons tuned to learned stimuli preferentially recruited in service of memory consolidation? To tackle this question, we recorded activity of more than 1,000 neurons in the human medial temporal lobe (MTL) during an associative learning task and tracked their activity throughout subsequent sleep. We found that MTL neurons exhibit robust reactivation during ripples, with significantly stronger activation during sleep ripples than during awake ripples. Notably, this reactivation was amplified when local ripple events co-occurred with other MTL ripples recorded in the same hemisphere. Importantly, neurons that were tuned to specific stimuli of the learning task coupled more strongly to ripples compared to other neurons. Again, this effect was particularly apparent during sleep ripples compared to awake ripples. Crucially, ripple-mediated reactivation was stronger in neurons whose preferred stimuli were successfully recalled compared to those neurons whose preferred stimuli were not successfully recalled, directly linking ripple-triggered reactivation to human memory performance. Together, these findings uncover a mechanism by which ripples recruit learning-related neurons to support memory consolidation during human sleep.

Topic Area: LONG-TERM MEMORY: Episodic

C49 - Emergence of Attentional Templates in Concept Learning and the Underlying Neural Mechanisms

Melisa Gumus[1] (melisa.gumus@mail.utoronto.ca), Wen Jia Zhao[1], Zoey Zhi Yi Lee[1], Michael L. Mack[1]; [1]University of Toronto

Attention optimizes learning, filtering relevant information to build conceptual knowledge. Despite prominent theories implicating attention during learning, it remains unclear how concepts stored in memory guide attention. We capture this phenomenon in attentional templates that emerge from learning, store goal-relevant representations, and aid attention allocation. Healthy young adults categorized complex visual items in two separate learning tasks. They then completed a test wherein each trial began with a cue, indicating which learning task should be employed. Random test trials included a probe instead of the visual stimulus; a small arrow appeared at a feature location that was relevant (i.e., valid) or irrelevant (i.e., invalid) for the cued task. Successful learners were faster at responding to valid probes than invalid, deploying concept-specific attentional templates that emerged from learning. Learning success determined the efficiency of attention allocation as the response time benefit was greater with higher learning accuracy. Neural mechanisms underlying attentional templates were then revealed with fMRI. Hippocampal representations exhibited task-specific shifts from pre- to post-learning consistent with the emergence of attentional templates. Higher learning performance led to greater representational shift, suggestive of efficient attentional allocation. Moreover, top-down signals controlled the deployment of attentional templates: parietal activation was associated with successful switching between learned concepts and the corresponding attentional templates. In conclusion, concept learning builds behaviourally relevant attentional templates that are modulated by top-down parietal signals and hippocampal representations. Concepts stored in memory guide attention, paving the way for understanding the complex relationship between learning, memory and attention.

Topic Area: LONG-TERM MEMORY: Episodic

C50 - Complex Experiences Are Represented as a Subset of Key Moments Which Capture the Underlying Semantics

June-Kyo Kim[1] (junekyo.kim@mail.utoronto.ca), Aditya Upadhyayula[2], Jeffrey M. Zacks[2], Alexander Barnett[1,3], Zachariah M. Reagh[2]; [1]University of Toronto, [2]Washington University in St. Louis, [3]McGill University

Recent work has used a Storyboard task to show that people represent and remember complex experiences as a sequence of key moments (KMs). These KMs capture distinct information compared to event boundaries, and could provide novel insights into event cognition. However, the nature of KMs and their significance remains to be fully explored. We tested whether the KMs capture meaningful semantic information pertaining to the underlying experience using topic modeling, using an episode of BBC's Sherlock. This dataset was annotated in detail, describing scene and dialogue in segments spanning every few seconds. In addition, we also used spoken recall transcribed from the 17 participants from an open access fMRI dataset to train the topic model, and then fit the movie annotations to the trained model. This produced a vector of topic activations that represents the abstract concepts present in the annotations for each event. To calculate the significance of each segment, we used a "lesion" approach where we systematically deleted each segment and correlated the resulting vector of topic activations to the original topic model. These lesioned correlations were then compared to the event boundary and storyboard probabilities calculated for each segment. The segments likely to be KMs, when lesioned, resulted in a significant drop in the topic model correlation (above and beyond event boundaries). Additionally, permutation analyses revealed that KMs were associated with important semantic elements in the narrative more so than would be expected by chance. This suggests that KMs capture meaningful semantic information about the underlying experience.

Topic Area: LONG-TERM MEMORY: Episodic

C51 - Reactivating spatial memories during sleep using multi-sensory cueing and an immersive virtual environment

Gautam Narayan[1,2] (narayag1@uci.edu), Amit Sofer[3], Katharine C. Simon[2,4,5], Evelyn M. Le[1,2], Hansen Zhang[1,2], Matthew Cho[1,2], Anat Arzi[3], Eitan Schechtman[1,2]; [1]Department of Neurobiology and Behavior, University of California Irvine, Irvine, California, USA, [2]Center for the Neurobiology of Learning and Memory, University of California Irvine, Irvine, California, USA, [3]Department of Cognitive and Brain Sciences, Hebrew University of Jerusalem, Jerusalem, Israel, [4]Department of Pediatrics, University of California Irvine, Irvine, California, USA, [5]Pulmonology Department, Children's Hospital of Orange County (CHOC), Orange, California, USA

Sleep plays an active role in the consolidation of memories. During sleep, the neural traces supporting newly formed declarative memories are spontaneously reactivated. Targeted memory reactivation (TMR) is a technique that uses non-invasive sensory cues, such as odors or sounds, to preferentially reactivate associated memories during sleep. One avenue of TMR research that has not yet been explored involves the combined use of odors and sounds to selectively enhance memories. Here, we examine the interactive effects of multi-modal reactivation cues during sleep on consolidation in a realistic first-person memory task. We used the Minecraft Memory and Navigation task, a first-person, engaging spatial task that demonstrates sleep's contribution to spatial memory (Simon et al., 2022). Following memory encoding of unique locations and the environment which we enriched with odors and sounds, we reactivated the encoded memories during NREM sleep using the odors, sounds, or both. We hypothesized that rich, multisensory synergetic reactivation during sleep, compared to the unisensory reactivation, would maximally benefit spatial memory recall. Additionally, we explored the effect of different cueing regimes on sleep spindles and slow oscillations during NREM sleep. Our study reveals the contribution of memory consolidation during sleep to real-life spatial memories, and provides insight into whether multisensory cueing has synergistic, additive, or competitive benefits for consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C52 - Event boundary-elicited neural activities correlate with recent and remote memory

Zexuan Mu[1] (evokee@connect.hku.hk), Jing Liu[2], Xiaoqing Hu[1]; [1]The University of Hong Kong, [2]The Hong Kong Polytechnic University

Although experience unfolds continuously, memories are structured into discrete events through the detection of event boundaries. However, the neural mechanisms of how individuals encode different types of event boundaries during naturalistic episodes, and how boundary-elicited neural activities contribute to long-term memory remain poorly understood. Here, we presented forty-five participants (Mage = 22.31, SD = 2.73) with 60 movie clips, each 23 seconds long, while electroencephalogram (EEG) were recorded. The clips comprised three conditions: no-boundary, soft-boundary (perceptual shift), and hard-boundary (perceptual + conceptual shift), with 20 clips in each condition. Recent and remote memory was assessed immediately, and 7 days after encoding using cued verbal recall tasks. To assess memory, independent raters listened to participants' verbal recall for each clip and rated the richness of accurately recalled content. We found that, compared to the no-boundary condition, soft and hard boundaries elicited significant EEG power increases in theta (4-7 Hz), beta (13-25 Hz), and low-gamma (26-30 Hz) frequency bands. Further linear mixed-effects model analyses revealed that soft-boundary-elicited beta power was negatively correlated with the rating differences (post-boundary minus pre-boundary) for remote, but not for recent, memories. In addition, hard-boundary-elicited theta power was positively correlated with ratings of remote, but not for recent, memories. The findings suggest that during naturalistic events encoding, boundary-elicited EEG power distinctly predicts remote memories. This study provides novel insights into how people encode different event boundaries in naturalistic experiences and how such encoding impacts subsequent memories of naturalistic events.

Topic Area: LONG-TERM MEMORY: Episodic

C53 - Neural Dynamics of Sequential Task Simulation in the Human Brain

Nicholas Menghi[1] (menghi@cbs.mpg.de), Simone Viganò[1,2], Ceren Eksi[3], Julia Hofschildt[1], Christian Doeller[1,4]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [2]Center for Mind/Brain Sciences, University of Trento, Rovereto, Italy, [3]La Sapienza University, Rome, Italy, [4]Kavli Institute for Systems Neuroscience, the Egil and Pauline Braathen and Fred Kavli Centre for Cortical Microcircuits, Jebsen Centre for Alzheimer's Disease, NTNU Norwegian University of Science and Technology, 7034 Trondheim, Norway

Our daily lives often involve navigating complex sequences of events that rely on diverse skills organized in a precise temporal order. Each task requires the recruitment of specialized brain regions in a coordinated sequence. How does the brain orchestrate the temporal dynamics underlying such sequential mental simulations? To address this question we trained participants to memorize three sequences of audio-visual-motor material, each involving specific cortical modules activated in a particular temporal order. Participants rehearsed these sequences mentally using word cues and verified their memorization by identifying whether two stimuli appeared in the correct sequence. We recorded whole-brain activity using MEG, both during the main task as well as during a functional localizer aimed at independently identifying the regions involved in sensory-motor representations. Preliminary analysis of the localizer data revealed the recruitment of visual, motor, and auditory areas, which aligned with the corresponding sensory and motor stimuli. This will provide Regions of Interest for studying the dynamics of neural activity during sequence rehearsal. More specifically, planned analyses will investigate 1) the decoding of different sequences at the sensor and source level, 2) the sequential reactivation of the sensory-motor regions during the main task, and 3) whether this reactivation is modulated by associative regions in medial temporal and parietal lobes. These results will be paired with a parallel fMRI study on the same paradigm, to comprehensively elucidate the spatio-temporal dynamics of sequential mental simulation.

Topic Area: LONG-TERM MEMORY: Episodic

C54 - The subiculum represents semantic boundaries for efficient temporal organization of verbal episodic memory

Jung Han Shin[1] (cautiousjh@snu.ac.kr), Sang Ah Lee; [1]Seoul National University

The human brain can efficiently remember a vast number of experiences through hippocampal segmentation of episodic memories at event boundaries. Crossing event boundaries has been reported to enhance within-context memory and perturb across-context memory. However, studies vary widely on what constitutes an event boundary, ranging from perceptual to semantic changes. Given the importance of semantic information in human cognition, we investigated how semantic boundaries impact the segmentation and temporal organization of episodic memory and its cortico-hippocampal neural correlates. 94 participants memorized ten-word sequences, followed by temporal order judgment tasks during fMRI scanning. In no-boundary trials, all words belonged to a single semantic cluster based on Word2Vec embeddings, whereas in boundary trials, the sequence crossed semantic clusters in the middle. Behavioral results showed that semantic boundaries enhanced temporal order memory accuracy, especially for across-boundary judgments. Accurate memory for higher temporal distances was observed only in within-boundary judgments, indicating the role of semantic boundaries in creating event hierarchies. Semantic boundaries elicited increased activation in cortical regions associated with event boundary detection during encoding, but exhibited reduced orbitofrontal engagement during retrieval, indicating more efficient recall. Within the hippocampus, the subiculum exhibited significant changes in representational pattern dynamics at boundary-crossing. Similarly, the subiculum showed higher pattern similarity for across-boundary judgments compared to within-boundary judgments, highlighting its role in contextual information processing. Our findings demonstrate that semantically driven event boundaries enhance temporal order memory by facilitating the hierarchical chunking of episodes, with the subiculum playing a critical role in event boundary and context processing.

Topic Area: LONG-TERM MEMORY: Episodic

C55 - Representation of spatial boundary-dependent episodic memory segmentation in the human subiculum

Hye Ja Kang[1] (piotwo412@snu.ac.kr), Jung Han Shin[1], Yu Jin Rah[1], Sang Ah Lee[1]; [1]Seoul National University

To efficiently remember long and complex episodes, it is useful to segment them into smaller chunks. Previous studies have shown that sharp contextual changes mark event boundaries that are processed by the hippocampus. Here we investigated the change in hippocampal representations across a spatial boundary within a single context (without a sharp contextual shift) and its potential role in the adaptive segmentation and organization of episodic memory. 61 participants in the fMRI scanner watched as five objects were placed into baskets scattered around a virtual room; after a delay, they re-enacted the episode using a controller. In the boundary condition, a low spatial boundary divided the room into two sides, with half of the event sequence occurring on one side and the other half on the other. First, we found that the event immediately following boundary crossing was better remembered compared to an event in the same temporal position in the no-boundary condition. During encoding, activation in the subiculum was significantly higher in the boundary than in the no-boundary condition. Furthermore, boundary and no-boundary trials showed different neural pattern similarity dynamics upon“crossing” the boundary. The difference between pre-and post-boundary event representations across conditions was positively correlated with the degree to which the spatial boundary improved memory. These findings suggest that crossing a spatial boundary induces representational changes in the subiculum that signify the organization of experience into discrete segments in episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

C56 - Age-Related Changes in the Cortical Replay of Landmark-Based Navigational Episodic Memory

Jeonghyun Lee[1] (jeonghyun.lee@snu.ac.kr), Sang-Eon Park[1], Sang Ah Lee[1]; [1]Seoul National University

How does the human brain replay memories of navigational sequences, and how does the retrieval of spatial information from a mental map of the environment contribute to this process? To examine the EEG correlates underlying map-based memory replay, we conducted a passive navigation task in which subjects were navigated through a virtual environment containing either proximal landmarks, distal landmarks, or uninformative buildings. The navigation episode included several turning events before reaching the final destination. Subjects were subsequently asked to identify the correct route or destination while viewing an overhead map. We recorded scalp EEG and eye-gaze during navigation (encoding) and map-viewing (retrieval) phases in younger (age: 20–44, n=27) and older subjects (age: 45–65, n=35). During retrieval, EEG activity in younger subjects showed a replay-like pattern of the turn events that comprised the episode, characterized by a transition from stronger reactivation of earlier turns to later turns over the retrieval period. The replay index (measuring linear changes in this temporally sequenced reactivation bias) correlated with memory performance, and was notably higher in conditions that included distal landmarks compared to other conditions. Older adults, in contrast, did not show a replay pattern during retrieval nor its correlation with memory performance. Across all participants, we found that distal landmarks (both across conditions and in the reactivation of landmark-related EEG activity) affected overall memory performance, mediated by the replay index. These findings suggest that distal landmarks during navigation enhance the formation of map representations and may facilitate mental replay during retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

C57 - Confirmed or disconfirmed – predictions pay off for memory retention

Regine Bader[1] (regine.bader@mx.uni-saarland.de), Samira Engels[1], Mecklinger Axel[1]; [1]Saarland University, Germany

Predicting upcoming information is fundamental for language comprehension, but its impact on long-term retention is less well understood. In strongly constraining (SC) contexts, such as "The birthday party was over, and Helene wanted to go home. She ordered herself a taxi," the target ("taxi") is expected because it aligns with prior knowledge (schema). Schema-based memory theories suggest that predicted information is better remembered due to this alignment. Alternatively, predictions that merely confirm expectations might be pro-cessed superficially, weakening retention. In contrast, unpredicted information may be es-pecially memorable due to prediction errors (PEs), which signal mismatches and prompt updates to the current situation model. Research on the memory effects of confirmed versus disconfirmed predictions has produced mixed results. One important factor might be if unexpected information can plausibly be integrated into the context (e.g., "some food" for the example above) or is anomalous ("a pillow"). Moreover, a comparison with a baseline condition, where minimal predictions are possible, is necessary. Weakly constraining (WC) contexts, like "Mathilde knew exactly what she wanted to do next. She ordered herself a taxi," are a suitable baseline as they minimize target predictability. In our study, participants read WC contexts and SC contexts, where the target was either expected, unexpected but plausible, or anomalous. After a 3-minute retention interval, participants discriminated old targets from new words. We found that predicted and unpredicted targets (plausible or anomalous), were better remembered than targets in WC contexts. Thus, both schema congruency and PEs during language comprehension enhance long-term memory formation.

Topic Area: LONG-TERM MEMORY: Episodic

C58 - Sleep predicts a hippocampal-cortical shift during memory recall

Mathew Thomas Kollamkulam[1] (mathew.thomaskollamkulam@psy.ox.ac.uk), Simon Faghel-Soubeyrand[1], Katrijn Schruers[1], Bernhard Staresina[1]; [1]University of Oxford

Consolidation theory proposes that sleep supports a shift in memory processing from the hippocampus to cortical regions. This study tests this hypothesis and examines the role of sleep architecture in consolidation. In a combined EEG-MRI experiment, participants completed an object-scene associative memory task. Half the stimuli were tested in the evening before sleep (PM session) and the other half in the morning after sleep (AM session). Behavioural results confirmed expected overnight forgetting, albeit at different rates across participants. Univariate fMRI analyses revealed session-dependent differences in brain activity during successful compared to unsuccessful recall (recall effect). Hippocampal and ventral visual cortex recall effects decreased in the AM session compared to the PM session, consistent with reduced hippocampal involvement and decreased vividness after sleep. Conversely, enhanced recall activity was observed in medial prefrontal regions during the AM session, consistent with prior findings. Importantly, the proportion of time spent in non-rapid eye movement (NREM) sleep correlated with both better memory performance and hippocampal activity modulation, highlighting the role of NREM sleep in memory consolidation. Together, these findings suggest a link between hippocampal-cortical activity changes, sleep architecture, and behavioural measures of memory consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C59 - Marking the Moments: ERP Evidence of Event Boundaries Enhancing Memory Formation in Narratives

Doruntinë Zogaj[1] (doruntine.zogaj@uni-saarland.de), Regine Bader[1], Axel Mecklinger[1]; [1]Saarland University, Germany

While event boundaries are known to enhance episodic memory, their influence on neural predictive processing and memory remains unclear. This study used ERPs to investigate the online processing of event boundaries during narrative comprehension, focusing on predictive processing and memory effects in naturalistic contexts. Participants listened to short stories (e.g., going to the supermarket). A critical word in the third sentence indicated either a predictable (no-boundary) or an unpredictable action (boundary), followed by two sentences confirming the action. EEG was recorded during listening, and memory was assessed with an old/new recognition task for the two words preceding the critical words, the critical words themselves, and new words. Memory was enhanced for the critical words in the boundary condition (BC) for high-confidence responses. As predicted, critical words in the BC elicited a larger N400 than in the no-boundary condition (NBC). In the BC, the ERPs to subsequently remembered critical words in the N400 time interval were more negative going than those to forgotten ones, an effect which was absent in the NBC. Notably, the ERPs elicited by the critical words showed a larger negativity for preceding words that were subsequently remembered compared to non-remembered ones. This retrograde subsequent memory effect was absent in the NBC. These findings suggest that detecting event boundaries in narratives triggers semantic processing, which supports memory formation for boundary events and pre-boundary information. Our study provides new insights into the role of event boundaries during the segmentation of continuous experiences and the shaping of episodic memory representations.

Topic Area: LONG-TERM MEMORY: Episodic

C60 - Integration and differentiation of object representations based on contextual association across the medial temporal lobe subregions

Ji Sun Kim[1] (kimjisun1006@gmail.com), Jae Min Seol[1], Choong-Hee Lee[2], Inah Lee[1], Sang Ah Lee[1]; [1]Seoul National University, [2]Institute for Basic Science (IBS), Suwon, Korea

Episodic memory is constructed by binding together the representation of objects with that of the spatial context. While increased neural representational similarity between items sharing the same context is useful for memory integration, differentiating between them is also important for memory precision. To explore how the medial temporal lobe (MTL) balances these complementary processes, 30 participants were trained on object-place associations across four transparent VR houses surrounded by distinct distal landmarks. The next day, they performed an fMRI task in which they saw each object presented on a blank screen and then navigated to the associated house. We compared representational similarity between objects from the same vs. different house (as well as corners and views). Memory performance was correlated with increased representational similarity between objects from the same house in the entorhinal cortex (EC) but with decreased representational similarity in the perirhinal cortex (PRC) and subiculum. These findings suggest complementary roles of integration across shared contexts in the EC and differentiation of objects in the PRC for memory binding in the hippocampus. Differentiation in the PRC, subiculum and CA3DG was also correlated with memory for objects sharing similar landmark views. Conversely, at finer spatial scales (corners within houses), integration in the posterior CA1 facilitated better memory retrieval, consistent with its role in associative memory and fine-grained spatial processing in the posterior hippocampus. These findings demonstrate the importance of both integration and differentiation underlying episodic memory, with distinct MTL subregions specializing in binding objects across contexts at different spatial scales.

Topic Area: LONG-TERM MEMORY: Episodic

C61 - Transcranial Direct Current Stimulation interferes with access and consolidation of weak episodic memories

Shawn Hiew[1] (shawn.hiew@unibe.ch), Konstantinos Ioannis Zervas[1], Katharina Henke[1]; [1]University of Bern

The ability to recall past events depends upon the strength and content of the memory traces which are determined as they are being formed, and which continue to be modifiable throughout the path of the memory trace until it is ultimately forgotten. In the present study, we perturbed different key processes of episodic memory, namely encoding, re-encoding, reconsolidation and retrieval, in order to uncover the key contributors to forgetting. 120 healthy young subjects received transcranial direct current stimulation (tDCS) targeting the right medial temporal lobe (MTL) during an episodic memory task. Participants form 96 face-object associations, which later, when presented with face cues, they retrieve indicating the category of the associated object (natural or man-made). They either receive real or sham tDCS, at one of three time points: encoding, early retrieval (30 mins), and late retrieval (24 hrs). A final retrieval – without brain stimulation - took place one week following encoding. TDCS applied at early retrieval enhanced the subjective memory quality reflected by enhanced clarity of scene retrieval and confidence of object category judgements. Compared to sham, anodal tDCS at early retrieval worsened the accuracy of object category judgements at all retrieval time points. TDCS applied at encoding and late retrieval had no effect on memory performance. Hence, tDCS may have interfered with the restabilization of memory traces as they are retrieved for the first time. Our findings suggest that memories are most vulnerable to interference during initial re-encoding and reconsolidation before their overnight consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C62 - Attentional Breadth Modulates Trade-offs in Memory Precision

Hannah Tarder-Stoll[1] (htarder-stoll@research.baycrest.org), Asaf Gilboa[1], Morris Moscovitch[1]; [1]Rotman Research Institute, Baycrest Hospital

Attention strongly influences what we remember. The breadth of attention–focusing on either a broad or narrow area of the environment—can fluctuate depending on behavioural goals. However, little is known about the consequences of such attentional fluctuations for memory. We hypothesized that the extent of attentional breadth would influence memory precision, such that broader attentional states at encoding would lead to less precise memories. Participants (N = 64) were cued to attend to narrow or broad sections on a screen. They then encoded objects and their spatial locations while making judgements about the object's location, relative to the cue. After, participants completed two memory tests: a location memory test and an object memory test. Location memories were less precise and more dispersed when they were encoded in a broad attentional state, compared to a narrow state. In contrast, object memories were more precise in the broad vs. narrow attentional state. This object memory enhancement may reflect increased incidental encoding of information not relevant to the behavioral task at encoding, which emphasized spatial location. Together, these findings suggest that broader attentional states reduce the precision of task-relevant memories but enhance encoding of peripheral, task-irrelevant details. These findings provide insight into the nuanced relationship between states of attentional breadth and their consequences for memory precision, depending on the relevance of the encoded information to behavioral goals.

Topic Area: LONG-TERM MEMORY: Episodic

C63 - Executive control deficits and memory brain state engagement in healthy aging

Hannah Buras[1] (hb2mn@virginia.edu), Subin Han[1], Nicole Long[1]; [1]University of Virginia

Healthy older adults exhibit both selective impairments in episodic memory, memory for events situated within a specific time and place, and deficits in executive function, reflected by difficulty switching between tasks and inhibiting task-irrelevant information. Based on our prior work, we hypothesize that episodic memory deficits in healthy aging may be due to older adults' difficulty switching out of an automatically induced, task-irrelevant retrieval state when their top-down goal is to encode. Our aim in the present study is to determine the extent to which stimulus processing time impacts memory state engagement, with the expectation that longer, compared to shorter, stimulus durations will enable older adults to switch into a task-relevant encoding state. We collected scalp electroencephalography data while conducting a mnemonic state task in which we explicitly biased younger and older adult participants to engage either an encoding or retrieval state based on trial-varying instructions. Our preliminary behavioral data replicate our past findings that both age groups can selectively encode vs. retrieve in response to top-down instructions. However, we find significant dissociations in mnemonic brain state engagement across age when we account for stimulus duration. Specifically, at the shortest stimulus duration (1000 ms), we find that when directed to retrieve, younger adults show stronger engagement of the retrieval state compared to older adults. We had anticipated finding dissociations specific to encode, rather than retrieve, trials; this surprising finding suggests that older adults may have a domain-general difficulty in switching between memory brain states.

Topic Area: LONG-TERM MEMORY: Episodic

C64 - Phenomenological and biophysiological differences between forgiven and not forgiven remembered wrongdoings

Gabriela Fernández-Miranda[1] (gabriela.fernandez@duke.edu), Leonard Faul[2], Caroline Howard[1], Annika Socia[1], Kaylee Miceli[1], Kevin LaBar[1], De Brigard Felipe[1]; [1]Duke University, [2]Boston College

Forgiveness is a valuable tool for overcoming negative emotions and healing relationships after interpersonal conflict. However, the cognitive mechanisms underlying this process remain unclear. Recent evidence suggests that forgiving involves a process of emotional fading, such that remembering wrongdoings is experienced with less negative valence and lower emotional intensity, while the episodic details of the memory are not forgotten[1]. In this study, we used self-report and psychophysiological measures to evaluate emotional responses and the recollection of episodic details of remembered wrongdoings as a function of forgiveness. Using a within-subject design, participants were asked to silently recall two neutral memories and two memories of wrongdoings while measuring electrodermal activity (EDA), and corrugator and zygomaticus electromyography (EMG). We also assessed their recollective experiences and degree of forgiveness toward the perpetrators with self-report. Using both, biophysiological and self-report measures, we found that memories of wrongdoings, compared to neutral memories, have greater negativity and higher emotional intensity associated with the time of the event and during recall. However, no differences were observed in the recollection of episodic details. Critically, and consistent with the emotional fading view, memories of forgiven wrongdoings were recalled with less negative valence compared to unforgiven wrongs. Yet, once again, we found no difference in the recollection of episodic details. We discuss the implications of these results for extant psychological theories of forgiveness and suggest possible memory mechanisms that may underlie people's tendencies to emotionally reassess their memories of past wrongdoings when forgiving perpetrators.

Topic Area: LONG-TERM MEMORY: Episodic

C65 - Understanding the mechanisms of lateral parietal memory modulation in Mild Cognitive Impairment

Matthew Slayton[1] (matthew.slayton@duke.edu), Margaret McAllister[2], Kirsten Gillette[1], Emily Finch[1], Jane Rothrock[1], Roberto Cabeza[1], Simon Davis[1]; [1]Duke University, [2]University of North Carolina Chapel Hill

Alzheimer's Disease is characterized by progressive impairment of cognition and memory, including the loss of episodic memory. An ongoing question in the field of memory neuromodulation is whether the memory benefit of Theta-Burst Stimulation (TBS) occurs in parietal cortex at the stimulation site or downstream in hippocampus. The current project seeks to address how the underlying visual and semantic information coded in the brain changes as a function of a parietal TBS over the course of three repeated TBS and subsequent neuroimaging sessions. We used Representational Similarity Analysis (RSA), to evaluate whether behavioral improvements in perceptual and conceptual memory are driven by the modulation of visual or semantic information in the brain. Consistent with the role of lateral parietal cortex as a hub for the processing of abstract knowledge, we show that semantic (but not visual) representations show greater TMS-related changes in left inferior parietal lobule and are associated with improvements in conceptual memory success. While we found enhanced semantic and visual representations in regions that support vision and memory, this effect applied to both conceptual and perceptual memory performance. These results suggest that lateral parietal TMS enhances the processing of semantic information in a way that supports conceptual memory specifically. We propose that site showing the biggest effect depends on the type of memory, and that both parietal cortex and inferior temporal cortex are affected by the stimulation. Such findings suggest an underlying mechanism by which neuromodulation may improve episodic memory in healthy aging and MCI.

Topic Area: LONG-TERM MEMORY: Episodic

C66 - Exploring the link between self-reported episodic memory traits and differences in episodic memory content and retention across time

Catalina Yang[1] (catalina.yang@mail.utoronto.ca), Quynh Nguyen[1], Nicole Yuen[1], Morgan Barense[1,2], Katherine Duncan[1]; [1]University of Toronto, [2]Rotman Research Institute

People significantly differ in how they remember past events. Some recall events in vivid, detail-rich ways, while others recall events in a more implicational and semantic way. These individual differences have been posited to reflect trait-level autobiographical memory abilities. The Survey of Autobiographical Memory (SAM) is a widely used tool for assessing trait mnemonics, which reliably assesses self-perceived recollective and visual imagery abilities. However, it remains unclear how the SAM, particularly its episodic sub-score, relates to objective measures of autobiographical and episodic memory. The current study investigates whether self-reported trait mnemonics on the SAM predict 1) the quality and quantity of a person's episodic memories for naturalistic video stimuli and 2) differences in memory retention patterns over short versus long delays. In our ongoing study (n=40/100), we administer the SAM and six other meta-memory and psychometric questionnaires. We test episodic memory using a three-part, within-in-subjects design task, where participants first view 30 brief narrative videos. After a short delay (30 min), participants complete a structured verbal memory interview on the contents of half of the videos. Then participants return after a long delay (2 weeks) to complete another interview on the remaining videos. To analyze our large free recall dataset, we will use LLMs to score how accurately people recall different types of details and then validate model outputs by comparing them with manually scored response. We expect our results to elucidate how self-reported trait mnemonics relate to episodic memory contents, and their qualitative and quantitative changes at different delays.

Topic Area: LONG-TERM MEMORY: Episodic

C67 - Reactivation of cortical representations predicts vividness and precision of objects' color and location

Xinhao Wang[1] (xinhao.wang@hu-berlin.de), Simon Davis[2], Roberto Cabeza[1,2]; [1]Humboldt University of Berlin, [2]Duke University

Several representational fMRI studies have shown that the similarity of multivariate activation patterns during encoding and retrieval (Encoding-Retrieval Similarity, ERS) predict memory performance. These studies typically focused on whether a particular item is encoded (item memory). In the current ERS study, in contrast, we examined relational memory for specific object features, color and location, and measured also memory precision. Participants encoded everyday objects presented in an arbitrary color and location, and later they were presented with the objects in greyscale in the center of the screen and asked to recall either the original color or location. For the target feature, subjects first rated the vividness of their feature memory and then reported the feature along a continuous scale. We calculated the ERS for each pair of encoding and retrieval trials. Mixed-effect linear models were used to assess the relation between ERS and memory quality on a trial-by-trial basis. Overall, successful feature memory was predicted by ERS in visual cortex and lateral prefrontal cortex. Interestingly, we found a dissociation between subjective vividness and objective precision: whereas vividness was predicted by ERS in prefrontal and temporal cortices (color>location), precision was predicted by ERS in visual cortex (location>color). To our knowledge, this is the first study to investigate the relation between ERS and relational memory for object features. We observed a dissociation between the neural substrates for vividness and precision, and a further dissociation between color and location information. Taken together, the results clarify the neural mechanisms of relational memory for object features.

Topic Area: LONG-TERM MEMORY: Episodic

C68 - The influence of shared age identity on the specificity of autobiographical memory

Bryan Hong[1] (bryan.hong@mail.utoronto.ca), Jialin Du[1], Kailin Summers[2], Morgan Barense[1,3], Signy Sheldon[2]; [1]University of Toronto, Toronto ON, Canada, [2]McGill University, Montreal QC, Canada, [3]Rotman Research Institute, Toronto ON, Canada

When recalling events from one's personal past, older adults typically generate fewer specific episodic details and more general non-episodic details than younger adults. Although these differences in autobiographical recall tend to be attributed to age-related structural and functional changes in the brain, other factors may potentially contribute. For example, past research has demonstrated how similarities and differences in social characteristics between communication partners can affect how we recall memories—this may be especially pertinent given that many studies investigating autobiographical memory in aging use paradigms involving interviews. In the current study, we investigate whether shared age identity between communication partners may influence the specificity of autobiographical recall. Here, we analyzed a dataset from an online study where younger (n = 71) and older (n = 72) adult participants recalled past events to fictional younger and older adult listeners. We then used the Autobiographical Interview scoring protocol to quantify the amount of episodic and non-episodic detail from participant responses. We found that shared age identity between communication partners had an effect on memory recall, with older adults tending to produce fewer episodic details when recalling an event to a younger adult listener. These results demonstrate how considering social factors, in addition to age-related changes in the brain, can provide a more fulsome understanding of autobiographical memory across the lifespan.

Topic Area: LONG-TERM MEMORY: Episodic

C69 - Examining neural representations of perceptual and semantic false memories in younger adults.

Luke Dubec[1] (lxd5406@psu.edu), Rebecca L. Wagner[1], John T. West[1], Nancy A. Dennis[1]; [1]The Pennsylvania State University

The aim of the current research was to examine common and distinct neural factors contributing to false memories across memory domains. To investigate this question, 30 younger adults underwent fMRI while completing perceptual and semantic memory tasks designed to induce false memories for related lures at retrieval. Specifically, retrieval stimuli were divided into items re-presented from the encoding phase (targets) and new items that were perceptually similar or semantically related to targets (lures). Based on previous work (Kurkela & Dennis, 2016), neural activity in frontal and parietal regions associated with domain-general cognitive processes was expected to influence false memory production, irrespective of memoranda. A univariate conjunction analysis of false alarms greater than hits was conducted to determine overlap of activity associated with false memories in both domains. Results were consistent with a prior meta-analysis from Kurkela & Dennis (2016) with common false memory activity observed in medial prefrontal cortex (mPFC) and inferior parietal cortex (IPC). Representational similarity analyses (RSAs) were conducted in these regions to examine if the neural patterns associated with perceptual and semantic false memories within these regions were also represented in a generalized manner. Results showed that despite similar increases in univariate activation, the mPFC and IPC display unique patterns of activity for false memories arising from each domain. These results expand our understanding of the neural representations of false memories and are a necessary step toward a more textured understanding of how false memories are produced and how they can be avoided.

Topic Area: LONG-TERM MEMORY: Episodic

C70 - Episodic and semantic memory contributions to imagination and creativity: Insights from eye-tracking

Preston Thakral[1] (pthakral@smith.edu), Kevin Madore[2], Aleea Devitt[3]; [1]Smith College, [2]Lumos Labs (Lumosity), [3]University of Waikato

The ability to generate novel creative ideas (divergent thinking) is closely linked with our ability to imagine novel future events (episodic simulation). Here, we employed an individual differences approach to examine whether divergent thinking and episodic simulation are differentially associated with the ability to retrieve episodic and semantic memory content. In response to object word cues, participants generated meanings and definitions (semantic memory), remembered a past event (episodic memory), imagined a novel future event (episodic simulation), or generated novel uses (divergent thinking). We monitored eye-movements during these tasks to gain insight into the mnemonic processes that might link these four abilities. Replicating previous findings, divergent thinking ability was predicted by the number of episodic details generated during episodic simulation, but not the number of episodic details generated during episodic memory. When directly comparing episodic and semantic memory, the strongest predictor of divergent thinking was semantic memory. However, episodic details during episodic simulation were predicted by the amount of details during both episodic and semantic memory. These behavioral findings indicate that during divergent thinking, retrieval is weighed more towards semantic relative to episodic memorial content. Episodic simulation, however, is associated with a relative equal balance of episodic and semantic memorial content. When examining eye-movements, pupil dilation tracked divergent thinking ability and the number of episodic details during episodic memory and simulation, but not semantic memory. These findings suggest that examining pupillometry is a promising direction for future research as it can identify common episodic processes not visible with behavior alone.

Topic Area: LONG-TERM MEMORY: Episodic

C71 - Targeted memory reactivation during wakefulness improves spatial recall under challenging retrieval conditions

Gayathri Subramanian[1] (gayathrisubramanian2024@u.northwestern.edu), Ken Paller[1]; [1]Northwestern University

Recently acquired memories can be reactivated and altered using Targeted Memory Reactivation (TMR) during sleep. TMR studies have thus revealed new information about consolidation. The present research sought to contrast TMR during sleep and wake. Participants learned 60 object locations while listening to object names (e.g.,"cat"). After learning the locations, participants were given a location recall test. Wake TMR was accomplished by presenting half of the object names with instructions to mentally recall the corresponding locations. Comparing recall accuracy from before to after TMR revealed no significant difference. Whereas this experiment occurred within a single session, a second experiment was run in three sessions over two days. In the TMR session, which was run 60 minutes after learning, 10 participants were asked to covertly recall locations (as in the prior experiment) and 10 to overtly place objects in their locations. The next day, all participants learned new locations for the same set of objects. Next, they were tested on the original locations. The challenge of recalling locations following a 1-day delay with interference learning was predicted to increase the likelihood of memory improvement from reactivation. Indeed, we observed a strong TMR benefit on recall accuracy. Furthermore, there was a nonsignificant trend for a larger benefit with overt compared to covert reactivation. These results help to define the boundary conditions for observing wake TMR benefits. We conclude that TMR during wakefulness may alter memory storage by counteracting forgetting in ways that are more likely to be apparent under challenging retrieval conditions.

Topic Area: LONG-TERM MEMORY: Episodic

C72 - Evaluating the role of left ventral premotor cortex in bodily self-consciousness and autobiographical memory

Utkarsh Gupta[1,2], Peter Bright[2], Alex Clarke[3,4], Lily Vissouze[5,6], Varvara Belova[2], Abin Andrews[2], Jane E. Aspell[2]; [1]University of North Dakota, [2]Anglia Ruskin University, [3]University of Cambridge, [4]University of Warwick, [5]Sorbonne University, [6]University of Paris

Autobiographical memories are memories of personal semantic knowledge and episodic experiences. Given that there is sensory input from the body during all life events raises the question of whether a representation of our bodily self is inherent in our episodic autobiographical memories. In keeping with this, we predicted that embodiment of a child-like body would enhance the recollection of episodic childhood autobiographical memories. Representations of the bodily self rely on multisensory and sensorimotor integration in brain areas including the left ventral premotor cortex. We first investigated if stimulation to left ventral premotor cortex increased the strength of embodiment of a child's body during a virtual reality based full body illusion experiment. We hypothesised that activation of the left ventral premotor cortex by anodal transcranial direct current stimulation would result in a stronger illusion of embodiment of the child's body (compared to sham stimulation). We further investigated if changes in embodiment affected the participants' ability to recollect childhood autobiographical memory, consistent with a link between bodily self and autobiographical memory. We did not find any significant differences in the strength of embodiment and autobiographical memory scores, suggesting that the bodily self is not solely dependent on left ventral premotor cortex involvement. However, we observed a positive correlation between the child's body ownership experience scores and episodic childhood autobiographical memory scores only following anodal stimulation and not sham stimulation. The study provides initial evidence for the involvement of the left ventral premotor cortex in the interaction between bodily self and autobiographical memory.

Topic Area: LONG-TERM MEMORY: Episodic

C73 - Effects of Psilocybin on Brain Representations of Movies

Brian Winston[1] (bwinsto2@jh.edu), Gabi Lofland[2], Janice Chen[1], Frederick Barrett[2]; [1]Johns Hopkins University, [2]Johns Hopkins School of Medicine

The classic psychedelic drug psilocybin is known to perturb the functional landscape of the human brain during unconstrained perception and cognition. However, the degree to which psilocybin alters processing of naturalistic, multi-modal stimuli is not well characterized. We sought to investigate whether psychedelics alter brain representations of real-world content in sensory, associative, and/or high-level brain regions. 12 participants (of a planned 30) watched nine short audiovisual movies totaling one hour while undergoing functional MRI during the acute effects of 10mg psilocybin and placebo administered at separate visits. Movies were segmented into events by human raters. To examine how psilocybin influences brain representations of movie content across the cortical processing hierarchy, intersubject pattern correlation (pISC) of event-wise multivoxel patterns (MVPs) were calculated and averaged across events separately for the placebo and psilocybin scans. The correlation between each subject's MVP and the remaining group's average MVP in primary auditory and visual cortices (A1, V1), posterior-medial cortex (PMC), medial prefrontal cortex (mPFC) and angular gyrus (AG) were averaged across events and movies and compared between drug conditions using two-tailed t-tests. pISC was reduced in all ROIs in the psilocybin condition after Bonferroni correction ($p < 0.01$). This suggests that altered stimulus processing as early as primary sensory cortex could contribute to psilocybin-induced perceptual changes. Follow-up analyses will incorporate eye-tracking and verbal recall of movies to investigate whether changes in pISC reflect altered neural processing or simply differences in attention to the stimulus.

Topic Area: LONG-TERM MEMORY: Episodic

C74 - Neural representation of relational memory types

Catherine Saunders[1] (cgs47@duke.edu), Paul Bogdan[1], Roberto Cabeza[1], Simon Davis[1]; [1]Duke University

Relational memory plays a fundamental role in our daily lives, helping us link names to faces, understand movie plots, and many other seemingly mundane tasks. Past research demonstrates that semantic relations between concepts are encoded based on distinctions between the semantic relationships themselves, not on the concepts involved. However, it remains unclear how the brain encodes specific types of semantic relations. We investigated this using fMRI. During encoding, participants saw word pairings corresponding to objects and compared each pair across one of four dimensions: color, price, sound, or touch. Retrieval included an old/new (identical/recombined) relational memory task wherein participants were asked whether a given pair was previously shown. Participants then completed a source retrieval task where they identified which relational type (color, price, sound, or touch) had been used to compare a previous word pairing. Univariate analyses showed strong effects of memory success in both the hippocampus and angular gyrus. Additionally, multivariate tests were conducted across the brain, searching for regions that encode the relation types. This was done by analyzing neural pattern similarity across trials of the same comparison condition. From this analysis, the angular gyrus emerged as representing multiple relation types. This supports previous research suggesting the inferior parietal lobe and the temporal lobe form a convergence zone enabling us to form abstract representations of perceptual experiences. Furthermore, identifying regions like the angular gyrus which are central to relational memory could prove helpful in designing future interventions to support relational memory with age.

Topic Area: LONG-TERM MEMORY: Episodic

C75 - Effects of Retrieval Demands and Cue/Trace Interactions on Pupil Dilation during Recognition Memory

Wen Jian[1] (wen_jian@brown.edu), Elena K. Festa[1], William C. Heindel[1]; [1]Brown University

Pupil dilation reflects multiple cognitive processes that impact phasic arousal mediated by the locus coeruleus noradrenergic system. During tests of recognition memory, greater pupil dilation is elicited by "old" than "new" items, although the mechanism underlying this pupillary old/new effect remains elusive. To investigate how this effect is jointly influenced by retrieval demands and the match between cue and trace information, we assigned healthy young adults to two retrieval conditions adapted from the process dissociation procedure. During the study phase, all participants were asked to remember words and pictures presented sequentially. During the test phase, previously studied words, words corresponding to previously studied pictures, and novel words were presented intermixed. In the Word condition, participants (N=33) were told to respond "Old" only to the words that also appeared as words during study ("Match" items) and "New" to everything else. In the Picture condition, participants (N=33) were told to respond "Old" only to the words corresponding to previously studied pictures ("No-Match" items) and "New" to everything else. Single-trial regression showed similar pupillary old/new effects in both conditions. However, greater pupil dilation was observed for No-Match than Match items in the Picture condition, while there was no difference between No-Match and Match items in the Word condition. These results suggest that when the task emphasizes remembering pictures, pupil dilation reflects successful reconstruction of previously studied mental images. In contrast, when the task emphasizes remembering words, pupil dilation reflects the semantic processing of previously studied items regardless of perceptual match with retrieval cues.

Topic Area: LONG-TERM MEMORY: Episodic

C76 - Does the DMPFC Prioritize Consolidating Unpredictable Social Information at Rest?

Courtney Jimenez[1], Meghan Meyer[1]; [1]Columbia University

The quality of our social connections determine the quality of our lives. Given that our social worlds are incredibly rich, complex, and dynamic, navigating them proves a computationally intensive task. It is possible that unpredictable social content is prioritized for learning via social consolidation mechanisms at rest in the DMPFC and this relates to subjective social connection. This is consistent with prior work that shows prediction errors generated during a reinforcement learning task 'tag' content for consolidation and relate to future behavior (Momennejad et al., 2018). Further, other work suggests social information is prioritized for learning via temporal dynamics of pattern reinstatement in the DMPFC. In this study, participants will view naturalistic video clips from a reality television series with characters who show variability in the predictability of their behavior while undergoing fMRI. After each clip, participants will be asked if they want to be socially connected to a specific character. Participants will rest and then be presented with a surprise memory test and rate subjective social connection. A reinforcement learning model will be fit to participants' choice behavior to generate prediction errors for the task. Neural pattern reinstatement methods will be used to investigate consolidation mechanisms of unpredictable and predictable social events during post-encoding rest. We hypothesize that unpredictable social information will be consolidated earlier than predictable social information at rest in the DMPFC. Further, we hypothesize that neural pattern reinstatement for unpredictable social information in the DMPFC at rest may meaningfully predict changes in subjective social connection ratings.

Topic Area: LONG-TERM MEMORY: Episodic

C77 - Neural Context Reinstatement of Recurring Events

Adam Broitman[1] (adamwb@sas.upenn.edu), Michael Kahana[1]; [1]University of Pennsylvania

Episodic recollection involves retrieving context information bound to specific events. However, autobiographical memory largely comprises recurrent, similar experiences that become integrated into joint representations. In the current study, we extracted a neural signature of temporal context from scalp electroencephalography (EEG) to investigate whether recalling a recurring event accompanies the reinstatement of one or multiple instances of its occurrence. We asked 52 young adults to study and recall lists of words that included both once-presented and repeated items. Participants recalled repeated items in association with neighboring list items from each occurrence, but with stronger clustering around the repetition's initial occurrence. Furthermore, multivariate spectral EEG analyses revealed that neural activity from just prior to the recall of these words resembled patterns of activity observed near the item's first occurrence, but not its second. Together, these results suggest that the initial occurrence of an event carries stronger temporal context associations than later repetitions. This work lays the groundwork for future investigations into the specific neural mechanisms by which repetition influences item-context associations.

Topic Area: LONG-TERM MEMORY: Episodic

C78 - Age Differences in Resisting Interference in an Eyewitness Memory Study

Himanshu Chaudhary[1,2] (himanshu.chaudhary@tufts.edu), Elizabeth Race[1], Ayanna Thomas[2]; [1]Tufts University Integrative Cognitive Neuroscience Lab, [2]Tufts University MetaCognition and Applied Memory Lab

Eyewitness memory is critical in the criminal justice system, yet can be unreliable. Two factors that affect the reliability of eyewitness memory are age and exposure to misleading post-event information (PEI). Prior studies have shown that warning young adults against misleading PEI and allowing them to strategically regulate their memory improves accuracy. Effective regulation is reflected in improved memory performance by withholding incorrect information when given the ability to. The present study tested whether older adults could benefit from warnings and the opportunity to strategically regulate memory retrieval in the face of misinformation. To examine this, older and younger adults underwent an eyewitness misinformation study in which they were presented with a video depicting a non-violent crime and were subsequently presented with an auditory summary of the video (PEI) containing misleading details about the original event. Participants were randomly assigned to either receive a warning after the PEI or to not receive a warning. Two tests about the original event served as measures for memory performance: a forced-report test, where participants answered every question, and a free-report test, where participants were given the opportunity to withhold answers they were uncertain about. We found that warnings reduced misinformation susceptibility in younger adults, but not in older adults. However, older adults' memory accuracy did improve when allowed the opportunity to withhold responses, displaying effective regulation. Inability to use retrieval strategies like warning could suggest that interference impedes memory differently as we age, and older adults may require additional scaffolding to counteract misinformation.

Topic Area: LONG-TERM MEMORY: Episodic

C79 - ESTIMATING MEMORY FUNCTION BY MEASURING THE HEMISPHERIC SPECIALISATION OF ATTENTION ALLOCATION

Daniela Montaldi[1] (daniela.montaldi@manchester.ac.uk), Oliver Gray, Charlotte Hunt, Haoran Guan; [1]University of Manchester

Recall of perceptually rich experiences can prompt a vivid perceptual re-experience. In contrast, a recall experience characterised by semantic features is often perceptually-impoverished and instead prompts the retrieval of associated semantic information. The inferior parietal lobule contributes to the retrieval of episodic memories and shows a hemispheric lateralisation of function that specifically relates to the qualitative distinction between perceptual and semantic memory experiences. The IPL also contributes to the healthy allocation of spatial attention. Importantly, this spatial attention function also exhibits hemispheric lateralisation. We recently developed two complementary landmark tasks to reliably measure this spatial attention lateralisation and explore its qualitative similarity to the lateralisation observed in memory. We directly assessed the relationship between the hemispheric lateralisation of memory and attention functions in young adults . We then investigated whether these relationships are informative of the memory abilities of older participants. Participants (N=187; 82 female) aged 35-73 were recruited. They were presented with four blocks containing an object study task, a line-based landmark task, an object-based landmark task, and a Yes/No object recognition memory task with similar lures. Hemispheric lateralisation of spatial attention allocation, as measured by two landmark tasks, was found to be closely related to the ability to recollect perceptually-rich memory experiences. We show that it is feasible to estimate recollection memory performance by measuring the hemispheric lateralisation of spatial attention allocation. We also better characterise spatial attention in the presence of semantic information revealing how the allocation of spatial attention and episodic memory retrieval changes with age.

Topic Area: LONG-TERM MEMORY: Episodic

C80 - Reinstatement of personal semantics during episodic recollection

D. Merika W. Sanders[1] (merikasanders@fas.harvard.edu), Preston P. Thakral[1,2], Daniel L. Schacter[1]; [1]Harvard University, [2]Smith College

In recent years, the stark distinction between episodic and semantic memory has blurred. Evidence not only suggests that these forms of memory share neural correlates, but, according to the semantic scaffolding hypothesis (e.g., Irish & Piguet, 2013), conceptual knowledge stored in semantic memory may also provide a framework to facilitate recollection of past events. Moreover, there exist understudied memory phenomena that exhibit characteristics of both memory types. Personal semantics (i.e., knowledge about one's life), although highly personal like episodic memory, also resembles semantic memory in that it is independent of any specific spatio-temporal context. Here we employed fMRI to investigate whether, like semantic memory, personal semantics supports episodic recollection by providing knowledge of personally familiar people and places. Participants recalled past autobiographical events, each comprised of a location and person detail, and generated facts about either the location or person featured in those memories. Participants then provided a measure of their subjective experience during each task via a detailedness rating. A multivoxel pattern similarity analysis revealed that both hippocampus and left middle temporal gyrus/anterior temporal lobe supported reinstatement of detail-specific personal semantic information during episodic recollection. Moreover, in both regions this reinstatement effect was modulated by the subjective experience of recollected details. Our data provide evidence that mechanisms underlying semantic scaffolding may extend to personal semantic memory.

Topic Area: LONG-TERM MEMORY: Episodic

C81 - Expression of CACNA1C in a circadian mouse model for bipolar disorder

Dennis Arruda[1], Victoria Heimer-McGinn[2]; [1]Roger Williams University

Cognitive deficits in bipolar disorder (BD) are understudied, undertreated, and poorly understood at the molecular level. In this study, we explore how two putative BD pathologies (circadian function and calcium signaling) may intersect to contribute to cognitive impairment. Both mechanisms have been linked to BD through genetic association studies: the CLOCK gene is a critical component in circadian regulation, while CACNA1C codes for a subunit of a calcium channel that mediates neuronal excitability and intracellular messaging. Both pathways regulate each other, with calcium fluctuations being under circadian control and circadian regulation relying on intracellular calcium signaling. Interestingly, mice with a Clock mutation (ClockΔ19), which display BD-like mood cycling and associated behavioral traits, may also display cognitive impairments in spatial memory (unpublished data from our lab). Finally, CACNA1C is essential for cognitive function. In this study, we quantified the relative expression of CACNA1C mRNA in ClockΔ19 mice (n=3) compared to littermate controls (n=5) using real-time PCR. We also correlated mRNA expression with behavioral data from the novel object location task. Preliminary data indicate no trends in differential mRNA expression between groups. Similarly, behavioral performance does not appear to be correlated to mRNA expression. This suggests that CACNA1C expression may not be related to location memory. Alternatively, considering circadian clocks regulate most bodily functions, it is possible that standard reference genes are not the appropriate control. We are currently in the process of optimizing the assay and clarifying how Clock and calcium mechanisms might intersect to support cognitive function.

Topic Area: LONG-TERM MEMORY: Episodic

C82 - Sex-specific visuo-spatial recognition memory impairments in adolescent CLOCKΔ19 mouse model of bipolar disorder

Eden Fraatz[1] (efraatz570@g.rwu.edu), Simrat Kaur Dhillon[1], Giana Guerra[1], Samantha Soares[1], Victoria Heimer-McGinn[1]; [1]Roger Williams University

Cognitive deficits are a trait symptom of bipolar disorder (BD) and are predictive of disease outcome and quality of life. However, they remain understudied due to difficulties developing animal models that reproduce mood fluctuations in BD. One emerging model, the ClockΔ19 transgenic mouse line, exhibits regular mood cycling between manic and euthymic behavior over 24 hours. Of interest, visuo-spatial recognition and emotion recognition are impaired in BD. In this study, we examined recognition memory using novel object recognition (NOR) and novel object location (NOL) tasks. We compared adolescent male (M) and female (F) homozygous (HOM) ClockΔ19 mice to wildtype (WT) mice with a sample of 9 F-HOM, 6 M-HOM, 8 F-WT, and 9 M-WT. In NOL, ClockΔ19 HOM mice displayed impaired location recognition (M=0.098) compared to WT (M=0.187; p=0.017), with trends suggesting the impairment is sex-specific to females. In NOR, data suggests the HOM group was unaffected in object recognition compared to WT. These investigations are being extended to social cognition and longitudinal measures of recognition memory. Our NOL findings are consistent with other circadian models, including an environmental mouse model (Short Day), and a Bmal1 genetic model, which speaks to the emerging role of circadian rhythms in BD-related cognition. Finally, since these other circadian studies have not included females, and sex differences in recognition remain unclear in BD patients, our results and future studies will help clarify how potential sex differences relate to BD endophenotypes. In the future, this model will be useful for developing sex-specific treatments for cognition.

Topic Area: LONG-TERM MEMORY: Episodic

C83 - The role of sleep and dreaming in autobiographical memory consolidation: one year delay

Nelly Matorina[1] (nelly.matorina@mail.utoronto.ca), Jeya Scott[1], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute

Sleep plays a role in memory consolidation for laboratory-based stimuli, but much less is known about how sleep impacts memory for real-word, autobiographical events. To answer this question, we used a smartphone application called the HippoCamera, which allows participants to record high fidelity videos and audio clips in their daily lives that function as memory cues. We have previously shown that sleep, compared to wake, preserves autobiographical memory richness over short 12-hour delays and that dreaming about an autobiographical memory impacts the emotion associated with the memory. We were also interested in how dreaming and proximity to sleep impacts autobiographical memory at a one-year delay. Participants completed the Autobiographical Interview for each of the memory cues that they recorded and answered questions about each memory on richness and emotion (n = 3, data collection ongoing). We anticipate that memories proximal to sleep will be better remembered at a one-year delay and that dreaming about an autobiographical memory will lead to preserved emotion for that event at a one-year delay. This research will demonstrate whether proximity to sleep for real-word events has long-term impact for the memories we retain, and whether dreaming about an autobiographical memory prioritizes that event for long-term consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C84 - Towards a Unified Theory of Memory for Similar Episodes

Andrew yonelinas[1] (apyonelinas@ucdavis.edu), Colleen Parks, Chris Wahlheim; [1]University of California Davis, [2]University of Nevada, Las Vegas, [3]The University of North Carolina at Greensboro

Important advances have been made in understanding the roles that recollection and familiarity, true and false memory, as well as pattern separation and pattern completion play in episodic memory using several experimental paradigms that examine memory for lures that are similar - but not identical - to prior episodes. These include the Process Dissociation Procedure, the Deese-Roediger-McDermott paradigm and the Mnemonic Similarity Task. However, research using each of these paradigms has remained largely isolated, and a coherent theoretical integration is lacking. We argue that these paradigms can be understood within a unified theory in which memory performance reflects the operation of three distinct processes: false recollection, false familiarity and recollection rejection. We review studies that have included memory confidence judgments in each of these paradigms and show how those results can be used to measure each process. The results indicate that these three memory processes are functionally distinct and they underly performance in each experimental paradigm. This new approach overcomes limitations of earlier methods, it bridges these different literatures, and it points to several open questions for future research.

Topic Area: LONG-TERM MEMORY: Episodic

C85 - fMRI Exploration Of Mind-Wandering And Memory Consolidation

Devayani Joshi[1] (dj584@drexel.edu), Aaron Kucyi[1], Alexa Tompary[1]; [1]Drexel University

Mind-wandering, which involves spontaneous thoughts that shift attention to internal processes, is often associated with impaired memory. However, the potential benefits of mind-wandering immediately following learning are not well understood. Quiet rest after learning supports memory consolidation—the process of integrating new information into long-term memory—and provides an ideal environment for mind-wandering. This study explores how mind-wandering during rest relates to neural signatures of systems-level consolidation and consequent memory outcomes. In the study, forty participants learned associations between objects and scenes before spending 40 minutes resting awake in an fMRI scanner. During this resting period, they reported whether they were mind-wandering and described their spontaneous thoughts through experience sampling every minute. Memory tests were administered immediately after the learning session and again after a 24-hour delay. Behavioral analyses showed a positive correlation between reported mind-wandering and performance on the delayed memory test. Using multivoxel pattern analysis (MVPA), fMRI results revealed that spontaneous memory reactivation counts were higher after learning compared to before learning. Interestingly, greater reactivation counts were associated with poorer memory performance. These findings suggest that while mind-wandering during rest may facilitate long-term memory consolidation, the role of hippocampal reactivation is complex and requires further investigation. Future analyses will investigate how the default mode network (DMN) contributes to the relationship between spontaneous mental processes and memory outcomes.

Topic Area: LONG-TERM MEMORY: Episodic

C86 - When practice doesn't make perfect: Retrieving real-word memories strengthens reviewed content and semantic links without broader episodic changes

Lauren Homann[1] (lauren.homann@mail.utoronto.ca), Mursal Jahed[1], Jessica Sun[1], Jia Gu[1], Simran Grewal[1], Morgan Barense[1,2]; [1]University of Toronto, [2]Rotman Research Institute

Retrieval practice (i.e., actively retrieving information from memory) is one of the most robust methods of modifying and bolstering memory. However, a comprehensive investigation of how this technique influences complex, personally meaningful memories—consisting of intricately interrelated and interdependent content—is lacking, leaving the full picture of retrieval practice's impact on memory incomplete. To address this gap, the current study extended a conventional retrieval practice paradigm by applying it to a rich staged event. Specifically, we explored the various ways memory may be altered when participants practice retrieving verifiable real-world event details without feedback, compared to merely restudying (i.e., passively reviewing) the same information. When examining the testing effect in its traditional form, the retrieval group outperformed the restudy group on a delayed memory test involving the same verifiable cued-recall questions presented during event review sessions, provided they had correctly recalled the answers during the review sessions. Surprisingly, retrieval practice did not enhance or distort broader episodic event memory, as shown across various measures, including free recall narratives (scored for event-specific details, memory accuracy, memory errors, and temporal organization), questions probing verifiable event details that participants had never reviewed, and self-reported memory phenomenology metrics. Interestingly, participants in the retrieval group included more personal and general semantic details in their free recall narratives, potentially reflecting enhanced integration of the event with prior knowledge structures. This work provides meaningful insights into the limits of retrieval practice's effectiveness, informs mechanistic theories of retrieval, and highlights the importance of studying complex mnemonic content.

Topic Area: LONG-TERM MEMORY: Episodic

C87 - Inter-Event Shifts in Emotional Valence Shape Event Memory Representations

Samira Tavassoli[1] (stavass1@jh.edu), Janice Chen[1]; [1]Johns Hopkins University

Studies on human episodic memory have demonstrated that emotional context shapes how we mentally encode and recall events (Dev et al., 2022; Cliver et al., 2024). However, there have been no studies to date that explore how changes in the emotional context of events within a cohesive narrative affect memory. In this study, we are exploring how the emotional flow of a narrative—i.e., the pacing of shifts in emotional valence between adjacent events—affects event order memory, event segmentation, and recall accuracy. We created three different versions of one story by reordering the sentences such that they had "fast," "medium," and "slow" emotional flows, while keeping the literal words the same; independent ratings confirmed that these versions were identical in perceived comprehensibility, chronologicity, cohesiveness, surprisingness, and immersiveness. In a preliminary experiment examining the relationship between emotional flow and event order memory, subjects (N=96) were assigned to one story condition, read the story, then completed a modified free recall task and an event timing estimation task. We found that faster flowing emotional contexts seemingly enhance representations of events' chronology; subjects in our fast flow condition spontaneously recalled story details more in their original order of presentation ($p<0.001$) and more accurately estimated when events occurred within the story timeline ($p<0.05$) than the slow and medium flow groups. In a series of ongoing experiments, we are investigating the neural mechanisms that may drive the observed influence of emotional flow on event memory, focusing on how emotional valence shifts impact neural and behaviorally-indicated event boundaries.

Topic Area: LONG-TERM MEMORY: Episodic

C88 - Aligning behavioral expressions of memory with convolutional neural network representations

Julian Gamez[1], Anisha S. Babu[1], Brice A. Kuhl[1]; [1]University of Oregon

Deep convolutional neural networks have become an increasingly popular tool in cognitive neuroscience. A primary appeal of these models is that they approximate human judgments of similarity for complex stimuli. However, less is known about how these models align with behavioral expressions of memory—in part because memory measures typically lack representational structure. Here, we used Natural Language Processing to capture the representational structure of verbal recall of naturalistic scenes and tested for alignment with different layers of a convolutional neural network (VGG-16). Subjects (N=38) first studied and practiced recalling associations between faces and scenes. Scenes included 6 exemplars from 6 visual categories (e.g., libraries, pools, etc.). After extensive training, subjects completed a final recall task where they were shown each face and typed a detailed description (memory) of the associated scene. MPNet was applied to these descriptions, yielding a unique semantic embedding for each memory. We then calculated the cosine similarity between (a) the semantic embeddings and (b) features extracted by VGG-16 across different layers of its architecture. We found that representational structure of recall was well explained by VGG-16. Interestingly, however, whereas relationships between scenes from different visual categories (e.g., libraries vs. pools) were much better explained by higher vs. lower model layers, fine-grained relationships between scenes from the same category (e.g., library 1 vs. library 2) were equally-well explained by intermediate and higher layers. Together, these results establish an important link between the behavioral expressions of memory and the representational structure of convolutional neural networks.

Topic Area: LONG-TERM MEMORY: Episodic

C89 - Motor-based versus declarative memory of multiple durations

Abigail Y. Liu[1] (abliu@u.northwestern.edu), Kezhen Qi[1], Marcia Grabowecky[1], Satoru Suzuki[1]; [1]Northwestern University

While time flows continuously, we often perceive and recall it as discrete segments of events with associated durations. We investigated how encoding and retrieval contexts influenced the memory of event durations. Participants encoded the durations of four, eight, or twelve visually presented words lasting 300-5000ms (log spaced) by immediately reproducing the duration of each word in four blocks. To facilitate comparisons across the memory set sizes, four medium-duration words were included in all word sets. The motor-based memory of durations was tested by having participants reproduce the duration of each remembered word. The declarative memory of durations was then tested by asking participants to choose the longer duration between each pair of the remembered words. Then motor-based memory was tested again. While the motor-based memory was equivalent across memory set sizes, declarative memory was degraded for the twelve-word set. Adding an auditory context (a generated voice speaking at an appropriate speed to match its duration) improved motor-based memory, but did not affect declarative memory. Further, declarative memory was substantially worse than predicted by the motor-based memory performance obtained before or after the declarative memory test; that is, even when participants accurately reproduced A as longer than B in the motor memory task, they often reported B as longer than A in the pairwise comparison task. These dissociations suggest that, although duration reproduction is an explicit task, the underlying motor-based memory of durations does not transfer to declarative memory to facilitate comparison of events based on their durations.

Topic Area: LONG-TERM MEMORY: Episodic

C90 - Moments of uncertainty during navigation provoke increases in autonomic arousal and changes in MTL activity in the real world

Amanda Holt[1] (u1309621@utah.edu), Kiersten Olson[1], Luis Garcia[2], Uros Topalovic[3], Mauricio Vallejo Martelo[3], Matthias Stangl[3], Tyler Davis[1], Martina Hollearn[1], Justin Campbell[1], Lensky Augustin[1], Wyatt Wilson[1], Dawn Eliashiv[1], Nick Hasulak[4], Sonja Hiller[3], Itzhak Fried[3], Nanthia Suthana[3], Cory Inman[1]; [1]University of Utah, [2]USC Information Sciences Institute, [3]University of California, Los Angeles, [4]David Geffen School of Medicine, [5]Phoenix Research Consulting

The goal of cognitive neuroscience is to understand and explain real-world behavior in terms of brain activity, and to use these insights to develop treatments for neural disorders. By using wearable EDA sensors synchronized with intracranial EEG recordings in epilepsy patients with permanently implanted RNS devices, we can explore the electrophysiological basis of real-world navigation and memory encoding in a way that captures the complexity of real-world experiences. We hypothesized we'd observe changes in medial temporal lobe (MTL) activity based on changes in spatial context, behavior, and movement speed. In this study, five participants navigated around campus while MTL electrophysiology and the participant's autonomic physiology (electrodermal activity, electrocardiography, respiration) were recorded. Subjects walked the route 7-8 times with the 1st walk guided (encoding) and 6-7 of the walks navigated by the participants (navigation retrieval). Changes in environmental context (doorways, indoors, outdoors, etc.) and behavior (getting lost, making a turn, abnormal social interactions, etc.) were annotated by expert observers. Overall, we found that electrodermal activity increased around moments of uncertainty, like getting lost, which was highly correlated with changes in MTL activity. Taken together, we find evidence that moments of uncertainty provoke changes in autonomic arousal and neural activity.

Topic Area: LONG-TERM MEMORY: Episodic

C91 - Dynamic Recruitment of Category-Selective Cortex During Episodic Retrieval and Future Thinking

Sarah E. Kalinowski[1] (skalinowski@fas.harvard.edu), Adrian W. Gilmore[2], Christopher Sokol[1], Alex Martin[3], Daniel L. Schacter[1]; [1]Harvard University, [2]University of Delaware, [3]National Institute of Mental Health

Episodic retrieval and episodic future thinking are supported by sustained activity in a common core network of brain regions. These and other findings support the constructive episodic simulation hypothesis, which suggests that future thinking relies on details from episodic memory that are flexibly recombined to form novel future events (Schacter & Addis, 2007, 2020). Recent advances in preprocessing make it possible to record participants' verbal reports during scanning, enabling the decomposition of events into their constituent details. Using this approach, it has been shown that episodic retrieval involves the dynamic recruitment of category-selective brain regions when remembering details about people, locations, and objects (Gilmore et al., 2021). In this study, we extend these findings to episodic future thinking. Participants overtly recalled past events and imagined future events for two minutes while undergoing an fMRI scan. Verbal reports were analyzed using an adapted Autobiographical Interview protocol to generate event regressors for specific detail types. A subset of participants also underwent a localizer scan to identify category-selective regions. Across both past and future events, participants primarily produced perceptual and action details, followed by objects, people, and locations. Neuroimaging results confirm sustained core network activity during both episodic retrieval and future thinking. Preliminary findings also suggest that future-event details, like past-event details, are represented in category-selective cortex. This study is the first to assess whether individual details composing both past and future events are supported by shared category-selective regions, providing evidence for the constructive episodic simulation hypothesis.

Topic Area: LONG-TERM MEMORY: Episodic

C92 - The big item theory: A high-resolution fMRI investigation into unitization using pattern similarity analysis

Catherine Carpenter[1] (cmc84@psu.edu), Alexa Becker[1], Amy Overman[2], Nancy Dennis[1]; [1]The Pennsylvania State University, [2]Xavier University

Unitization has traditionally been defined as the process by which two or more discrete items (typically words or objects) are processed in memory, such that they are perceived as a single ensemble (or unit). Evidence for the item theory of unitization comes from behavioral and neuroimaging evidence that shows a reliance on familiarity processing and the recruitment of item-based neural resources, such as perirhinal cortex. Yet, because a single item condition has not been utilized in this past work as a point of comparison, a true test of the item theory has not been undertaken. The current study tests the item account of unitization by investigating whether unitized words (in the form of compound words) are processed more similarly to single words than to unrelated word pairs. Challenging a strict account of the item theory, the results show that unitized information is represented more similarly to unrelated associations (unrelated word pairs) than to single items, during both encoding and retrieval. Specifically, greater neural pattern similarity between compound words and unrelated word pairs was found across the associative memory network, including hippocampal subfields such as the perirhinal cortex, CA1 and DG/CA3, as well as the inferior frontal gyrus, and regions in the parietal lobe. The results suggest that unitization, even in its strongest form, may not operate through item-like processing and may represent an intermediate level of processing between associative and item level representations.

Topic Area: LONG-TERM MEMORY: Episodic

C93 - Hippocampal repulsion as a function of memory similarity and experience

America Romero[1] (america@uoregon.edu), Soroush Mirjalili[1], Dominik Graetz[1], Wanjia Guo[1], Eric Wang[1], Ulrich Mayr[1], Brice A. Kuhl[1]; [1]University of Oregon

Recent research indicates that interference between similar memories is minimized via targeted differentiation of activity patterns in the hippocampus—a phenomenon we term 'hippocampal repulsion'. Repulsion is thought to critically depend on the degree of similarity between memories and the amount of experience with those memories. However, potential interactions between similarity and experience are not well understood. Here, participants (n = 50) learned associations between images of scenes and objects. The scenes were drawn from two categories (beaches and gazebos; 24 scenes each). One category (counterbalanced) received high training; the other received low training. During fMRI scanning, participants repeatedly viewed all scenes. fMRI analyses focused on the hippocampus (CA1, CA3/dentate gyrus) and visual cortical areas. For each pair of images within each category, we computed fMRI pattern similarity (separately for each region of interest) as well as a measure of 'objective' stimulus similarity based on VGG-16. We found that, for CA3/dentate gyrus, the relationship between stimulus similarity and fMRI pattern similarity strongly depended on experience. Surprisingly, low training was associated with a negative relationship between stimulus similarity and pattern similarity (consistent with repulsion), whereas a qualitatively opposite pattern was observed for high training. This pattern of results differed sharply from what was observed in CA1 and visual cortical regions. Together, these results reinforce the relevance of stimulus similarity and experience in determining hippocampal repulsion but suggest that repulsion may be most likely to occur during the intermediate stages of learning (before stimuli are over-learned).

Topic Area: LONG-TERM MEMORY: Episodic

C94 - Episodic simulation samples from recently encoded memories

Tongle Cai[1] (tonglec@uoregon.edu), Zhifang Ye[1], Katie L. Hedman[1], Alexandra G. Tremblay-McGaw[1], Sara DuBrow[1], Robert J. Molitor[1], Brice A. Kuhl[1]; [1]University of Oregon

Episodic memory is crucial for both remembering the past and simulating novel or future events. Recent neuroimaging studies emphasize the constructive nature of memory retrieval and suggest that remembering the past and simulating novel events engage similar neural processes. Yet, it is not entirely clear how the brain incorporates the contents of existing memories into simulated events. Here, we used fMRI pattern similarity analyses to compare neural representations of retrieved and simulated events. Participants (n=33) were scanned while watching short video clips, remembering previously viewed videos, and simulating novel events that were conceptually related to the content of watched and remembered videos. Critically, we manipulated the order of these tasks such that sometimes simulation was performed before watching or remembering related events (thereby preventing sampling from recent experience), whereas other times simulation following watching or remembering related events (thereby enabling sampling). Within regions of the episodic memory network, pattern similarity between conceptually-related simulation and retrieval trials was significantly stronger when simulation followed related experience than when simulation preceded related experience, suggesting that simulation sampled from recent, relevant experience. This finding was reinforced by verbal descriptions of simulated events that were collected after scanning. Importantly, similarity between simulated and remembered events was absent in visual cortical areas, highlighting a unique role of the episodic memory network in reflecting episodic sampling during event simulation. Collectively, these findings contribute to understanding of how the brain incorporates past experience when simulating new experience.

Topic Area: LONG-TERM MEMORY: Episodic

C95 - Natural Scene Representations in Parietal Cortex Predict Fine-Grained Representational Structure of Verbal Recall

Anisha Babu[1] (ababu@uoregon.edu), Julian Gamez[1], Zhifang Ye[1], Brice Kuhl[1]; [1]University of Oregon

Human fMRI studies frequently use representational similarity analyses to test whether brain regions reflect objective properties of visual stimuli during memory encoding or retrieval. While these fMRI measures have been linked to memory success (e.g., remembered or forgotten), there is less evidence linking representational similarity to subjective expressions of memory. Here, N=38 human participants learned associations between faces and naturalistic scene images during fMRI. Scene images consisted of six exemplars from each of three categories (e.g., 'libraries'). After scanning, participants completed a verbal recall task in which each face was presented as a cue for participants to type a description of the corresponding scene from memory. Recall descriptions were then transformed into embeddings using a Natural Language model. Of critical interest was whether neural representations predicted the representational structure of recall for images within each category (e.g., which libraries were associated with the most similar verbal recall). To test this, pairs of images from each category were sorted according to the similarity of their recall embeddings. Then, fMRI pattern similarity was computed for these pairs, separately for regions of interest in the hippocampus, visual cortex, and parietal cortex. Across these regions, parietal cortex similarity (angular gyrus) was uniquely, and positively, related to verbal recall similarity ($p<0.001$). These findings indicate that angular gyrus representations contained fine-grained information that predicted subtle differences in verbal recall of naturalistic scenes.

Topic Area: LONG-TERM MEMORY: Episodic

C96 - Emotionally-motivated differentiation of hippocampal memory representations

R. Gerald Monkman[1], Vinshu P. Murty[1], Brice A. Kuhl[1]; [1]University of Oregon

Memory interference can occur when experiences overlap with each other (e.g., family dinners that involve the same people at the same location). The hippocampus is thought to play a key role in differentiating similar memories, but there remains limited understanding of the factors that promote differentiation of hippocampal representations. One potentially relevant factor is emotion. The emotional significance of events is known to alter hippocampal neurophysiology, which may change the propensity for the hippocampus to differentiate similar memories. In a human fMRI study, we will test whether emotional motivations influence hippocampal memory differentiation. 40 participants will undergo fMRI scanning while encoding and recalling highly similar pairs of emotionally ambiguous video clips. We will manipulate emotional motivations (controlling for the actual videos) by instructing participants to construe the clips in either a positive or negative manner. fMRI pattern similarity analyses will be used to evaluate hippocampal differentiation for video pairs with matched emotional motivations (positive-positive pairs, negative-negative pairs) and in pairs with distinct emotional motivations (positive-negative pairs). We predict that hippocampal differentiation will be greatest when pairs include negative motivations (negative-negative pairs or positive-negative pairs) compared to positive-only motivations (positive-positive pairs). Findings from this study will contribute to understanding of how emotional motivations influence the balance of differentiation versus integration in the hippocampus.

Topic Area: LONG-TERM MEMORY: Episodic

C97 - The Role of Relational Reasoning and Schemas in the Simulation of Novel Future Events

Sabrina Valenzano[1,2] (svalenzano@research.baycrest.org), Isaac Kinley[1,2], Reece P. Roberts[3], Daniel L. Schacter[4], Donna Rose Addis[1,2,3]; [1]Baycrest Academy of Research and Education, [2]University of Toronto, [3]The University of Auckland, [4]Harvard University

Imagining future events is a cognitively demanding process thought to rely on relational reasoning and schematic knowledge. To examine this hypothesis, 50 participants completed an experimental recombination task where the detail-sets (location-object-object) provided as stimuli for future events comprised a location that was either congruent or incongruent with two objects. Participants rated their imagined events for detail and plausibility. To quantify schema usage in event narratives, we collected general descriptions of the locations in a separate sample (N=21) as a proxy for general location knowledge. These texts were segmented into three sub-schema categories (perceptual, preparation, event) and converted into vectors capturing semantic meaning using Universal Sentence Encoder (USE). We then computed cosine similarity between USE vectors for subschema and future event narratives (1=100% similarity). Results revealed that relational reasoning ability predicted higher detail ratings. Of the three sub-schemas, perceptual schemas were most evident in future event narratives, but this did not differ by congruency condition. Although preparation sub-schemas were used more during congruent trials, their usage was associated with higher detail ratings on incongruent trials. In contrast, the higher usage of event sub-schemas during incongruent trials was associated with lower plausibility. This study quantifies, for the first time, usage of schemas when imagining novel events and relational reasoning in future thinking. High reliance on schemas during incongruent simulations was linked to increased detail but reduced plausibility, suggesting that schemas can provide a scaffold for simulation but may fall short in addressing incongruencies when the chosen schema is not well-suited.

Topic Area: LONG-TERM MEMORY: Episodic

C98 - Neural Decoding of Anticipation

Joseph Kahana[1] (kahana@psych.upenn.edu), Michael Kahana[1]; [1]University of Pennsylvania

You know it's coming: the start of a race, the beginning of a quiz, the onset of a memory task, but how does the brain time the anticipation period? Neuronal recordings reveal time cells that fire at specific delays and ramping cells that increase or decrease their firing across an interval. Here, we asked whether spectral EEG components similarly represent temporal information. We analyzed intracranial recordings as 396 patients watching ten-second countdown videos preceding the onset of a memory task. We decomposed these signals into frequencies from 3-280 Hz. We first asked how theta [3 Hz], alpha [12 Hz] and gamma [110 Hz] power varied across the countdown period across frontal (N = 337), temporal (N = 352), and hippocampal (N = 173) electrodes. Theta increased throughout the interval, gamma decreased, and alpha exhibited spikes corresponding to the ten countdown ticks. Next, we used penalized regression to predict time as a function of spectral power, evaluating these models in hold-out sessions in 50 subjects who contributed multisession data. Both lasso and ridge regression reliably predicted time within the interval, with correlations of 0.12 ($p < 0.001$) and 0.11 ($p < 0.001$), respectively. These results, however, could have arisen from the transient neural response to countdown onset. To rule this out, we repeated our analysis, excluding the first two seconds of the interval, and found similarly reliable correlations 0.11 ($p < 0.001$) and 0.10 ($p < 0.001$), respectively. These results demonstrate that spectral EEG components reliably decode temporal information during anticipation.

Topic Area: LONG-TERM MEMORY: Episodic

C99 - Can memory representations in parietal cortex be predicted from perceptual representations in sensory cortex?

Zhifang Ye[1] (zhifangy@uoregon.edu), Tongle Cai[1], J. Benjamin Hutchinson[1], Brice A. Kuhl[1]; [1]University of Oregon

Remembering an event from the past involves reactivation of neural activity patterns initially evoked during the perceptual experience of that event. However, measurements of reactivation only test for the match between perception and memory retrieval, effectively treating any differences as noise. In contrast, recent neuroimaging studies have revealed systematic differences in how the brain represents perceptual experiences and memories. In particular, whereas sensory areas exhibit stronger representations during perception than memory, parietal cortex exhibits an opposite bias. In the proposed study, we aim to conduct a large-scale, well-powered fMRI experiment with the goal of developing a ‘transfer function’ such that memory representations in parietal cortex can be predicted from perceptual representations in sensory cortex. Each participant (planned n = 30) will be scanned for 8 sessions and will perceive and remember 560 unique stimuli. During perception trials, participants will view 3-second video clips. During associative learning (not scanned), participants will learn associations between words and videos. During memory recall, participants will be presented with a word and asked to recall the associated video as vividly as possible. The overarching goal of this study is to develop a cross-validated model that learns a perception-to-memory transformation function. In a smaller-scale pilot experiment with a similar design, we demonstrated successful prediction of memory representations in the lateral parietal cortex from perception representations in the visual cortex. Replicating and extending this finding in a larger study will provide a foundation to better understand systematic differences between perceptual and mnemonic representations.

Topic Area: LONG-TERM MEMORY: Episodic

C100 - Neural oscillatory mechanisms of autobiographical memory and future imagination: a MEG study

Isaac Kinley[1,2] (isaac.kinley@gmail.com), Reece P Roberts[3], Jed Meltzer[1], Donna Rose Addis[1,2,3]; [1]Baycrest Academy for Research and Education, [2]University of Toronto, [3]The University of Auckland

Neuroimaging research on memory and imagination has revealed that these processes rely on many of the same neural structures, particularly those within the default mode network. Nevertheless, previous fMRI findings have found neural differences, with stronger activity during imagining versus remembering occurring primarily during event construction (when searching for an event representation) as opposed to elaboration (when adding details to a schematic event scaffold). Relatively less is known about the neural oscillatory mechanisms that enable the brain to remember the past and imagine the future. Recent EEG results from our group suggest that a suppression of mid-frontal theta power occurs during the transition from construction to elaboration, and that the magnitude of this suppression is greater for imagination than memory reflecting the greater cognitive demands in imagination versus memory. In this talk, we will report results from an ongoing MEG study in which participants recall autobiographical memories of past events, imagine personal future events, or engage in a non-autobiographical object imagery and internal speech control task. We will leverage the spatial resolution of MEG to examine theta phase synchronization between medial temporal and medial prefrontal regions during the transition. Such synchronization, which we expect to find during both memory and imagination, may enable medial-prefrontal-dependent schematic representations to coordinate the hippocampus-dependent process of binding details in a coherent event representation. More broadly, this study represents a step toward the use of high-temporal resolution methods to examine slower cognitive processes such as autobiographical memory and imagination.

Topic Area: LONG-TERM MEMORY: Episodic

C101 - Novelty in everyday life promotes memory for real-world autobiographical events

Victoria Schelkun[1] (vrs2122@columbia.edu), Camille Gasser[1], Erin Welch[1], Kathryn Lockwood[2], Lila Davachi[1,3]; [1]Columbia University, [2]Temple University, [3]Nathan Kline Institute

Our everyday lives are comprised of multidimensional events involving people, places, and emotions, both new and familiar. A core focus of memory research is to understand how these features may influence memory. While much prior work has investigated these facets of memory using controlled laboratory studies, the current study aimed to understand how features of real-world experiences influence autobiographical memory. To this end, we enrolled participants in an intensive longitudinal “daily diary” study that asked participants to record a wide range of rich information about their experiences each day for two weeks. Participants reported written descriptions of three events that they had engaged in each day, as well as quantitative metrics of novelty of these experiences and their day in general (e.g., how typical a day felt, whether they visited a new location). The written event descriptions were used to prospectively test participants’ autobiographical memory after a two-week delay. Our findings suggest that novelty bolsters both subjective vividness and objective level of detail reported in the memory test. Furthermore, we find that the benefit of novelty extends to other non-novel events that occurred within the same day, and that multiple sources of novelty independently and cumulatively improve memory. These data suggest that novel experiences enhance memory, and that daily diaries are a valuable method to naturalistically investigate these processes.

Topic Area: LONG-TERM MEMORY: Episodic

C102 - Dissociating forward versus backward transitions in free recall: Re-analysis of oscillatory EEG activity from a large open data set (PEERS)

Jeffrey Johnson[1] (johnsonjeffre@missouri.edu), Roman Gutierrez[1], Alliya Padiak[1], Brittney Bishop-Chrzanowski[1]; [1]University of Missouri

Free recall tasks have been instrumental to our understanding of the strategies and search processes involved in episodic memory retrieval. In particular, these tasks have revealed ways in which memories are organized on the basis of temporal, contextual, and associative factors, and how subjects might capitalize on this organization to maximize the likelihood of retrieval. Although recent EEG studies have begun to characterize the neural correlates of correct recall versus errors (intrusions), little attention has been given to distinguishing neural activity according to forward and backward transitions in free recall. In the current study, we reanalyzed scalp EEG data from the openly available Penn Electrophysiology of Encoding and Retrieval Study (PEERS; Kahana et al., 2024), consisting of about 200 subjects tested across multiple sessions, to investigate the possible oscillatory signatures of these transitions. EEG from about 1.5 seconds just prior to verbal report of each item was used to assess the deliberation period leading to recall. Our results indicated enhanced low-frequency (theta and alpha) activity for forward compared to backward transitions but enhanced high-frequency (gamma) activity for the reverse contrast. These findings provide novel evidence for dissociable neurocognitive processes related to deliberation in free recall and potentially reflect direction-based strategies that guide memory retrieval.

Topic Area: LONG-TERM MEMORY: Episodic

C103 - Changes in hippocampal structure and spatial memory performance associated with rise and fall in estradiol across the menstrual cycle

Hillary Schwarb[1] (hschwarb2@unl.edu), Aaron T. Anderson[2], Bradley P. Sutton[2], Graham R. Huesmann[2], Neal J. Cohen[2], Ana M. Daugherty[4], Curtis L. Johnson[3]; [1]University of Nebraska-Lincoln, [2]University of Illinois at Urbana-Champagin, [3]University of Delaware, [4]Wayne State University

Decades of preclinical research have identified differences in hippocampal structure as sex-hormones shift across the estrous cycle. Indeed, when estradiol is high, dendritic spine density increases as much as 30% compared to when estradiol is low. Human studies investigating hippocampal volume changes across the menstrual cycle have been equivocal. Volume, however, is a gross measure of tissue composition and perhaps not sufficiently sensitive to identify subtle, hormone-related changes. Magnetic resonance elastography (MRE), an emerging imaging tool, is sensitive to microstructural alterations in brain tissue. We hypothesized that tissue viscoelasticity, an MRE-derived measure of microstructural organization, would be more sensitive than volume and show measureable changes as estradiol fluctuates. In this study, natural-cycling women were tested twice: At the start of menses (low estradiol) and just before ovulation (peak estradiol). At each testing session, participants completed a blood draw to confirm estradiol levels, an MRI/MRE scan, and the virtual Moris Water Maze task. Preliminary data (N=10) indicate that while hippocampal volume did not differ when estradiol was high vs. low, MRE-derived measures of hippocampal viscoelasticity did significantly differ such that hippocampal organization was greater when estradiol was high. Furthermore, Morris Water Maze task performance significantly differed such that participants traveled shorter distances to find the hidden platform (indicative of better memory) when estradiol was low compared to when estradiol was high. In the age of precision medicine and individual differences in structure-function relationships, it is essential that we acknowledge and account for hormonal shifts that may well contribute to these relationships.

Topic Area: LONG-TERM MEMORY: Episodic

C104 - event boundary modulation of theta-oscillations in the hippocampus and amygdala

Brandon S. Katerman[1] (katerman@ucla.edu), John J. Sakon[2], Itzhak Fried[2], David Clewett[1]; [1]UCLA, [2]UCLA Neurosurgery

Event boundaries play a critical role in structuring continuous experiences into discrete, memorable episodes. Recent work using short neutral video clips has shown that activity in medial temporal lobe structures (MTL) are responsive to boundaries on the timescale of milliseconds, suggesting that they may play an important role in signaling important changes and promoting the separation of adjacent memories. However, this effect was only examined using single-unit recordings and with a series of short, unrelated video clips. Using intracranial electroencephalography (iEEG) recordings from the hippocampus and amygdala, we investigated spectral power changes associated with event boundaries during an emotionally engaging 43-minute viewing of a TV episode. A separate group of participants provided real-time emotion ratings while watching the episodic, enabling us to assess the level of arousal and valence in each scene, or event. Analyses were focused on theta (3 – 8Hz) and gamma (50-180Hz) frequency bands, which have been associated with memory-related encoding and retrieval processes in controlled word list and object recognition paradigms. Time-averaged analyses revealed significant increases in theta (3-8 Hz) power at scene-change boundaries within the anterior hippocampus and amygdala compared to matched within-event time points. We also found that event boundaries that followed high- versus low-arousal events led to greater theta suppression in both of these brain regions. These findings help to advance our understanding of how temporally dynamic activity in MTL structures are modulated by meaningful changes in naturalistic contexts, including shifts in emotional arousal.

Topic Area: LONG-TERM MEMORY: Episodic

C105 - The Relationship Between Mental Imagery Ability and Memory Representations

Rayna Tang[1] (rayna@wustl.edu), Xinran Zhao[1], Hannah Sabio[1], Zachariah Reagh[1]; [1]Washington University in St. Louis

Mental imagery ability varies considerably among individuals. While previous research has primarily examined visual perception and memory in individuals with polarized mental imagery abilities, the relationship between mental imagery and memory representations remains poorly understood. Here, we designed a novel paradigm using The Wonderful Story of Henry Sugar, a movie stimulus ideal for studying mental imagery due to its comprehensibility through audio alone. Participants with varying mental imagery abilities, as assessed by the Vividness of Visual Imagery Questionnaire, engaged in two encoding conditions: watching half of the movie with both visuals and audio (Condition 1) and the other half with audio only (Condition 2). Following each encoding block, participants completed a verbal recall task. We also administered a perceptually-driven screenshot recognition task, and a separate sentence recognition task. In the recognition task, novel images were taken from a separate movie, Poison (matched for director, cast, and style). Data collection is in progress. Planned analyses include comparing semantic similarities between movie transcripts and verbal recall, and calculating the hit and false alarm rates for both recognition tasks. We predict that participants with higher mental imagery scores will show lower semantic similarity in recall and reduced accuracy in recognizing transcript wording, with heavier reliance on visual representations during recall. Relatedly, given a reliance on visual representations for memory-guided decisions, we predict increased target hits and false alarms for visually-similar screenshots in individuals with strong mental imagery. This study will provide novel insights into the relationship between mental imagery and episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

C106 - Inhibition of the Left Amygdala via Low-Intensity Focused Ultrasound Enhances the Encoding of Emotional and Neutral Episodic Memories

Sydney Lambert[1] (sydney.lambert@austin.utexas.edu), Manoj Doss[1], Charles Nemeroff[1], Gregory Fonzo[1], Joseph Dunsmoor[1]; [1]The University of Texas at Austin

The amygdala is thought to be crucial to the formation and encoding of emotional episodic memories, but causal evidence for this assertion in humans is limited. In a double-blind, sham-controlled, repeated measures study ($N = 18$), we inhibited the left amygdala with low-intensity focused ultrasound during the encoding of emotional episodic memories. Following sonication, participants completed the encoding phase of an emotional episodic memory task in which emotionally negative, neutral, and positive pictures were presented. The following day, participants completed the retrieval phase in which memory for pictures was tested on a cued recollection test and picture recognition test. Surprisingly, active vs. sham sonication enhanced memory for negative, neutral, and positive stimuli (main effect of sonication on cued recollection memory accuracy: $F(1,17) = 4.35$, $p = .005$, $\eta p2 = .20$), without differential effects of sonication on emotional stimuli (sonication × emotion interaction on cued recollection memory accuracy: ($F(2, 34) = .86$, $p > .250$). Memory enhancements were found across multiple other measures on both memory tests and came from an increase in hit rates (rather than a decrease in false alarm rates). These findings motivate a novel hypothesis for the role of the amygdala in emotional episodic memory. Rather than the amygdala enhancing memory via amplification of salient stimuli, it may instead act as a filter that attenuates the maintenance of non-salient stimuli in long-term memory. With temporary inhibition, these findings suggest that memory can be acutely enhanced, thereby opening avenues for transient memory enhancements in disorders exhibiting mnemonic impairments.

Topic Area: LONG-TERM MEMORY: Episodic

C107 - Repetition facilitates differentiation of neural representations in the hippocampus

Emily T Cowan[1] (ecowan@adelphi.edu), Busra Tanriverdi[2], Ingrid Olson[2], Vishnu P Murty[2,3], Jason Chein[2]; [1]Adelphi University, [2]Temple University, [3]University of Oregon

While memory seems to benefit from repeated learning opportunities, it remains unclear how repetition affects the organization of memories in the brain. In an fMRI study, 25 participants viewed image-location pairs, each of which was repeated 4 times. To examine how the representational patterns change across repetitions, for each pair, we calculated pattern similarity between consecutive repetitions. In bilateral hippocampus, we found evidence of differentiation in the representational patterns evoked across repetitions, with a significant decrease in pattern similarity between the first two versus last two repetitions ($t(24)= 2.73$, $p=0.01$). This pattern of results was particularly evident in the anterior hippocampus ($t(24)= 2.38$, $p=0.03$). We next developed several theoretical models of the patterns of voxel-wise changes that could explain the observed differentiation across repetitions. Versions of models tested changes based on novelty, gradual versus abrupt changes across repetitions, and the effects of general representational drift. For each of these models, we simulated patterns of voxels and calculated the similarity between consecutive repetitions (100,000 simulations). The simulated similarity data was then compared to the fMRI data. Comparisons across models will provide theoretical explanations for the differentiation we observed in the fMRI data.

Topic Area: LONG-TERM MEMORY: Episodic

C108 - Memory content shapes event-specific representations in the default mode network

Nina Curko[1] (curko@bc.edu), Rosalie Samide[1], Valentina Krenz[1], Elizabeth A. Kensinger[1], Maureen Ritchey[1]; [1]Boston College

Successful memory retrieval has been associated with the representational stability of event-specific activity patterns during recall. However, it is unclear whether representational stability is tied to specific kinds of memory details. For example, stable recall patterns may be associated with broader narrative details about an event by providing a consistent conceptual or affective frame. Alternatively, stable recall patterns could reflect a more faithful recapitulation of the perceptual details of an event. We examined representational stability within the default mode network (DMN), a set of regions commonly implicated in representing events during recall. The present study used representational similarity analysis (RSA) to ask whether the stability of a memory representation in the DMN reflects the persistence of event details in memory, in particular narrative, perceptual, or emotional information. Participants first viewed positive, negative, and neutral news clips, then brain activity was recorded while participants covertly recalled the videos three times in response to word cues. One day later, participants wrote memory descriptions for each video, and content was categorized into narrative and perceptual details. RSA was used to compute each event's representational stability across the three retrieval rounds. Greater representational stability across repeated recalls was associated with the emotional valence of recall in more dorsal DMN areas, while stability in ventral DMN areas was associated with perceptual recall. These findings suggest that representational stability in the DMN depends on the content being recalled, with differential recruitment of DMN regions based on the type of information retrieved.

Topic Area: LONG-TERM MEMORY: Episodic

C109 - EEG Correlates of Event Model Stability in Aging

Mohsen Davoudkhani[1] (mohsen135@ksu.edu), Michael Tollefsrud, Trase Byarlay-McQueen, Kristen McGatlin, Alexia Bouslog, Ashi Wickramasundara, Olivia Edwards, Jordyn Gibson, Morgan Skinner, Heather Bailey; [1]Kansas State University

Older adults segment and remember everyday activities less effectively than young adults. Previous fMRI studies (Bailey et al., 2013; Kurby & Zacks, 2019) indicate that both age groups recruit similar brain regions at event boundaries, suggesting intact event model updating. In the current study, we evaluated whether age-related declines in event memory are due to age-related changes in event model maintenance, which was operationalized as EEG pattern similarity. To do so, 41 young (18-33) and 42 older adults (60-85) watched an episode of BBC's Sherlock while their EEG was recorded, and then they completed event memory measures and a battery of standardized cognitive measures (NIH Toolbox) without EEG. EEG pattern similarity is calculated as a Pearson correlation of point-to-point spatiotemporal similarity for voltages across all electrodes over time. Previous work has shown that pattern similarity is higher within the same event versus across two different events. If age-related deficits in event processing are due to older adults' inability to maintain a stable event model as an event unfolds, then older adults will show lower pattern similarity within events compared to young adults. We found that pattern similarity was higher within events than across events in both young and older adults; however, we observed no interaction with age. Further, within-event pattern similarity was not related to overall memory for the episode.

Topic Area: LONG-TERM MEMORY: Episodic

C110 - Does a shift in mental time translate into a shift in low-frequency oscillations?

Anna M.A. Wagelmans[1] (anna.wagelmans@cea.fr), Virginie van Wassenhove[1]; [1]CEA/DRF/Inst. Joliot, NeuroSpin; INSERM, Cognitive Neuroimaging Unit; Université Paris Saclay, Gif/Yvette, France

Through mental time travel (MTT), humans can explore past events or possible futures. One hypothesis is that MTT builds on flexible temporal cognitive maps of events' position in time (Gauthier & van Wassenhove, 2016). Previous studies showed the implication of the hippocampal-entorhinal system for MTT (Gauthier et al., 2020), where the sequential firing of neuronal assemblies on shifting phases of theta oscillations codes for spatial position and distance (Dragoi & Buzsáki, 2006). Yet, the computation of temporal distances remains to be characterized. In a novel paradigm (N = 63), participants mentally projected themselves to different dates in the past or future. They were shown historical events, and had to report whether the event would happen before or after, with respect to their temporal position. The further away in time participants imagined themselves to be, the slower their reaction times. This behavioural parametric shift shows that distance computations can be captured during MTT, grounding the hypothesis of a similar shift in neural responses. Herein, we adapted this task to magnetoencephalography (N = 31). We show that the amplitude of neural responses evoked by mentally projecting in time increased compared to being in the present, but did not shift along distance. This suggests that the evoked response captures the operation of mentally projecting oneself, but not the underlying distance computations. Analyses are ongoing to test whether the phase of low-frequency oscillations shifts with the distance of projection, which would provide evidence that temporal distance computations can be implemented by low-frequency neural dynamics.

Topic Area: LONG-TERM MEMORY: Episodic

C111 - The roles of event content and recall specificity in shaping representations of naturalistic narratives

Angelique Delarazan[1] (a.delarazan@wustl.edu), Tej Bhoga[1], Katherine March[1], Zachariah Reagh[1]; [1]Washington University in St. Louis

Episodic memory plays a fundamental role in cognition, allowing us to convert a continuous influx of information into representations we can learn and later retrieve. The multifaceted nature of memory representations poses a challenge for disentangling the neural processes that support them. For instance, remembering one's own tenth birthday may consist of retrieving the individual entities of the event such as the people and objects involved, as well as contexts including the place and situations that have unfolded. One could also retain and represent these memories at varying levels of specificity, including a gist-level summary the event, or a highly specific detailed-level account, incorporating rich and vivid details about the event. Here, we aimed to examine how different neural representations of specificity (gist versus detailed memories) and content (people versus locations) may interact with one another. Twenty-eight participants were introduced to eight distinct short narrative events. Two central characters and two locations were combined such that one narrative involved one central character and one location. Participants were then cued to verbally recall the characters, locations, and events at a gist- or detailed-level immediately and after a two-week delay. Ongoing representational similarity analyses will assess the functional organization of cortico-hippocampal networks in supporting event memory representations of specificity and content. Additional analyses will investigate how these representations change over the course of encoding, retrieval, and re-retrieval after a delay. Together, results will clarify the way individual components of complex events are processed and remembered at different levels of specificity.

Topic Area: LONG-TERM MEMORY: Episodic

C113 - The effect of threat intensity on higher-order fear generalization

lingwei ouyang[1] (lingwei.ouyang@utexas.edu), Isaias De La Rosa[1], Joseph Dunsmoor[2,3]; [1]Department of Psychology, University of Texas at Austin, [2]Institute for Neuroscience, University of Texas at Austin, [3]Department of Psychiatry, University of Texas at Austin

It is often important to infer potential danger without direct knowledge. Such inference can arise from leveraging prior associations formed before an emotional learning experience—a higher-order fear learning process known as sensory preconditioning. A crucial factor that determines the extent of fear generalization following an emotional event is the emotional intensity of such event. However, it remains unclear how emotional intensity affects fear generalization within the framework of sensory preconditioning. For example, does a more intense emotional learning experience lead to stronger transfer of fear to stimuli previously associated with those directly related to threat? In this project, 60 participants were randomly assigned to a high or low fear-conditioning group, with intensity of an electrical shock (unconditioned stimuli, US) as the independent variable. Prior to fear-conditioning, participants associated neutral category images of animals or tools (preconditioned stimuli, PS) with images of either outdoor or indoor scenes, respectively. One scene image category (conditioned stimuli, CS+) was then paired with the US. Images from the PS categories were presented again in a generalization (i.e., transfer) test, followed the next day by a test of recognition memory for the PSs. Results showed greater transfer of autonomic arousal (skin conductance responses) as well as better overall recognition of PSs, in the high versus low intensity group. These results highlight that the intensity of an emotional event impacts the indirect transfer of memory and emotional responses, and may in part explain seemingly irrational threat inferences following highly negative emotional experiences.

Topic Area: LONG-TERM MEMORY: Episodic

C114 - Forming episodic memories one transition at a time

Valentina Krenz[1] (krenzv@bc.edu), Maureen Ritchey[1]; [1]Boston College

Episodic memory requires integrating multiple features into cohesive representations, yet the neural mechanisms underlying this process remain unclear. Event transitions, particularly stimulus offset-related activity in the hippocampus and its interactions with regions of the posterior medial network (PMN), have been linked to subsequent memory for multifeatural events. This study investigates the neural mechanisms of memory formation as an encoding event unfolds, examining whether cortico-hippocampal activity patterns at event transitions predict subsequent memory for event features and their specificity. During fMRI measurements, participants encode scene images that are briefly overlaid with objects at variable spatial locations, with active inter-trial intervals isolating offset-related activity. At retrieval, participants are cued with scene images to recall detailed object information, followed by a recognition task probing memory specificity using original, novel, and similar objects. Multivariate fMRI analyses will assess when cortico-hippocampal activity patterns predict subsequent memory and its specificity. Additionally, reinstatement of encoding-related patterns at event offsets will be examined as a potential mechanism supporting memory formation. Functional connectivity analyses will unravel interactions among content-selective regions, the PMN, and the hippocampus as the encoding event unfolds, revealing the neural dynamics underlying episodic memory formation. Together, this study aims to provide an experimental framework for testing key predictions about how multifeatural events are integrated into episodic memory.

Topic Area: LONG-TERM MEMORY: Episodic

C115 - Using EEG to test the impact of attention deficits on memory performance in cancer-related cognitive dysfunction

Alexandra Gaynor[1], James Root[2], Pangzhongyuan Pei[3], Dishari Azad[4], Maria Estelle[1,2], Isabella Mohr[2], Tim Ahles[2], Jennifer Mangels[4,5]; [1]Montclair State University, [2]Memorial Sloan Kettering Cancer Center, [3]Teachers College, Columbia University, [4]The Graduate Center, The City University of New York, [5]Baruch College, The City University of New York

More than half of cancer survivors report struggles with “forgetting” information from long-term memory, but traditional neuropsychological tests often fail to detect these subtle memory deficits. Previous work has shown that survivors demonstrate atypical event-related potentials (ERPs) related to early attentional gating, suggesting what survivors report as “forgetting” may actually stem from attention difficulties that impact encoding. The present study examined whether memory deficits in cancer-related cognitive dysfunction (CRCD) are exacerbated under distraction, and whether these deficits are associated with changes in ERPs at encoding previously associated with attention and subsequent memory. EEG was recorded while breast cancer survivors (BCS; n=23) and non-cancer controls (NCC; n=23) completed 6 study-test runs of a verbal old/new recognition task. Half of runs included an auditory distractor during encoding. Participants gave memory confidence (metamemory) ratings for each item at study and test to examine whether poor subjective awareness of memory accounts for survivors’ tendency to mischaracterize encoding deficits as retrieval problems. Data analyses are ongoing. We hypothesize that the effect of distraction on the amplitude of attention-related ERPs, including those that predict subsequent memory (i.e., P3/LPC, sustained frontal waveforms), will be greater for BCS than NCC. We also expect BCS to have poorer metamemory accuracy than NCC, suggesting difficulty detecting attentional failures in real time. Results of this study will elucidate the relationship between attention and memory dysfunction in CRCD, and whether survivors demonstrate deficits in awareness which would pose a challenge for current methods of remediation.

Topic Area: LONG-TERM MEMORY: Episodic

C116 - Decoding memory-guided predictions in the medial temporal lobe and visual cortex

Dingrong Guo[1] (guo@psych.uni-frankfurt.de), Javier Ortiz-Tudela[2], Yee Lee Shing[1,3]; [1]Department of Psychology, Goethe University Frankfurt, [2]Mind, Brain and Behaviour Research Center (CIMCYC); Department of Experimental Psychology, University of Granada, [3]Brain Imaging Center, Goethe University Frankfurt

How we perceive the visual environment relies on the integration between concurrent contextual information and our existing memories or prior knowledge. The predictive processing framework suggests that this integration is supported by the hierarchical and/or laminar organizations of the visual cortex, as well as its interactions with the medial temporal lobe (MTL), especially the hippocampus and entorhinal cortex (EC). To investigate the neural basis of this integration, we collected ultra-high-field 7T fMRI data using an occluder paradigm designed to isolate signals from mnemonic information and signals from concurrent contextual cues. In this 2-day experiment, participants first learned cartoon images of real-world locations featuring key objects. Twenty-four hours later, while inside the scanner, they were asked to mentally retrieve the missing objects that were located in the occluded part of the learned images. Planned data analyses will include layer-specific classifiers and representational similarity analysis to delineate different types of feedback signals across cortical layers of our regions of interest (i.e., early visual cortex, object-selective cortex and MTL subregions). Additionally, connectivity analyses will explore the interactions between these regions and their layer-specific connectivity patterns. The findings of this study are expected to enhance our understanding of how predictions are formed through the dynamic interplay between sensory inputs and pre-existing memory representations.

Topic Area: LONG-TERM MEMORY: Episodic

C117 - Investigating the impact of cognitive load on hippocampal activity and episodic memory

Emma Laurent[1] (emmalaurent@g.harvard.edu), Elizabeth Miclau[1], Lila Davachi[2], Elizabeth Phelps[1]; [1]Harvard University, [2]Columbia University

Accumulating evidence highlights the role of hippocampal replay during sleep and wakeful rest in supporting memory consolidation. Additionally, post-encoding rest has been shown to enhance long-term memory compared to task engagement. These "offline" internally-oriented states are associated with increased activity in the Default Network (DN), which is implicated in retrieving past experiences and simulating future events. In contrast, the Dorsal Attention Network (DAN) is thought to allocate cognitive resources toward external stimuli and exhibits functional opposition to the DN. A plausible mechanism underlying the benefits of rest as compared to "online" task engagement is that the latter recruits the DAN, suppressing the DN and thereby its constituent hippocampus, which is critical for memory processing. Leveraging existing fMRI data, we find that hippocampal activity is systematically suppressed with increasing cognitive load. In a within-subjects fMRI study, we investigate whether this load-dependent suppression of hippocampal activity impairs memory consolidation. Participants completed a brief 0- or 2-back task following an incidental encoding task, with episodic memory subsequently assessed. This process was repeated for the remaining N-back condition. We hypothesize that increasing post-encoding cognitive load will lead to diminished memory performance, reflecting group-level reductions in BOLD activity in the DN. To test this, we will conduct an ROI analysis of two DN constituents: the hippocampus and vmPFC. Furthermore, we predict this effect will be mediated by individual differences in hippocampal suppression, as revealed by first-level contrasts. These findings aim to advance our understanding of the relationship between cognitive load, hippocampal function, and memory consolidation.

Topic Area: LONG-TERM MEMORY: Episodic

C118 - Distortions in Consolidation of Competing Memory Traces by Use of a Post-Encoding Manipulation.

Katelyn Cliver[1] (kate.cliver@drexel.edu), Alexa Tompary[1]; [1]Drexel University

Memories are dynamic and malleable, representing a reconstructed version of the initially encoded information that is shaped by both episodic event details and relevant general knowledge. In this study, we explored whether consolidation mechanisms can be manipulated to prioritize specific episodic details or more generalized prior knowledge. By examining the interaction between event details and generalized knowledge—particularly through hippocampal-cortical mechanisms—we aim to understand how distinct memory systems influence consolidation processes. We utilized a paradigm previously employed in studies in which individuals learned spatial locations of images. Critically, most images locations clustered by their category (e.g. birds, tools) but some images were located far from their category, which differentiates their episodic memories from generalized category knowledge. Following this learning phase, we implemented a delay-dependent retroactive memory manipulation to selectively tag or reinforce either the episodic or generalized memories. This approach was inspired by prior retroactive tagging manipulations and allowed us to induce post-consolidation memory distortions and explore their underlying mechanisms. We hypothesized that prioritizing prior knowledge would emphasize the importance of category information, increasing distortions in retrieval while focusing on specific details would reduce the magnitude of error in retrieval. Our findings revealed that memories for images involved in the post-encoding manipulation targeting category membership were biased toward the spatially consistent category, but only after a 24-hour delay. While this work highlights the potential for retroactively targeting memories over a delay using novel behavioral manipulations, further research is needed to uncover the cognitive and neural mechanisms underlying these effects.

Topic Area: LONG-TERM MEMORY: Episodic

C119 - Something Old, Something New: Interacting effects of novelty and similarity on autobiographical memory

Erin Welch[1], Victoria Schelkun[1], Camille Gasser[1], Kathryn Lockwood[1], Lila Davachi[1,2]; [1]Columbia University, [2]Nathan Kline Institute

Novelty and schemas have been shown to support later memory retrieval through differing mechanisms. Critically, autobiographical experiences are rarely completely novel or completely congruent with prior experience, existing somewhere within this spectrum of 'absolute' novelty to 'absolute' familiarity. We examined their interacting effects using daily diary data (N=41). Participants described three events that took place each day for two weeks, generating a unique title for each event. After a two-week delay, participants' memory was tested for the diary events. Events reported as being 'new' were remembered with significantly greater vividness than periodic and routine events. Using a pre-trained SBERT model, an event-level relative semantic similarity (RSS) variable was created to represent how semantically similar an event is in relation to all remaining events reported by that participant. Routine events had significantly higher overall RSS values, while new events had significantly lower RSS values. Further, RSS modulated the effect of novelty on memory vividness. Routine events with low RSS were remembered with significantly greater vividness than routine events with high RSS. By contrast, an inverse relationship was found in new events, greater RSS predicting significantly greater vividness, suggesting that novelty supports memory vividness, but does so more effectively when there is a scaffold of familiarity. These results suggest that novelty and schemas can collaboratively support autobiographical memory vividness. Further, utilizing SBERT to analyze narrative data has only become a recent possibility, and has the potential to be an exciting new tool given its efficiency and flexibility.

Topic Area: LONG-TERM MEMORY: Episodic

C120 - Does Rewarding "Effort" Rather than Accuracy Alter Feedback- and Reward-related ERPs in a Declarative Memory Task?

Jennifer Mangels[1,2] (jennifer.mangels@baruch.cuny.edu), Rebecca McCune[1], Daisy Reyes[2], Caesar Ekya[2]; [1]Baruch College, CUNY, [2]Graduate Center of CUNY

Rewards are most beneficial to learning if they are contingent on agency and competence. When competence is defined exclusively as accuracy, however, individuals may avoid more challenging, effortful tasks over concerns that mistakes will result in reward loss. In the present study, we asked whether and how rewarding students for "genuine effort," rather than either accuracy exclusively (or mere participation), would support sustained engagement in a challenging task and lead to improved feedback-based learning outcomes. EEG was recorded as students attempted difficult general knowledge questions (30% correct) and received accuracy feedback which included the correct answer (i.e., learning opportunity). In a "reward" block, students then intermittently (~30%) received a $0.25 reward (signaled by a yellow disk) not only when correct but also if their incorrect answer was semantically-related to the correct answer; semantically-unrelated answers were reward-ineligible. In a "control" block, yellow disks appeared based on the same contingencies but were not associated with reward and rather, were counted. Successful learning was based on a subsequent surprise retest. Data collection is ongoing, but we predict that under reward framing compared to control framing, learning will be facilitated and the feedback-related negativity (FRN) to effortful incorrect responses may be attenuated because the prospect of reward reduces the loss/negative valence. FRN amplitude may be inversely related to indices of reward salience (RewP). This novel approach to reward may provide insights into the FRN, as well as an evidenced-based way to motivate students to approach challenging tasks and learn optimally from mistakes.

Topic Area: LONG-TERM MEMORY: Episodic

C121 - Cultural differences in the self-referencing memory effect and underlying neural mechanisms

Ahhyun Seo[1] (ahhyun@utexas.edu), Iva Dujmic[2], Angela Gutchess[2], Audrey Duarte[1]; [1]The University of Texas at Austin, [2]Brandeis University

The self-reference effect, a boost in episodic memory when linking information to oneself rather than others or making semantic judgments, is a robust memory encoding strategy. However, the self-reference effect has been investigated almost exclusively in Non-Hispanic White participants from individualistic culture. This study investigates the effects of culture on self-referencing memory effects and underlying neural mechanisms in Non-Hispanic Whites (NHWs), and people with bicultural collectivistic and individualistic identities: Mexican Americans (MAs), and Chinese Americans (CAs). We also examined the emotional contents of self-referenced information in the two bicultural groups, focusing on how cultural differences between Latinos and East Asians in the expression and valuation of emotions influence memory. EEG was measured as participants encoded and retrieved positive and negative adjectives under self-referencing, close-other referencing, or semantic judgment conditions. We hypothesized that self-referencing memory and associated old/new ERP effects would be stronger in NHWs compared to two bicultural groups (MAs, CAs). Furthermore, we predicted that MAs would find more positive words self-relevant than CAs, reflecting cultural differences in the expression and valuation of emotions, which could lead to better memory for specific emotionally valenced adjectives. Preliminary data support our predictions, showing robust self-referencing memory and associated old/new ERP effects across groups, with cultural group differences in latency and magnitude. MAs also endorsed more positive words as self-referential than CAs. We will further explore how these differences in emotional valence endorsement influence memory performance across various emotional adjectives. This work aims to inform culturally tailored memory interventions for diverse populations.

Topic Area: LONG-TERM MEMORY: Episodic

C122 - Characterizing Novelty-evoked Prediction Errors across the Mesolimbic System

Yifang Liu[1] (yifangl@uoregon.edu), Ian C. Ballard[2], J. Benjamin Hutchinson[1], Vishnu P. Murty[1]; [1]University of Oregon, [2]University of California, Riverside

Novelty signals a violation of predictions and a need to update our models of the world. These novelty-evoked prediction errors play a significant role in shaping learning and memory, yet may reflect different learning signals across brain regions underlying motivation. While some regions prioritize rapid adaptation to unexpected events, others focus on gradually integrating novel information into stable memory networks, a process that can be characterized as learning rates in reinforcement learning models. We hypothesize that mnemonic structures like the anterior hippocampus exhibit slower learning rates compared to non-mnemonic structures such as the VTA and nucleus accumbens. To address this, we will use the Natural Scenes Dataset, which provides high-resolution fMRI data from 8 participants exposed to thousands of novel and familiar natural scene images. We will fit a reinforcement learning model with neuroimaging data from novelty-evoked prediction error responses to estimate learning rates across the anterior hippocampus, VTA, and nucleus accumbens during novelty processing. We will then compare these learning rates across regions using a multi-level modeling approach to capture region-specific dynamics in responding to novelty. These findings will provide insights into how different brain regions contribute to novelty-driven learning and will refine our understanding of how the brain balances adaptability and memory stability.

Topic Area: LONG-TERM MEMORY: Episodic

C123 - Examining vivid recollection of autobiographical memories using fMRI and eye movement data

Ryan Yeung[1] (ryeung@research.baycrest.org), Devin Sodums[1,2], Brian Levine[1,3]; [1]Rotman Research Institute, [2]Valparaiso University, [3]University of Toronto

Vivid recollection is theorized to be supported by the visual and oculomotor systems. Activity of these systems could help instantiate perceptual or scene-based details, upon which feelings of vividness or reliving rely. Past studies have independently found relationships between vivid memory and visual brain regions (e.g., occipital cortex, precuneus), and between vivid memory and eye movements (e.g., more fixations). Here, we aim to examine relationships between all three: vivid memory, brain activity, and oculomotor activity. To do so, we reanalyzed data from an fMRI study (Palombo, 2013), in which 44 participants silently retrieved twenty autobiographical memories (AMs) in the scanner and provided ratings of subjective reexperiencing. These fMRI data have been preprocessed using fMRIprep, and will be further passed through DeepMReye to decode gaze position during the AM task (free viewing). We will then use these eye movement data to replicate the previously observed fixation-recall relationship and extend it to neuroimaging data. Specifically, we predict that the benefit of more fixations during AM retrieval will be recapitulated in brain regions related to vision and imagery. Results will help understand mechanisms of vivid recollection using subjective, neural, and oculomotor data.

Topic Area: LONG-TERM MEMORY: Episodic

C124 - 10-year remote memory evaluation of a verifiable event: Follow-up from the Saguenay Youth Study

Krista Mitchnick[1] (kmitchnick@research.baycrest.org), Louis Richer[2], Tomas Paus[3], Brian Levine[1]; [1]Rotman Research Institute at Baycrest, Toronto, Canada, [2]Université du Québec à Chicoutimi, Montreal, Canada, [3]University of Montreal, Montreal, Canada

Remote memory is typically assessed by probing public or personal events. While informative, these approaches assume similar exposure and processing of these events across participants. The present study assessed remote memory of a shared event with unprecedented control over event characteristics. Approximately 10 years ago, a two-generational study of adolescents and their parents (n= 1029 adolescents and 962 parents) was conducted, aimed at investigating the aetiology, early states, and trans-generational trajectories of common brain diseases. The participants in this Saguenay Youth Study (Quebec, Canada) were extensively phenotyped, including structural brain imaging, a full neuropsychological evaluation, mental health profiling, and various social (e.g., social economic status) and health (e.g., in utero nicotine exposure) factors. Approximately half (n = 446; ages 22-28) of these youth have recently participated in a 10-year follow-up, including structural brain imaging and both neurocognitive and mental health evaluations. Critically, they additionally completed a recognition memory test for events occurring as part of the initial study protocol. Responses to true/false questions and item confidence ratings allow the assessment of memory accuracy and memory type (i.e., recollection vs. familiarity). Results will also be compared to previous and current structural imaging (particularly medial temporal lobe regions), societal and health factors, and neuropsychological evaluations. Findings are anticipated to highlight covariance patterns between memory performance and regional brain volumes, as well as the extent to which classic neuropsychological tests of memory relate to real-world memory performance as measured by this novel assessment.

Topic Area: LONG-TERM MEMORY: Episodic

C125 - Influence of expertise on episodic autobiographical memory performance during demanding outdoor adventure experiences

Lexi Golestani[1] (lexi.golestani@utah.edu), Cory Inman[1]; [1]University of Utah

Episodic autobiographical memory (EAM) is essential for constructing a cohesive identity and foundational schema by enabling individuals to reflect on and integrate past experiences in order to respond and adapt to future challenges. This ability is especially critical for those navigating dynamic, high-risk environments as they necessitate high-consequence decision-making during demanding experiences, which relies on schema-based recall. While stress (demand), emotion, arousal, and expertise have been studied individually in relation to memory performance, their complex interactive effects on memory performance in real-world settings remain underexplored. We use the well-established Autobiographical Interview (Levine, 2002) measure to investigate how expertise influences EAM performance during whitewater boating, which is considered a high-risk, complex recreational activity that often requires managing cognitive, physical, and emotional demands simultaneously. The Autobiographical Interview offers a window into hippocampal-dependent memory processes by quantifying episodic and semantic details from recalled experiences using validated manual coding and Natural Language Processing (NLP). We measure risk perception, sensation seeking, alexithymia, and personality as potential covariates influencing memory differences between experts and novices. Preliminary analyses suggest that expert whitewater boaters encode and retain more episodic details than novices during demanding whitewater experiences, which aligns with theories of cognitive load and schema reliance. This suggests that higher levels of proficiency, specialization and familiarity facilitate more effective EAM encoding and retrieval by leveraging pre-existing cognitive frameworks during moments of intense demand (stress). Future work looks to integrate stress biomarkers and neuroimaging to further elucidate the role of the hippocampus in EAM during demanding outdoor adventure experiences.

Topic Area: LONG-TERM MEMORY: Episodic

C126 - Anterior theta and posterior alpha oscillations in associative memory

Tamari Shalamberidze[1] (shalambe@ualberta.ca), Yvonne Y. Chen[2], Kyle Nash[1], Jeremy B. Caplan[1]; [1]University of Alberta, [2]University of Pennsylvania

Higher anterior theta oscillations and lower posterior alpha oscillations are related to better memory performance (e.g., Klimesch, 1999). Chen (2017) found that anterior theta and posterior alpha oscillations distinguished correctly versus incorrectly remembered words in associative recognition. Moreover, theta but not alpha subsequent memory effects correlated with associative memory performance across participants. We replicated Chen's (2017) findings and observed a significant anterior theta subsequent-memory effect, which correlated with associative memory performance across participants. However, no clear posterior alpha peak was evident in our memory-task analysis despite confirming eyes-closed alpha in resting-state conditions (Shalamberidze et al., in revision). The alpha activity that was present showed the opposite pattern, with less alpha activity during later-forgotten than later-remembered trials. Interestingly, the second experiment was run during the COVID-19 pandemic, shortly after EEG lab restrictions were lifted, though many other restrictions remained. Despite these changes in circumstances, the theta subsequent memory effect remained robust, whereas the alpha oscillation effects were inconsistent. Taken together, these findings suggest that, consistent with the literature, theta oscillations play a fundamental role in associative memory. In contrast, alpha oscillations appear less crucial for associative memory performance.

Topic Area: LONG-TERM MEMORY: Episodic

C127 - The Relationship Between Physiological Arousal and the Emotional-Trade Off Effect in Younger and Middle-Aged Adults

SEHAM KAFAFI[1] (skafafi@nd.edu); [1]University of Notre Dame

Negative experiences are often more memorable than neutral ones, partly due to the central noradrenergic system, particularly the amygdala, activating during negative emotion encoding. This activation, driven by the norepinephrine-releasing locus coeruleus, enhances physiological arousal responses like increased heart rate and sweating, marking events as goal-relevant. This study examines how physiological arousal during encoding affects memory for negative and neutral scenes in younger and middle-aged adults. A multi-level structural equation model was employed to predict whether trial-level arousal enhances memory for items or backgrounds. Greater skin conductance response to negative scenes was linked to poorer memory for negative versus neutral objects, while greater heart rate deceleration predicted better memory for negative objects. Both age groups showed higher false alarm rates for negative scenes, but middle-aged adults were more prone to such errors, indicating increased susceptibility to memory distortions with age. These findings suggest physiological arousal may overgeneralize negative memory encoding, with this effect intensifying as individuals age.

Topic Area: LONG-TERM MEMORY: Episodic

C128 - How Changes in Mental Replay Speed Impact Retrospective Duration Judgments of Past Events?

Wing Yin Winny Yue[1] (winnyue@connect.hku.hk); [1]The University of Hong Kong

We often replay memory episodes mentally in daily life at varying speeds for different purposes. Previous research has shown that our memory of the event structure, particularly the number of event boundaries, significantly influences how we retrospectively judge the duration of entire memory episodes. Nevertheless, when the structure of the event is maintained, how does manipulating mental replay influences retrospective duration judgement? In the current study, participants watched video clips depicting everyday life events, with subevents separated by clear event boundaries, while EEGs were recorded. Immediately after viewing a video, participants were instructed to mentally replay the event at one of three replay speeds—compressed, expanded, or at their natural pace. We then measured both the natural replay duration and retrospective duration judgments. Analyzing EEGs during video viewing showed that participants detected event boundaries as evidenced by two significant clusters: one within the delta-theta band and another within the sigma-beta-gamma band (two-tailed t-tests with cluster-based permutation correction). During post-encoding mental replay, participants successfully adhered to the manipulated replay speeds, with slower speeds resulting in longer natural replay durations. However, retrospective duration judgments were not influenced by the manipulation of speed of mental replay. Overall, these findings suggest that while individuals can flexibly adjust the speed at which they mentally replay events, retrospective duration judgments are neither updated nor affected by the dynamics of post-encoding replay.

Topic Area: LONG-TERM MEMORY: Episodic

C129 - De-Confounding Associations between Neural Activity and Memory Performance

Riley DeHaan[1] (rdehaan@sas.upenn.edu), David Halpern[1]; [1]University of Pennsylvania

Decades of work have demonstrated associations between neural activity at the time of memory encoding and subsequent memory performance. However, the vast majority of this literature estimates the subsequent memory effect without simultaneously accounting for stimulus properties such as study position and item identity, which are known to affect both memory and neural activity. It therefore remains unclear whether these effects from observational data reflect causes of successful memory encoding or task-related confounds. Here we analyze intracranial EEG recorded from 375 subjects during a delayed free recall task and from 72 subjects during a paired associates learning task. We compare estimates of the subsequent memory effect, computed with and without adjustments for confounding variables of serial position and item identity. We find that accounting for these confounds significantly attenuates the magnitude of the subsequent memory effect. Furthermore, stimulus features are twice as effective at predicting memory outcomes than neural data alone. After removing stimulus-related effects, neural activity remains a significant behavioral predictor but only explains an additional 3.9% of the variance in recall performance. We further analyze differences in subsequent memory effects across anatomical regions, frequency bands, and time periods relative to item presentation after accounting for task variables. These results show qualitative differences in the regions associated with successful memory as opposed to item identity and serial position. Confounding is large in these memory tasks and should be expected to be large across much of neuroscience. These results suggest careful de-confounding should be a central step in systems neuroscience.

Topic Area: LONG-TERM MEMORY: Episodic

C130 - Hippocampal volume changes linked to mnemonic discrimination gains following cognitive training in older adults: a 7T MRI study

Panagiotis Iliopoulos[12] (panagiotis.iliopoulos@med.ovgu.de), Helena Gellersen[2], Anne Maass[13], Boyan Rong[3], Radoslaw Martin Cichy[2], Emrah Düzel[12]; [1]Institute of Cognitive Neurology and Dementia Research, Otto-von-Guericke University, Magdeburg, Germany, [2]German Center for Neurodegenerative Diseases (DZNE), Magdeburg, Germany, [3]Department of Education and Psychology, Freie Universität Berlin, Berlin, Germany

Mnemonic discrimination (MD), the ability to distinguish current experiences from similar memories, declines with age. Whether cognitive training can enhance MD and induce brain plasticity in older adults remains unclear. Here we investigated whether 8 weeks of web-based cognitive training improves MD and we tested if these gains are linked to structural changes in key medial temporal lobe regions. A total of 151 older adults (age M = 69.71 years, SD = 4.17) completed the study, divided into three groups: object stimuli training (OG), scene stimuli training (SG), and an active control (AC). A subset of OG (n = 33) and AC (n = 28) participants also underwent pre- and post-training 7T MRI scans. The training paradigm involved differentiating similar objects and scenes ('lures') from repeated items ('repeats'). The stimuli were first presented in a 2-back set-size, which increased progressively across the training based on performance. Participants completed behavioral assessments pre- and post-training, including MD and other cognitive tasks. Training improved MD performance. OG participants showed enhanced object MD and near transfer to scenes, while SG participants improved only in scene MD. A change-change linear model revealed that MD performance gains in OG participants were associated to post-training increased gray matter volume in the hippocampal CA2-3 regions. These findings demonstrate that cognitive training can enhance MD in older adults and suggest structural plasticity in the CA2-3 hippocampal area as a potential mechanism for these improvements

Topic Area: LONG-TERM MEMORY: Episodic

C131 - Characterizing the relationship between episodic memory and hippocampal functional networks in individuals at familial risk for schizophrenia

Aslihan Imamoglu[1], Mackenzie E. Mitchell[2], Tehila Nugiel[3], Mackenzie Woodburn[4], Jessica R. Cohen[5], Aysenil Belger[5], Kelly S. Giovanello[5]; [1]Vanderbilt University Medical Center, [2]University of Illinois, Urbana-Champaign, [3]Florida State University, [4]Nature Communications, [5]University of North Carolina, Chapel Hill

Episodic memory impairments are consistently observed in individuals with first-episode psychosis and chronic schizophrenia, as well as their high-risk, first-degree relatives. In individuals with schizophrenia, these impairments have been linked to disruptions in the modularity of two hippocampal resting-state networks integral to episodic memory: the hippocampal-medial temporal lobe cortex (MTLC) and the extended hippocampal cortical networks. The current study extends these findings by characterizing the relationship between resting-state hippocampal modularity and episodic memory in individuals at high familial risk for schizophrenia. Participants were 73 children and adolescents (aged 9 to 16 years old) who completed a measure of episodic memory (i.e., delayed-free recall task), as well as a 6-minute resting-state scan. We hypothesized that when compared to age-matched healthy controls (N = 49), participants at high familial risk for schizophrenia (N = 24) would exhibit reduced modularity in the core hippocampal-MTLC network, and that this difference in modularity would relate to lower accuracy on the free recall task. We also hypothesized that both groups would show comparable modularity in the extended hippocampal-cortical network, consistent with findings in schizophrenia. Contrary to our hypothesis, the two groups were comparable in the modularity of both hippocampal networks. Notably, modularity for these two networks was unrelated to episodic memory performance. These findings suggest that the modularity of functional hippocampal networks may not serve as an endophenotype in individuals at familial risk for schizophrenia but instead may be associated with the onset or progression of the disease state.

Topic Area: LONG-TERM MEMORY: Episodic

C132 - Divided attention narrows visual exploration in ways that differentially impact item and relational encoding

Heather Lucas[1] (hlucas2@lsu.edu), Chloe Kindell[1]; [1]Louisiana State University

Visual exploration is essential for memory formation, but many factors can impact the quantity and quality of eye movements deployed during memory tasks. Here we examine how attentional resource availability impacts viewing patterns during study, as well as whether these effects differ when the goal is to memorize item identities versus item-location bindings. In two experiments, participants viewed a series of multi-item displays while eye

movements were recorded, each followed by either a spatial reconstruction test (Exp 1) or an item recognition test (Exp 2). Attentional resource availability was manipulated by varying the difficulty of a concurrent auditory task. In Experiment 1, higher secondary task difficulty impaired spatial reconstruction and led to more constrained study-phase viewing, which was characterized by fewer fixations, longer fixation durations, and lower scanpath entropy relative to lower secondary task difficulty. By contrast, item recognition in Experiment 2 was unaffected by cognitive load. Fixation durations and scanpath entropy also remained stable in Experiment 2, though fixation counts slightly decreased in the higher-load condition. Across-experiment analyses further revealed that participants in Experiment 2 exhibited more constrained viewing strategies than those in Experiment 1 regardless of load, highlighting parallels between the way viewers adjust to changes in cognitive load and task demands. Overall, these findings indicate that divided attention narrows visual exploration during memory tasks, and that this narrowing can have the effect of reducing item-location binding but preserving the encoding of item-level details.

Topic Area: LONG-TERM MEMORY: Episodic

C133 - Chronotype Misalignment and Memory: Exploring Circadian Rhythms, Sleep, and Episodic Memory Retention with Machine Learning Insights

Shijia Yin[1] (syin84@gatech.edu), Elyse Carlson[1], Jillian Connolly[1], Mark Wheeler[1]; [1]Georgia Institute of Technology

Human cognition has evolved alongside circadian rhythms; however, the operation of modern society sometimes asks individuals to work against their biological peak times. This study examines how chronotype misalignment with learning schedules affects memory consolidation by combining behavioral testing and machine learning-based chronotype classification. This research investigated episodic memory retention across different encoding and retrieval time points. We hypothesized that chronotype would affect memory performance according to time tested. Participants (n=130) were pseudo-randomly assigned to encode pairs of different pictures of faces and locations with words either approximately 8 AM or 8 PM during Week 1, followed by an immediate retrieval test. Week 2 assessed delayed retrieval, which also assigned participants into morning or evening sessions pseudo-randomly. Throughout the week, sleep data were recorded via actigraphy, allowing us to model individual chronotypes using Gaussian Mixture Modeling (GMM). Results revealed a significant time-of-day effect for the evening-type group: memory accuracies were significantly higher when encoding occurred approximately 8 PM compared to 8 AM, both for immediate and delayed retrieval accuracies. Moreover, memory decay (delta difference) was significantly lower when the evening-type encoded information at their biological peak (8 PM), suggesting enhanced consolidation efficiency. In contrast, the morning-type exhibited no significant performance variation across time conditions. These findings highlight the critical role of circadian alignment in memory retention. Future applications could be based on chronotype-aware scheduling in education and cognitive interventions to optimize learning outcomes. Additionally, this work may help people mitigate memory decline and provide ideas on sleep-chronotype-based memory enhancement strategies.

Topic Area: LONG-TERM MEMORY: Episodic

C134 - The gut microbiota composition is associated with human face recognition

Javiera Oyarzun[1] (joyarzun@fas.harvard.edu), Thomas Kuntz[2], Frederike Stein[3], Lila Davachi[4], Curtis Huttenhowe[5], Stefan Hofmann[6], Tilo Kircher[7], Tim Hahn[8], Elizabeth Phelps[9]; [1]Harvard University, [2]Department of Biostatistics, Harvard T.H. Chan School of Public Health, MA, USA, [3]Department of Psychology, Columbia University, NY, USA, [4]Department of Psychology, Philipps University Marburg, Germany, [5]Institute of Translational Psychiatry, University of Münster, Germany

Studies in animal models suggest that the gut microbiota can influence memory performance. However, the relationship between commensal gut bacteria and human episodic memory remains largely unexplored. This study investigated this link in 628 participants from the FOR2017 Consortium, who completed a face recognition task and provided stool samples for 16S rRNA gene sequencing. Our findings reveal that the overall structure of the gut microbiota (beta diversity) was significantly associated with participants' performance on the task, even after adjusting for common confounds. Both linear regression and machine learning models highlighted a robust relationship between face recognition performance and the relative abundance of the genus Dialister. Specifically, individuals with higher levels of Dialister exhibited poorer face recognition performance. This study, involving a larger sample size than previous human experimental research and examining unmanipulated gut microbiota, demonstrates that individual differences in face recognition are associated with gut microbiota composition, underscoring the potential role of Dialister in human cognitive processes.

Topic Area: LONG-TERM MEMORY: Episodic

C135 - Temporal (a)symmetries in cued recall of naturalistic events

Xinming Xu[1] (xinming.xu.gr@dartmouth.edu), Jeremy R. Manning[1]; [1]Dartmouth College

Episodic memory involves retrieving the context associated with past experiences. How does retrieved context facilitate recall of nearby events? Prior studies using random (temporally unstructured) word lists have demonstrated a forward advantage in cued recall, whereby a cued item facilitates recall of the subsequent item more strongly than the preceding item. In this study, we ask whether cued recalls of events from structured naturalistic sequences like movie narratives (which contain complex networks of meaningful forward and backward associations) show similar forward asymmetries. We ask participants to watch 30-min-long movies. Afterwards, we cue them with short clips from the just-watched movie and ask them to either recall what happened immediately before or immediately after the cued clip. A subset of cues are selected either immediately before or immediately after scene boundaries in the movie. First, we aim to replicate the finding from prior work that cued-recall performance is lower with across-event cues than that with within-event cues. We then plan to compare cued recall performance in the forward versus backward directions. If cued recall of naturalistic events is similar to that of random word lists, then we anticipate a forward asymmetry in participants' cued recalls. Alternatively, if other factors that are specific to naturalistic experiences play a role, then we might instead observe symmetric cued recall performance or even a backward advantage.

Topic Area: LONG-TERM MEMORY: Episodic

C136 - Comparing the impacts of rumination and replay on memory

Paige Sevchik[1] (psevchik@sas.upenn.edu), Brynn Sherman[1], Anna Schapiro[1]; [1]University of Pennsylvania

Replay, the automatic reinstatement of past experiences, and rumination, the more explicit review of negative events, are both offline processes which involve reactivating prior memories. Though they have distinct characteristics, the hippocampus is known to be involved in both processes, and there is evidence that memory is influenced by both. Although it is well-known that replay strengthens and transforms memories, the links between rumination and memory are mixed. While there is some evidence that rumination, and depression more generally, leads to less specific, overgeneralized memories, other research suggests it actually contributes to more specific and even exceptionally detailed memory. Here, we aim to directly compare the effects of replay and rumination on memory. Participants will watch sad film clips to simulate the experience of a real-life negative event, then for each film clip will be induced to either replay the movie events using awake targeted memory reactivation or ruminate over the events, with the order of inductions counterbalanced within-participant. Memory for the film events will be assessed via a free recall task both immediately and after a 24-hour delay. Recall will be analyzed for information such as level of detail and emotional tone. Comparing the contents of recall across the rumination and replay induction conditions will provide insight into the extent to which rumination and replay have related impacts on memory, which could have implications for clinical interventions targeting rumination symptoms.

Topic Area: LONG-TERM MEMORY: Episodic

C137 - Understanding spontaneous false memory in the naturalistic recall of narratives

Phoebe Chen[1] (hc2896@nyu.edu), Omri Raccah[2], Todd M. Gureckis[1], David Poeppel[1,4], Vy A. Vo[3]; [1]New York University, [2]Yale University, [3]Intel Labs, Intel Corporation, Hillsboro, OR, [4]Center for Language, Music, and Emotion, NYU & Max Planck Institute, Frankfurt, Germany

Human memory has traditionally relied on highly controlled, trial-based paradigms. A growing body of work is now investigating memory function under naturalistic conditions, primarily focusing on the recall of accurate details in audiovisual and spoken narratives– as such, memory errors for narrative content remain largely unexplored. This study examines the factors that drive spontaneous false memories in the natural retelling of stories. Leveraging a recently published dataset comprising hundreds of verbal recalls of four spoken stories (Raccah*, Chen*, et al., 2024), we employed in-context learning with large language models (LLMs) to detect memory errors. First, we automatically segmented the story into distinct events and prompted GPT-4o to align recall sentences with corresponding story events. Next, we used GPT-4o to identify and categorize memory errors in each recall sentence. The model learned to perform the scoring by relying on examples of memory errors (factual conflicts, confabulations) and reasonable inferences based on the story. We validated the LLM scoring by using human ratings for a subsample of participant recollections (average human-AI agreement: 0.73; average inter-rater agreement: 0.72). Next, we correlated the rate of false recollections for each event in the story with established factors known to influence memory performance. Our results revealed that contextual surprise – i.e., the model-estimated likelihood of an event given all previous events – significantly predicts the false memory rate ($\beta=0.18$, $p=0.009$). This work demonstrates the potential of LLMs in evaluating errors in naturalistic recollections and uncovers contextual factors that determine spontaneous false memories.

Topic Area: LONG-TERM MEMORY: Episodic

C138 - Audio-Visual Stimulation to Enhance EEG Theta and Episodic-Memory Consolidation

Tashi Lhamo[1] (tashilhamo2026@u.northwestern.edu), Nathan W. Whitmore[2], Ken A. Paller[1]; [1]Northwestern University, [2]Massachusetts Institute of Technology

Theta EEG rhythms have been linked with memory encoding and retrieval in both animal and human studies. Is theta also associated with post-encoding consolidation? Multiple methods for altering theta have been used to address this question. For example, Shtoots and colleagues (2024) applied transcranial-alternating-current stimulation (tACS) after learning and found improved recall for frontal theta stimulation compared to parietal theta, frontal beta, and sham stimulation. During tACS, assessing the electroencephalogram (EEG) during and after stimulation is difficult. In our experiment, we attempted to replicate the recall improvement using a different method to increase theta. Custom-built goggles emitted light flashes and sounds at 6 Hz as a sensory-entrainment tool. In a learning phase, 30 objects were shown for 3 seconds each followed by a recall test. This sequence was repeated three times, improving recall to an average accuracy of 60-70% correct. Next, participants received 20 minutes of sensory entrainment or control stimulation. Recall was tested after three delays: 2 hr, 24 hr, and 7 days. Preliminary data showed a recall decline, as expected. We further predict that theta stimulation will enhance consolidation compared to the control condition, leading to reduced forgetting across the three delays. We will also analyze theta power in each participant to look for relationships with memory performance. This research seeks a better understanding of offline memory consolidation and the potential role of theta rhythms. Based on such progress, new strategies may be developed to help people who are experiencing memory difficulties.

Topic Area: LONG-TERM MEMORY: Episodic

C139 - Do verbal labels bias visual memory?

Weifang Huang[1] (huangwei@bc.edu), Maureen Ritchey; [1]Boston College

The words we use can shape what we remember. Previous studies suggest that verbal labels provide a conceptual interpretation for encoded information and direct attention to category-specific features. Because word categories are hierarchical, an object may have multiple possible labels (e.g., latte as 'latte' or 'coffee'), yet how the category level of the label affects memory remains unclear. Our study used a recognition memory paradigm to examine how word category level influences memory for visual details. During the study phase, participants viewed object images that were accompanied by either a specific label (e.g., “Is this a latte?”) or general label (e.g., “Is this a coffee?”). Specific and general labels were rated as similarly well-matched to the object image, and label conditions were counterbalanced across participants. In the test phase, participants viewed old items as well as similar lures from the same specific category and judged whether the images were old or new. For items endorsed as old, they were additionally classified as remembered or familiar to permit calculation of recollection and familiarity estimates. (Generalized) linear mixed effects models were used to analyze the effects of label level on memory performance. Participants showed better target-lure discrimination in the specific label condition, driven by a lower false alarm rate compared to the general label condition. Recollection and familiarity estimates did not differ between conditions. These results suggest that more specific word labels can direct people’s attention to distinctive features during visual encoding, helping them better distinguish targets from lures.

Topic Area: LONG-TERM MEMORY: Episodic

C140 - Sleep efficiency during the retention period predicts episodic memory reconstruction across young and old adults

Chuu Nyan[1] (chuu.nyan@utexas.edu), Sahana Ram[1], Aiden Wachnin[1], Soroush Mirjalili[2], Masoud Seraji[3], Audrey Duarte[1]; [1]Department of Psychology, University of Texas at Austin, [2]Department of Psychology, University of Oregon, [3]TReNDS Center, Georgia State University & Marcus Autism Center in Emory University

Sleep deprivation studies in young adults suggest that sleep post-encoding is essential for episodic memory consolidation. Habitual sleep quality, and episodic memory, are typically reduced with age, with substantial individual differences, but relatively little is known about the impact of habitual sleep on episodic memory consolidation and supporting neural activity in young or older adults. In the current study, we examined how individual differences in post-encoding sleep quality contribute to episodic memory performance and supporting neural activity in young and old adults. We recorded EEG from cognitively unimpaired younger (n=30) and older (n=29) adults while they retrieved object-scene pairs that either matched or did not match those studied during encoding following a 72-hour, post-encoding, sleep interval. Participants wore a wrist-worn accelerometer for 1 week to measure their habitual sleep, both prior to and following encoding. Memory for object-scene associations, particularly for mismatch pairs, was impaired following the delay in older compared to younger adults, as was retention. A pronounced later posterior negativity (LPN) associated with episodic memory reconstruction was reduced with age, particularly for the mismatch pairs. Moreover, the magnitude of this ERP effect was positively predicted by higher sleep efficiency during the retention period across age groups. Our findings suggest that better sleep efficiency, particularly during the retention period, may facilitate neural mechanisms supporting episodic reconstruction and memory performance that are reduced in older age.

Topic Area: LONG-TERM MEMORY: Episodic

C141 - Do fMRI connectivity abnormalities in epilepsy matter?

Johanna M. H. Rau[1] (jmhrau@uchicago.edu), Robert Baudo[1], Daniel Biro[1], Arantzazu San Agustín[1], Shasha Wu[1], Naoum P. Issa[1], Joel L. Voss[1]; [1]The University of Chicago

Mesial temporal lobe epilepsy (mTLE) has been associated with hippocampal network dysfunction, such as abnormally low fMRI connectivity of the hippocampus with areas of the default-mode network (DMN). It is unclear, however, whether these network abnormalities reflect irregular brain activity that contributes to mTLE symptoms (i.e., seizures and memory impairment) or, conversely, whether network alterations merely develop as consequences of the disease (e.g., due to epileptic activity and its potential impact on cognition). To address this, we are applying Hippocampal Indirectly Targeted non-invasive Stimulation (HITS) in patients with mTLE. HITS increases hippocampal fMRI connectivity in healthy adults, especially with posterior-medial areas of the DMN. If HITS increases hippocampal network connectivity in mTLE, this will allow us to test whether fMRI network abnormalities contribute causally to mTLE symptoms: will "normalizing" abnormally low hippocampal connectivity via HITS reduce mTLE symptoms, or not? The effects of HITS on fMRI connectivity and episodic memory are measured at baseline and one day after mTLE subjects receive HITS. Seizure activity is tracked one month before through one month after HITS. We anticipate that this design will allow us to determine whether HITS-induced modulations of hippocampal network connectivity are related to reductions of mTLE symptoms. We have obtained pilot data from N=2 participants, indicating that the HITS methods are safe and well-tolerated in mTLE patients, with preliminary evidence for episodic memory improvement in both participants. In this Sketchpad presentation, we will present updated findings and hope to benefit from feedback on our methods and preliminary analyses.

Topic Area: LONG-TERM MEMORY: Episodic

C142 - Effects of Sleep Quality on Episodic Memory Reinstatement in Young and Older Adults: Insights from EEG Representational Similarity Analysis

Masoud Seraji[1,2] (m.seraji@utexas.edu), Soroush Mirjalili[1,3], Chuu Nyan[1], Aiden Wachnin[1], Sahana Ram[1], Vince Calhoun[2], Audrey Duarte[1]; [1]University of Texas at Austin, [2]TReNDS Center (G-tech, Emory, GSU), [3]University of Oregon

Abundant research from animal models shows that sleep is crucial for episodic memory and supporting neural mechanisms, yet the impact of habitual sleep quality on episodic memory and supporting neural activity in humans, particularly across age, remains underexplored. This study investigates the relationship between habitual sleep quality and episodic memory using EEG-based encoding-retrieval similarity analysis (ERS). Fifty-five participants (28 young and 27 older adults) wore wrist accelerometers for one week to capture habitual sleep patterns. Memory performance was assessed with an object-scene, paired associate learning task following a sleep-filled, 72-hour delay, with EEG data recorded during encoding and delayed retrieval phases. Spatiotemporal encoding-retrieval neural similarity was applied to EEG oscillatory power to measure episodic reinstatement effects. Results showed reduced delayed associative memory performance and neural reinstatement effects in older compared to younger adults. Greater sleep efficiency was associated with episodic reinstatement, across young and older adults. This research underscores the critical role of habitual sleep patterns in shaping memory-related brain activity across the adult lifespan.

Topic Area: LONG-TERM MEMORY: Episodic

C143 - Medial Pre-frontal & Hippocampal Functional Connectivity at Encoding Supports Prior Knowledge Leveraged Acquisition Of Novel Events In Older Adults

Rujuta Pradhan[1] (rujuta.p5@gmail.com), Morgan Brucks[2], Kristen McGatlin[1], James Bartolloti[2], Alexia Bouslog[1], Dr. Laura Martin[2], Dr. Heather Bailey[1]; [1]Kansas State University, [2]University of Kansas Medical Center

Research has shown better episodic memory retention in younger adults (YAs) as compared to older adults (YAs). But studies also show that OAs can leverage their prior knowledge (event schemas, scripts) to facilitate the encoding of newer episodic memories. Neuroimaging studies conducted on YAs report effective connectivity between the medial prefrontal cortex (mPFC) and hippocampus (HPC) at encoding supports retention of new events with stronger schemas/prior knowledge. The current study investigated if the same neural mechanism also underlie older adult's ability to compensate for deficit in encoding episodic memories. To investigate this, participants in the current study encoded a 30 min video of BBC's Sherlock in an fMRI scanner and completed free and cued recall tasks following the scan. Behavioral analysis found no difference in the number of events remembered (mean accuracy = 30%) across age groups (n: OA = 36, YA = 38). But mixed effects logistic regression analysis of the imaging data showed greater effective connectivity (Fisher z-transformed Pearson correlation) between mPFC and HPC at event boundaries was predictive of successful recall of events in OAs but not in YAs. Instead, YAs showed a negative correlation between recall success and effective connectivity ($\beta = -0.66$, SE = 0.34, z = -1.95, $p < 0.05$). Results confirmed that OA's event encoding is aided by prior knowledge which was facilitated by greater mPFC-HPC connectivity. Differential processes aiding encoding at event boundaries between OAs and YAs is discussed as a possibility for observing the inverse relationship between connectivity and memory for YAs.

Topic Area: LONG-TERM MEMORY: Episodic

C144 - Menstrual cycle effects on rule-plus-exception category learning vary by BDNF genotype

Mateja Perovic[1] (m.perovic@mail.utoronto.ca), Janice Hou[1], Shreeansha Bhattarai[1], Cathlin Han[1], Michael Mack[1]; [1]University of Toronto

Both brain-derived neurotrophic factor (BDNF) and ovarian hormones have established effects on neuroplasticity, learning and memory. Critically, ovarian hormones modulate BDNF expression across the menstrual cycle and its animal analogues. In order to examine the effects of this complex interaction on cognition, we use BDNF genetic polymorphism as an estimate of participants' baseline BDNF availability and study their performance on a rule-plus-exception category learning task at two points in the menstrual cycle. We find that, while Met homozygotes show advantages during the early follicular phase (typically characterized by low levels of ovarian hormones), Val homozygotes outperform them in the late follicular phase (typically characterized by high estradiol), indicating nuanced, genotype- and menstrual cycle-specific effects on category learning ability. Follow-up analyses suggest that the effect may be driven by Met carriers' increased sensitivity to estradiol: both overall levels of estradiol and rate of change in estradiol between menstrual cycle phases are negatively associated with performance in Met carriers but not Val homozygotes. These results provide the first evidence of BDNF genotype interacting with the menstrual cycle to predict cognitive performance in women and deepen our understanding of menstrual cycle-dependent changes in memory and learning. Notably, both BDNF and ovarian hormones have major effects on the hippocampus, and the category learning task we use, which necessitates memory integration and differentiation, is significantly associated with hippocampal processes. As such our findings are of interest to neuroscientists broadly interested in hippocampus and its role in learning.

Topic Area: LONG-TERM MEMORY: Episodic

C145 - Modulation of Fixation-Locked Hippocampal iEEG Activity by Visual Content

Arantzazu San Agustín[1] (asanagustin@uchicago.edu), James E. Kragel[1], Joel L. Voss[1]; [1]University of Chicago

Saccadic eye movements sample visual content during memory encoding. Hippocampal activity is sensitive to content, with activity modulations noted for different categories (e.g., human faces versus various object categories), potentially providing a bridge between semantic and episodic memory processing within hippocampus. However, previous studies have not determined whether content-specific effects occur in immediate response to eye-fixations versus slower emergence across the viewing episode. To investigate this, we used eye-movement tracking during encoding of naturalistic scenes comprising objects of distinct categories while hippocampal activity was recorded using intracranial EEG (iEEG) in 6 neurosurgical patients with refractory epilepsy. In prior work, we described analyses of phase locking of theta oscillations to fixations, which showed greater phase locking immediately before and after fixations to "people" versus other visual categories. Here, we characterized ERPs to examine differences among visual categories in the time course of fixation-evoked activity. ERP amplitude varied for "people" (n=544 eye-fixations) versus "food" (n=824) and "animals" (n=789) categories from approximately 300-450 ms after fixation (maximum differentiation at 363 ms, $F(2,10)=8.855$, $p=0.006$). These findings build on our prior work by showing that visual sampling of specific content evokes rapid changes in hippocampal activity and therefore, that the processing of visual concepts could be an immediate response to saccadic eye movements. These processes may thus underlie the relational processing of semantic and episodic content during scene encoding. Future research aims to explore further evidence of rapid memory processes on the fixation-locked hippocampal activity.

Topic Area: LONG-TERM MEMORY: Episodic

C146 - A Life Turned Upside Down: Exploring the Narrative Structure of the Memory for the Event Leading to a Moderate-to-Severe Traumatic Brain Injury

Suhaah Nadir[1] (suhaah.nadir@vanderbilt.edu), Natalia Rivera[2], Daniela Palombo[3], Melissa C. Duff[2], Annick F. N. Tanguay[2]; [1]Vanderbilt University College of Arts and Sciences, [2]Vanderbilt University Medical Center, [3]The University of British Columbia

Traumatic events are often recalled with greater detail than non-traumatic events. Traumatic Brain Injuries (TBIs) are physically and psychologically traumatic events. An open question is if individuals with TBI produce greater details for their injury narratives given the increased likelihood of loss of consciousness and post-traumatic amnesia for the event. We recruited 30 individuals with chronic moderate-severe TBI who freely recalled their injury event. We developed a scoring protocol to examine narrative stages and defined "prologue" and "context" as stages leading up to the "core event" (i.e., the injury), distinguished by their relevancy/effect on the event. "Reflection" and "epilogue" contained details following the event, distinguished by temporal and spatial proximity. We have analyzed data from 15 participants to date and compared the narrative stages by the proportion of words dedicated to them. Stages representing core event (M=0.32, SD=0.25), reflection (M=0.25, SD=0.27), and context (M=0.21, SD=0.20) dominated the narrative. The remaining categories were lower comparatively (~0.07). Similar proportions of context and reflection to "core event" details may reflect individuals' with TBI ongoing work to make sense of the event, its cause, and its immediate and ongoing repercussions. The stages representing lower narrative proportions suggest that, although participants often provide overarching context/take-away lessons, much of their memory surrounding their TBI is anchored in the temporal and spatial proximity to the event. Narrative scoring, combined with Autobiographical Interview scoring, will help to elucidate patterns of memory composition in autobiographical narratives by mapping semantic/episodic details across stages, in TBI and other neurological conditions.

Topic Area: LONG-TERM MEMORY: Episodic

C147 - Acute stress modulates episodic memory and statistical learning in the hippocampus

Irene Zhou[1] (irene.zhou@yale.edu), Yuye Huang[2], Zihan Bai[1], Elaine G. Wijaya[1], Lusangelis Ramos[1], Brynn E. Sherman[3], Nicholas B. Turk-Browne[1], Elizabeth V. Goldfarb[1]; [1]Yale University, [2]Johns Hopkins University, [3]University of Pennsylvania

Acute stress strongly influences the hippocampus. Prior research has focused on negative stress effects on memory for individual events (episodic memory), which is supported by the trisynaptic pathway (TSP; EC-DG-CA3-CA1). However, an additional, monosynaptic pathway (MSP; EC-CA1) supports the extraction of regularities across events (statistical learning). Based on evidence from rodent studies that these pathways are differentially affected by stress, we hypothesize that stress will facilitate statistical learning (SL). Participants were exposed to acute stress (socially evaluated cold pressor) or a control manipulation before learning. They then underwent fMRI while encoding sequences of unique scenes containing temporal regularities. Namely, scene categories were paired such that some categories (predictive; A) reliably preceded others (predictable; B). The next day, participants completed behavioral tests of episodic memory and SL. As in past work, we successfully decoded prediction of upcoming B categories in CA2/3 in both groups. Consistent with our hypothesis, stress promoted SL and enhanced prediction. With stress (but not control), MSP connectivity predicted better performance on the SL test, which was in turn associated with better episodic memory for predicted exemplars. Predictive items were also represented more categorically in the hippocampus, suggesting anticipation of category-level regularities. In only the control group, retrodiction of A categories during B items could be decoded in CA1, consistent with a bias towards prediction under stress. Together, these results show how stress alters hippocampal circuit mechanisms to prioritize statistical learning and prediction, sometimes at the expense of episodic memory, supporting active comparison between inputs and learned regularities.

Topic Area: LONG-TERM MEMORY: Episodic

C148 - Hippocampus-ventral tegmental area structural connectivity patterns are associated with functional activation patterns of motivation

Blake Elliott[1] (blake.elliott@temple.edu), Vishnu Murty[2]; [1]Temple University, [2]University of Oregon

While a large body of work has highlighted the role of the hippocampus in spatial navigation/episodic memory, the hippocampus is also critical for motivated behaviors putatively driven by its connectivity with the dopaminergic midbrain (e.g., VTA). While functional activation patterns of motivation and navigation have been well-studied, less is known about the structural connectivity underlying these patterns. In this study, we investigated the relationship between hippocampus–ventral tegmental area (VTA) structural connectivity and functional activation patterns associated with the hippocampus (motivation and navigation). Using a large sample of subjects (N = 628) from the Human Connectome Project dMRI data release, we previously found that connectivity profiles with the hippocampus and VTA showed stronger connectivity with the anterior versus posterior hippocampus. When comparing the voxel-level pattern of connectivity with meta-analytic functional activation maps of the term “motivation,” we identified a strong positive correlation between left ($\rho = 0.61$, $p < 0.01$) and right ($\rho = 0.20$, $p < 0.01$) hippocampus–VTA structural connectivity and motivation-related activation patterns. Notably, anterior hippocampus-VTA connectivity and anterior hippocampus functional activation patterns were most pronounced, consistent with hypothesized functional gradients of hippocampal involvement in reward and motivation. However, we found no relationship between hippocampus-VTA structural connectivity and functional activation maps of the term “navigation” for both the left ($\rho = 0.002$, N.S.) and right ($\rho = 0.06$, N.S.) hippocampus. These findings provide novel evidence selectively linking hippocampus–VTA structural connectivity with task-evoked functional patterns, offering new insights into how hippocampal circuits support goal-directed behavior.

Topic Area: LONG-TERM MEMORY: Episodic

C149 - A common hippocampal gradient for semantic and spatial information

Anikka G. Jordan[1] (anikka@uchicago.edu), Joel L. Voss[1], James E. Kragel[1]; [1]University of Chicago

Memories differ in precision from highly detailed to vague, but the neural basis of this spectrum is not yet known. Current theories suggest that memory-relevant processing increases in resolution from the anterior to posterior hippocampus. However, it remains unclear whether semantic and spatial memory share a functional gradient. To relate hippocampal function to behavioral measures with high temporal resolution, we recorded eye movements during fMRI while participants (N = 29) learned visuospatial sequences of objects. They detected mismatching test sequences that differed along spatial and semantic dimensions. Critically, we manipulated the magnitude of these mismatches, allowing us to examine how they affected memory-guided behaviors and long-axis organization. The degree of mismatch affected accuracy on the task, with better detection of mismatching sequences that were either spatially or semantically far from targets ($F(1,27.7) = 39.0$, $p < 0.001$). Eye-movement behavior also reflected spatial and semantic memory. Participants made more predictive eye movements to repeated compared to mismatched object locations ($F(1,28.0) = 48.8$, $p < 0.001$). Fixation durations increased for unexpected objects compared to objects presented in unexpected locations ($F(1,25.5) = 257.0$, $p < 0.001$), reflecting semantic memory. Neural pattern similarity decreased along the hippocampal long axis for both semantic and spatial mismatches ($F(1,22.3) = 3.00$, $p = 0.003$). Additional fMRI connectivity analyses utilizing these behaviors relate semantic and spatial hippocampal gradients to distributed brain networks. Taken together, these findings suggest a common gradient of memory precision in the hippocampus.

Topic Area: LONG-TERM MEMORY: Episodic

C150 - EEG biomarkers distinguish good and poor learners

Benjamin Falkenburg[1] (benfalken@g.ucla.edu), Michael Kahana; [1]University of Pennsylvania

Background/Objective: Individual differences in learning ability – particularly episodic memory – are well-documented, yet the neural mechanisms underlying these differences remain unclear. Electroencephalographic (EEG) biomarkers have been shown to differentiate successful from unsuccessful encoding events within individuals; this study aims to determine whether EEG spectral patterns can reliably distinguish high and low recall performers, thereby advancing cognitive assessments with neural biomarkers. Design: We analyzed data from three independent studies involving over 1,000 subjects and 5,000 hours of memory testing. Subjects completed word-list learning tasks with free recall, while high-density EEG recorded neural activity during encoding. Spectral decomposition isolated theta (3–5 Hz), alpha (8–10 Hz), and gamma (80–90 Hz) power across anterior and posterior regions. The subsequent memory effect (SME) was computed by comparing spectral power for words later recalled versus forgotten, and participants were grouped by recall performance. Results: Consistent with previous findings, successful encoding was marked by increased anterior theta and decreased posterior alpha power. However, high performers exhibited significantly reduced anterior theta activity compared to low performers, suggesting a reduced reliance on effortful encoding processes. Multivariate analyses identified anterior theta suppression during encoding as the strongest predictor of recall ability ($p \leq 0.05$). Conclusion: These results challenge the view of theta as a uniform marker of successful encoding. Instead, reduced anterior theta in high performers may reflect a shift toward more automatic, efficient encoding. Incorporating EEG biomarkers into cognitive assessments could enhance memory performance predictions and guide personalized clinical interventions.

Topic Area: LONG-TERM MEMORY: Episodic

C151 - Hippocampal Representational Shifts Underlie the Learning of Exceptions to Category Knowledge

Yongzhen Xie[1] (yongzhen.xie@mail.utoronto.ca), Michael L. Mack[1]; [1]Department of Psychology, University of Toronto

We can acquire categories by extracting regularities across experiences, but when we encounter exceptions to such regularities, how do we reconcile them with our prior category knowledge? Existing work indicates that the hippocampus supports the acquisition of category regularities and exceptions by updating object representations through pattern integration and differentiation. However, there is currently no direct characterization of the hippocampal representational shifts in exception learning. We aimed to fill this gap by having participants learn competing object categories in which two exceptions were introduced after repeated exposure to regular category items. One exception was a unique oddball, and the other was a structural exception resembling items from the competing category. We collected fMRI data before and after participants learned these exceptions and found that exception representations underwent distinct changes in different hippocampal subfields. Specifically, through learning, representations of both exceptions became more distant from their regular category members in the dentate gyrus. Also, the structural exception – but not the oddball – became overlapped with its regular members in the representational space of CA1. Furthermore, within the CA1, greater increases in representational similarities between the structural exception and other members of its category were associated with better categorization and generalization performance post-learning. These findings, while consistent with theorized roles of dentate gyrus and CA1 in pattern differentiation and integration, demonstrate that learning-driven representational shifts vary across exception types. In conclusion, our study helps delineate the flexible hippocampal operations underlying the acquisition of items exceptional to existing category knowledge.

Topic Area: LONG-TERM MEMORY: Semantic

C152 - Age-Related Differences in Semantic Counterfactual Thinking

Martin Ma[1], Shenyang Huang[1], Felipe De Brigard[1]; [1]Duke University

People frequently engage in counterfactual thinking (CFT)—mentally simulating alternatives to reality. CFT plays a crucial role in everyday reasoning and decision-making, as well as high-stake situations such as in tort law. While previous research has mainly focused on the psychological underpinnings of episodic CFT—thoughts about alternative ways past personally experienced events could have occurred, less is known about the psychological mechanisms behind semantic CFT (sCFT)—imagining alternatives to objective knowledge of the world. This study examines age-related differences in the perceived plausibility of semantic counterfactual scenarios. Over four hundred younger adults (YAs, aged 18–30) and older adults (OAs, aged 60–85) evaluated factual and counterfactual statements across eight knowledge domains. Participants rated their knowledge and confidence about the facts, and rated how plausible the counterfactual scenarios are, how similar the counterfactual scenarios are to reality, and how detailed their imaginations are. OAs reported having higher confidence and more knowledge than YAs in most knowledge domains, as we expected. Importantly, we found that plausibility was strongly correlated with perceived similarity, replicating two past studies. More interestingly, this relationship was more pronounced in OAs. Additionally, we found that both the detailedness of the imagination and the semantic similarity between the factual and counterfactual statements predicted the perceived plausibility. Taken together, these findings validated the intimate relationship between perceived plausibility and similarity, and point toward an age-related cognitive difference in assessing counterfactual scenarios owing to OAs' increased semantic knowledge, extending our understanding of how semantic memory and imagination evolve with age.

Topic Area: LONG-TERM MEMORY: Semantic

C153 - Unlocking The Power of Memory: Perception, Encoding, and Recall

Kristie Stephens[1], Emily Stripling[1], Karlie Souder[1], Aram Akbari[1], Emma Chacon[1], Liam Fienberg[1], Dara Olopade[1], Smyth Harper[1], Michael D. Oliver, Ph.D.[1]; [1]Belmont University

Memory encoding, storage, and retrieval are crucial cognitive processes, influenced by the sensory modalities through which information is presented. However, research is mixed regarding which stimulus presentation (e.g., auditory vs. visual) is more effective during long-term retrieval. In this study, it is hypothesized that auditory presentation will result in better retrieval due to more elaborate spreading activation when compared to visual. Thirty-four participants were divided into 3 groups and exposed to 33 items presented in either auditory (i.e., sound) or visual formats; with visual stimuli further divided into visual imagery (i.e., picture) and visual words. After a 10-minute delay, participants were asked to write as many words as they could freely recall, as well as to complete a computerized Lexical Decision Task on E-Prime where they pressed a button indicating whether they recognized the stimulus word from the previous presentation while event-related potentials were measured simultaneously. Results reveal better free recall in the auditory compared to both visual conditions ($p<0.001$), which is supported by the fact that auditory information reaches the brain faster, and is thus encoded and likely recalled more efficiently, than visual information. For the recognition task, P300 amplitude was greater for incorrect compared to correct trials specifically in the visual word condition ($p<0.001$), suggesting that familiarity influences how visual errors are processed neurologically. Investigating how sensory stimuli impacts memory processes can highlight neural areas involved in auditory versus visual information processing, which may lead to optimizing educational strategies tailored to specific sensory modalities, potentially enhancing learning environments.

Topic Area: LONG-TERM MEMORY: Semantic

C154 - Time-Course Differences in the Processing of Taxonomic and Thematic Semantic Relations Revealed by EEG Spatiotemporal Cluster Analysis

Stephen J. Ball[1] (stephen.ball-4@postgrad.manchester.ac.uk), Jennifer C. Thompson[1,2], Jason R. Taylor[1]; [1]University of Manchester, [2]Northern Care Alliance NHS Foundation Trust

Taxonomic relations (items related through shared features, e.g., WOLF-DOG) and thematic relations (items related through context, e.g., KENNEL-DOG) are critical components of semantic knowledge, and thus critical to understanding the world around us. Behavioural studies have reported that thematic relations may be processed more rapidly than taxonomic, yet electrophysiological evidence to support this is inconsistent. To elucidate the neural dynamics underlying semantic relationship processing, we conducted an EEG study using threshold-free spatiotemporal cluster analyses of event-related potential (ERP) and Time-Frequency (TF) data during a semantic relatedness task. 29 healthy young adult participants completed a semantic similarity judgement task on 560 cue-target word pairs while EEG was recorded (64-channel BioSemi ActiveTwo). Cue-target relationships were manipulated between Unrelated/Taxonomic/Thematic conditions. Surface Laplacian-transformed ERP analysis revealed a significant increase in current source density (CSD) in thematically cued targets across left frontal electrodes in an early time window (158-681ms) and left posterior electrodes later in the epoch (455-1000ms). In TF, increases in theta (4-7Hz) power were associated with thematic processing in two temporal clusters across frontocentral channels at 190-280ms and 570-1000ms. By using a robust and unbiased statistical approach to determine significance, we have identified EEG effects which suggest that taxonomic and thematic processing use dissociable neurological systems, supporting existing behavioural and electrophysiological studies. Finally, we discuss the implications of these findings for existing neurocomputational models of semantic representation and control.

Topic Area: LONG-TERM MEMORY: Semantic

C155 - The One with the Neural Synchrony: How Long-Term Shared Narrative Experiences Shape Brain Activity Over Time

Joshua Koh[1], Alexander Barnett[2,3]; [1]Integrated Program in Neuroscience, McGill University, [2]Department of Neurology & Neurosurgery, McGill University, [3]The Neuro (Montréal Neurological Institute-Hospital), McGill University

People's brain activity meaningfully synchronizes during shared experiences, but synchrony in higher-order regions is restricted to coherent events. If higher-order regions represent the abstract features of events that are integrated over longer timescales, then shared prior knowledge should increase their synchrony. However, few studies have examined how the accumulation of shared prior knowledge (for a given context) over extended periods of time (e.g., weeks or months) might influence such shared brain activity. In this study, we examined how shared neural representations evolved over time using a unique dataset in which six participants watched episodes of the TV show Friends (Seasons 1 to 4, in sequence) while undergoing fMRI scanning. In an additional exploratory analysis, we investigated the relationship between these shared neural responses and the IMDb ratings of the Friends episodes. Results indicated that networks responsible for top-down attentional control, motor control, salience detection, and the representation of event-related semantic knowledge showed increased synchrony over long-term shared experiences. A notable exception was regions within the language network, which exhibited decreased neural synchrony over time. Interestingly, all networks exhibited a significant positive relationship between neural synchrony and individual episode IMDb ratings. This was particularly evident in networks associated with attention, visual, and event processing. These findings suggest that collective audience reception and engagement to multi-modal narratives may be reflected in the extent of shared brain activity, as well as offer new insights into how long-term exposure to shared content shapes neural representations.

Topic Area: LONG-TERM MEMORY: Semantic

C156 - Category learning drives neural repulsion initially but integration at a delay

Marlie Tandoc[1] (tandoc@sas.upenn.edu), Sarah Solomon[1,2], Ashley Williams[1], Alex Gordienko[1], Jacob Parker[1], Anna Schapiro[1]; [1]University of Pennsylvania, [2]Binghamton University

There has been accumulating evidence in the memory literature of a striking neural repulsion effect, where learning associations between highly similar items can drive their representations apart. These findings stand in contrast with work suggesting that we represent the commonalities across related items, especially with consolidation. Here we investigate the tension between these phenomena in a category learning task, where item similarity and task structure could motivate both integration and differentiation, measuring representations initially and after a period of consolidation. Thirty two participants learned novel flower categories, where each flower had petal types shared with category members as well as a unique petal. In an fMRI scan immediately after learning, we found that the hippocampus represented flowers from the same category as more dissimilar than flowers from different categories, consistent with other remarkable findings of repulsion in the literature. In the precuneus, this repulsion manifested at the feature level, with unique petals exhibiting lower similarity to others in the same category. After a 1-2 week delay, the repulsion effects vanished and there was instead evidence of integration in other cortical regions, including the anterior temporal lobe. Behaviorally, the delay resulted in forgetting of individual items but persistence of category knowledge. The findings suggest that the initial ability to differentiate highly similar information may be supported by an exaggeration of their differences, but that neither the detailed memory nor the differentiated representations persist over time, giving way to integration that might support a more generalized understanding of the environment.

Topic Area: LONG-TERM MEMORY: Semantic

C157 - N400 Evidence for Rapid Semantic Integration Through Fast Mapping

Patric Meyer[1,2] (patric.meyer@srh.de), Ann-Kathrin Zaiser[1], Lisa Festag[3], Regine Bader[3]; [1]SRH University Heidelberg, [2]Heidelberg University, [3]Saarland University

Recent evidence challenges traditional theories of memory consolidation, suggesting that novel picture-label associations can be rapidly integrated into semantic memory networks through fast mapping (FM). In FM, participants infer that an unfamiliar label corresponds to an unknown item by excluding a known item presented alongside it. There is behavioral evidence that a high feature overlap between the unknown and the known item is associated with rapid semantic integration of the picture-label associations, as measured by semantic priming effects. Moreover, the perirhinal cortex (PrC), a medial temporal lobe structure specialized in distinguishing highly similar objects and facilitating semantic integration contributes to successful learning through FM if feature overlap is high. We manipulated feature overlap and assessed semantic integration using event-related potentials within a semantic priming task, in which the newly learned labels served as primes for existing words. Our study revealed a robust centro-parietal N400 semantic priming effect (i.e. less negative ERPs to words preceded by related primes as compared to unrelated primes) in a high-overlap FM condition. Moreover, the N400 semantic priming effect was significantly stronger in this high-overlap FM condition compared to a low-overlap FM condition. These findings emphasize the influence of high visuo-semantic similarity in accelerating the incorporation of novel associations into semantic memory networks. They highlight the critical role of the PrC and cortical networks in this process, offering neurofunctional evidence that challenges traditional views of memory consolidation, and provide new insights into how the brain integrates novel information into existing knowledge frameworks.

Topic Area: LONG-TERM MEMORY: Semantic

C158 - Conceptual Fluency Supports Retrieval of Labels Encoded Through Fast Mapping: Evidence from Event-Related Potentials

Lisa Festag[1] (lisa.festag@uni-saarland.de), Ann-Kathrin Zaiser[2], Patric Meyer[2,3], Regine Bader[1]; [1]Saarland University, Germany, [2]SRH University Heidelberg, Germany, [3]Heidelberg University, Germany

Previous research suggests that novel picture-label associations can be rapidly integrated into neocortical memory networks through an encoding paradigm called “Fast Mapping” (FM). In the FM paradigm, associations are incidentally encoded through an inference process: An unknown label is inferred as the name of an unknown picture presented alongside a known picture. Recent fMRI results revealed that memory success following an FM condition in which the known and the unknown picture shared many features was predicted by encoding activity in the perirhinal cortex, a structure involved in conceptual integration and familiarity-based recognition. In an event-related potential (ERP) experiment, we investigated the processes associated with retrieval of labels encoded through FM versus explicit encoding (EE). We hypothesized that FM encoding boosts conceptual integration and therefore familiarity for the labels, whereas retrieval following EE requires recollection. Picture-label associations were either encoded within a high-overlap FM task or a standard EE task, followed by an old/new recognition test on the labels. After correct “old” responses, the corresponding picture had to be selected from a forced-choice display. ERP old/new effects were assessed by contrasting hits to old labels followed by correct forced-choice judgements with correct rejections to new labels. We found no evidence that the recollection-related late parietal old/new effect differed between groups. However, a larger N400 old/new effect was observed in the FM compared to the EE group, indicating that FM encoding gave rise to larger familiarity signals in the former condition, presumably due to enhanced conceptual fluency of the newly learned labels.

Topic Area: LONG-TERM MEMORY: Semantic

C159 - Foraging in conceptual spaces: neurophysiological mechanisms of mental search in semantic memory

Simone Viganò[1,2] (vigano@cbs.mpg.de), Giuliano Giari[2], Roberto Mai[3], Christian F. Doeller[1,4], Roberto Bottini[2]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [2]Center for Mind/Brain Sciences, University of Trento, Rovereto, Italy, [3]"Claudio Munari" Center for Epilepsy and Parkinson Surgery, Niguarda Ca' Granda Hospital, Milan, Italy, [4]Kavli Institute for Systems Neuroscience, Center for Neural Computation, The Egil and Pauline Braathen and Fred Kavli Center for Cortical Microcircuits, Jebsen Center for Alzheimer's Disease, Norwegian University of Science and Technology, Trondheim, Norway

The medial temporal lobe represents both spatial and abstract relational information. However, how do we search and access stored knowledge? During navigation the hippocampal formation displays rhythmic oscillatory activity in the theta band (3-8 Hz), conveying information about traveled distance. Here we asked if this physiological signature of physical exploration also extends to mental exploration of abstract spaces, such as when recalling concepts from memory. We used stereo-EEG to record local field potentials from the hippocampus of 20 epileptic patients performing a categorical verbal fluency task, randomly "foraging" for concepts from different categories (animals, professions, or famous cities). In the period preceding the utterance of a word, when people are searching for and eventually finding a concept, the oscillatory component of hippocampal theta power was significantly higher than during or after word pronunciation. This effect was independent of the semantic category. We used linear mixed models to investigate the possibility that theta power conveys information about exploration of the semantic space, including as predictors semantic distances between words (modeled as FastText linguistic vectors) and temporal distance between utterances. We observed significant modulation when considering high-dimensional semantic distances, as well as modulation by the temporal distance between words, indicating that both temporal and spatial dimensions modulate theta power when people search for concepts in their memory. These results suggest that physiological signatures of hippocampal activity during physical exploration might also extend to mental exploration of abstract spaces, and potentially reveal novel mechanisms underlying the access of conceptual information from memory.

Topic Area: LONG-TERM MEMORY: Semantic

C160 - Exposure to semantic information prior to retrieval practice accelerates learning of chemistry molecule names

Janvi Subramanyan[1] (janvisubramanyan2023@u.northwestern.edu), Evan Grandoit[1], Paul J. Reber[1]; [1]Northwestern University

Rote learning by simple repetition is effective for memorization but is often thought to be inferior to learning in the context of richer content in education. Here we sought to test how acquisition of factual information could be accelerated by providing relevant semantic information before learning through repetition. We hypothesized that having initial semantic information from instruction would create a more robust associative network for word-image associations that will increase the likelihood of durable memory formation. Participants attempted to learn image-name associations for a set of 50 novel chemistry molecules over a 45-minute study session. In one condition, participants were presented with instructional slides explaining five rules for identifying parts of molecules related to their names (e.g., molecules containing ketones end with '-one'; 10 molecules per rule), followed by three random-order study repetitions where they attempted to select the correct molecule name from four options (4AFC) with feedback to allow for trial-and-error learning. In the other condition, participants did not learn the naming rules, and instead engaged in an extra repetition of 4AFC practice (four total) to match total learning time across conditions. All participants showed a significant increase between pretest and posttest scores, indicating robust learning of the chemical structure-name associations. The instructed participants exhibited significantly greater learning than non-instructed participants. We conclude that exposure to the theoretical basis of the chemical word-image associations enhances initial learning of each cued structure and its name, and facilitates a stronger associative link when later retrieved, compared to trial-and-error training alone.

Topic Area: LONG-TERM MEMORY: Semantic

C161 - Intraindividual Semantic and Brain Networks Provide Evidence of Individual Differences in General Knowledge about Emotions

Alexandra E. Kelly[1] (allie.e.kelly@gmail.com), Evangelia G. Chrysikou[1]; [1]Drexel University

Conceptual knowledge about emotions is inherently associated with core affect as interpreted through interoceptive sensation regarding physiological states (e.g. high heart rate, accelerated breathing). It is unknown whether and to what extent individual differences in the ability to sense and interpret these interoceptive signals affect the long-term representations of emotion concepts. In this study, we administered a semantic relatedness judgment task that involves emotion concepts and constructed semantic networks based on the participant-specific relatedness judgment ratings. These networks were statistically tested for differences based on participants' interoceptive sensibility as assessed by a self-report scale. Differences in network topology, specifically captured by the clustering coefficient, demonstrated a relationship between individual semantic networks and interoceptive sensibility. Functional magnetic resonance imaging data collected during an interoceptive attention localizer task and a semantic localizer task allowed us to construct participant-specific brain networks reflecting regions underlying interoception and semantic processing. Connectivity matrices derived by correlating BOLD signal between each statistically thresholded parcel within the interoceptive and semantic networks were used to select connectivity features predictive of the behavioral semantic network metrics. Our results provide tentative evidence that emotion concepts exhibit some modality-specificity in their grounding, as connectivity between the neural resources used to process interoceptive signals and to access and evaluate generalized knowledge about emotions predicts aspects of the structure of general knowledge about emotions.

Topic Area: LONG-TERM MEMORY: Semantic

C162 - Memory reactivation during sleep facilitates abstraction of category structure

Sarah Solomon[1,2] (ssolomon4@binghamton.edu), Siri Krishnamurthy[2], Anna Schapiro[2]; [1]Binghamton University, [2]University of Pennsylvania

Successful learning involves the generalization of details into an abstracted format that can be applied to new situations, and sleep has been hypothesized to play a role in this abstraction process. We conducted a test of this idea in the semantic learning domain. Participants learned about novel insect categories with different structures (different patterns of feature co-occurrence) in a missing feature task. The categories all had non-overlapping sets of surface-level features, but the structure of the initial categories was either congruent or incongruent with the final target category. Structure knowledge of the final category was tested using a visual feature sorting task. Experiment 1 tested for immediate structure transfer to the final category with no delay. Experiment 2 tested for structure transfer after a period of awake rest, a nap, or a nap during which the memory of a recently learned category was reactivated. Memories were reactivated during sleep using targeted memory reactivation (TMR): sound cues that were paired with a category during learning were replayed during sleep. Across the two experiments, we only observed successful transfer learning when the initial congruent category was reactivated during sleep using TMR. The finding that category structure transfer is possible at all suggests that learned category structure can indeed become abstracted away from surface-level features. The finding that this transfer only occurs after related memories are reactivated with TMR suggests that disentangling structure from surface-level details is not automatic but rather may rely on reactivation-related processes during sleep.

Topic Area: LONG-TERM MEMORY: Semantic

C163 - Does an impaired sense of smell make it harder to think about things like garlic?

Ishrat Khan[1], Nathan Lautz[1,2], Charles Davis[3], Gitte Joergensen[1,2], Eiling Yee[1,2]; [1]University of Connecticut, [2]The Connecticut Institute for the Brain and Cognitive Sciences, [3]Duke University

According to sensorimotor-based (also called "embodied" or "grounded") theories of semantic memory, accessing conceptual knowledge about things involves reactivating—or “simulating”—the sensory and motor experiences that we have had with them. For instance, thinking about things for which olfactory experience is dominant (e.g., garlic or lavender) would involve simulating their smell. However, evidence for olfactory simulation when thinking about "smelly” things is sparse and mixed. We tested smell-impaired (“anosmic”) and control participants (N=140 in each group) on three tasks (1) Picture-word verification and (2) Semantic property judgement and (3) Free recall. We predicted that anosmic participants should have more difficulty with smell/taste-experienced items compared to control participants, but perform similarly on “non-smelly” items primarily experienced via other modalities (e.g., zipper, water). In preliminary analyses of picture-word verification task data, anosmic and control participants performed similarly across smelly and non-smelly items. This pattern suggests that for a task like picture-word verification, which does not require retrieving olfactory information, the ability to simulate how something smells does not necessarily improve performance. Additional analyses will explore whether performance on this task is affected by factors like response speed, anosmia duration, or anosmia extent. We will also analyze the other tasks to explore whether, when the task requires retrieving olfactory information (e.g., judging whether sugar is musty), anosmic participants will have difficulty relative to controls. If they do, this would suggest that the extent to which we simulate olfactory information depends on the demands of the task.

Topic Area: LONG-TERM MEMORY: Semantic

C164 - Timing is Everything: Temporal Community Structure is Sufficient for Categorical Inference

Alexander N. Lawriw[1] (alawri1@lsu.edu), Christopher R. Cox[1]; [1]Louisiana State University

Sequences are parsed into events by tracking transitional probabilities. How well such structure has been learned correlates with activity in the hippocampus. Recent work has raised the possibility that the hippocampus has some capacity to learn categorical representations and may even support categorical inference. We critically evaluated this interpretation in two experiments where participants were exposed to sequences of stimuli that were, unbeknownst to the participant, generated by random walks on a 15-node graph with three 5-node “communities” and one path between each community. Learning this structure is understood to involve the hippocampus. In experiment 1, following sequence exposure, participants responded to a series of 2AFC trials consisting of a reference stimulus paired with an attribute that was either distinctive of its community or generic (shared by all stimuli). During these trials, participants were asked to choose which of two alternative stimuli was more likely to share that attribute with the reference stimulus. Behavior was similar regardless of whether the attribute was distinctive or generic. In experiment 2, participants were explicitly taught to associate a community-distinctive attribute with a single member from each community before being exposed to the structured sequence. Following sequence exposure, participants selected which of two alternatives were more likely to have a particular community-distinctive attribute on each 2AFC trial. Preliminary analysis of 35 of the planned 60 participants in experiment 2 indicates a significant category inference bias, $t(34) = 2.12$, $p = .04$, suggesting that hippocampus-mediated representation of temporal community structure is sufficient for categorical inference.

Topic Area: LONG-TERM MEMORY: Semantic

C165 - Neural desynchronization during speech planning of phrase composition

Marco C. H. Lai[1], Ellie Abrams[1], Sherine Bou Dargham[2], Jacqui Fallon[3], Ebony Goldman[4], Miriam Hauptman[5], Alicia Parrish[1], Sarah F. Phillips[1,6], Alejandra Reinoso[7], Liina Pylkkänen[1,2]; [1]New York University, [2]New York University Abu Dhabi, [3]University of Colorado Boulder, [4]City University of New York Graduate Center, [5]Johns Hopkins University, [6]Georgetown University Medical Center, [7]Northwestern University

Previous research on language production has observed power desynchronization during single-word speech planning (Ala-Salomäki et al., 2021; Piai et al., 2015). Furthermore, the Information via Desynchronization Hypothesis suggests that increased power desynchronization reflects the amount of information encoded within the neural population (Hanslmayr et al., 2012). The present study used a picture naming task with magnetoencephalography (MEG) to investigate (1) whether neural desynchronization is modulated by the amount of information during speech planning and (2) how information is integrated when speakers plan to produce phrases. In the experiment, participants described a picture using either an adjective-noun phrase (e.g., “green house”) for phrase naming or a noun (e.g., “house”) for word naming. Time-frequency analyses of MEG data from 20 adult participants (mean age: 26.3 years) revealed that, compared to word naming, phrase naming showed greater theta (4–7 Hz) power desynchronization in the left anterior temporal lobe (ATL) and precuneus approximately -400 to -200 ms before speech onset. Additionally, greater beta (15–30 Hz) power desynchronization was observed for phrase naming in the bilateral posterior temporal lobes around -250 ms before speech onset. Representational similarity analysis further showed that theta power desynchronization in the left ATL is associated with a conceptual combination process—an additive operation that combines the semantic vectors of adjectives and nouns—during phrase naming. Our findings indicate that increased power desynchronization corresponds to a greater amount of information processed during speech planning. Moreover, theta power desynchronization in the left ATL plays a crucial role in the conceptual combination of simple phrases.

Topic Area: LONG-TERM MEMORY: Semantic

C166 - Resolvin alleviates mechanical and heat, tumor-induced, hyperalgesia by inhibition of HIF-1 Alpha

Laura Neal[1], Kira Braun[2], Iryna Khasabov[3], Donald Simone[3]; [1]Macalester College, [2]Amherst College, [3]University of Minnesota

More than 60% of patients with primary or metastatic osteosarcoma experience severe chronic pain. This pain is exacerbated by cancer treatments such as chemotherapy. Cancer-related pain is hard to treat as it is inflammatory, tumorigenic, and neuropathic. Cancer patients currently lack sufficient non-opioid pain treatment. Resolvin (RvD1), a pro-resolving antinociceptive product of ω−3 polyunsaturated fatty acids, may alleviate tumor-induced hyperalgesia by resolving inflammation. We have previously shown the antinociceptive properties of Resolvin in tumor-bearing mice, but the exact mechanism through which Resolvin alleviates pain is not yet understood. We hypothesized that Resolvin decreases levels of Hypoxia Inducible Factor 1-Alpha in the central nervous system. Our data from qPCR of the lumbar spinal cord shows that tumor-bearing mice treated with Resolvin have lower levels of HIF-1a in the CNS than untreated tumor-bearing mice. Tumor-bearing mice also have higher levels of HIF-1a than naive mice, as HIF-1a is associated with tumor survival. To explore this possible mechanism of Resolvin, we injected tumor-bearing mice with si-RNA to block HIF-1a. Through Von Frey and the Hargreaves test we show that this treatment significantly attenuates heat and mechanical hyperalgesia. This shows that HIF-1a is directly involved in the central pain pathways of tumor-related mechanical and heat hyperalgesia and that this pathway can be intercepted through treatment with Resolvin. These findings support Resolvin being a viable treatment option to attenuate osteosarcoma induced chronic pain.

Topic Area: PERCEPTION & ACTION: Other

Poster Session D

Monday, March 31, 2025, 8:00 – 10:00 am, Back Bay Ballroom/Republic Ballroom

D1 - Exploring Sex Differences in Late-Life Depression and Genetic Alzheimer’s Disease Risk

Taline Bicakci[1], Claire Murphy[2]; [1]San Diego State University, [2]University of California, San Diego

Late-life depression (LLD) is a risk factor for Alzheimer’s disease (AD) that disproportionately impacts females. Females also exhibit increased vulnerability to AD and cognitive decline, particularly when carrying the Apolipoprotein-E (ApoE) ε4 allele, a biomarker implicated in AD and LLD-related cognitive dysfunction. Given that sex-specific factors may modulate the relationship between depression and cognitive decline in preclinical

AD, examining whether depressed females exhibit worse cognitive function than depressed males in older adulthood is critical. This study uses data from the Rancho Bernardo Study (RBS) of Healthy Aging, focusing on a 1992-1996 subsample of 671 non-demented adults aged 50+. Participants completed the Mini Mental State Examination (MMSE), Beck Depression Inventory (BDI), and RBS questions on emotional function and life balance. Multiple linear regression models assessed main effects of depressive/depressive-like symptoms and interaction effects of depressive/depressive-like symptoms and ε4 status on cognitive function for each sex, while controlling for education, age, and antidepressant/anti-anxiety medication usage. Only among males, poor life balance significantly predicted worse cognitive function (β = 657.957, p = 0.031), and only among male ε4 carriers, poor emotional function significantly predicted worse cognitive function (β = -3278.764, p = 0.002). Results indicate that males, particularly male ε4 carriers, with depressive-like symptoms (i.e., poor life balance, emotional function) exhibit worse cognitive function. The unexpected findings may be attributed to reduced help-seeking behavior in men, which could hinder the development of coping strategies to mitigate the maladaptive effects of depression on cognitive function. NIH grant #R01AG062006 National Institute on Aging to CM.

Topic Area: EMOTION & SOCIAL: Development & aging

D2 - Astrocytic Cholesterol Dysregulation in Fragile X Syndrome

Joy Nguyen[1] (jnguy851@medsch.ucr.edu), Luis Hernandez[2], Victoria Wagner[3], Iryna Ethell[4]; [1]UCR SOM

Fragile X Syndrome (FXS) is the most common inherited intellectual disability, affecting 1 in 4,000 males and 1 in 8,000 females worldwide. It is caused by a mutation in the FMR1 gene, resulting in the loss of FMRP. Lovastatin, a cholesterol-lowering drug, has been shown to reduce the frequency and severity of audiogenic seizures in FXS patients. Deficits in synapse development may underlie the hyperexcitable circuits and behavioral symptoms observed in FXS. Cholesterol, a critical synaptic component, is supplied to neurons by astrocytes. Dysregulated cholesterol homeostasis in astrocytes could explain lovastatin's beneficial effects (Talvio K. et al. Commun Biol 6, 789 (2023)). This study examines the impact of FMRP loss on cholesterol regulation in astrocytes. We analyzed gene expression of cholesterol-regulating proteins in three brain regions critical to cortical hypersensitivity and behavioral deficits in FXS (frontal cortex, temporal cortex, and hippocampus) from 5 wildtype and 4 FMRP astrocyte-specific conditional knockout mice. A significant reduction in the ABCA1 expression was observed in the hippocampus of knockout mice. ABCA1 is a transmembrane efflux protein responsible for cholesterol transport out of cells. These findings suggest that FMRP loss leads to cholesterol accumulation in hippocampal astrocytes, impairing their function. As demonstrated in Li Xiaohui, et al., neurons may then need to synthesize their own cholesterol, an energetically costly process that diverts acetyl-CoA, potentially disrupting histone acetylation and epigenetic modifications critical for learning and memory. Our study provides insight into a potential mechanism underlying the therapeutic benefits of lovastatin in FXS patients.

Topic Area: EMOTION & SOCIAL: Development & aging

D3 - Sex-Dependent Neural Predictors of Internalizing and Externalizing Behaviors in Children

Skyler Cohen[1] (skycohen@outlook.com), Clare Shaffer[1], Laurie Cutting[2], Silvia Bunge[3], Susan Whitfield-Gabrieli[1,4]; [1]Department of Psychology, Northeastern University, [2]Peabody College of Education and Human Development, Vanderbilt University, Nashville, Tennessee, [3]Helen Wills Neuroscience Institute & Department of Psychology, University of California at Berkeley, Berkeley, [4]Center for Precision Psychiatry, Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts

Research has sought to identify neural markers associated with early behavioral risk factors for psychopathology. Studies have identified promising brain imaging markers in regions involved in visceromotor regulation and mood, such as the subgenual anterior cingulate cortex (sgACC), which may be a viable marker of vulnerability in children. However, sex differences in functional connectivity (FC) during development complicate prediction models. In this study, we examined sex differences in connectivity patterns that predicted two dimensions of the Child Behavior Checklist (CBCL): internalizing behavior and externalizing behavior. Participants were a sample of fifty 7-year-old children (30 female) who provided written informed consent and completed a baseline visit (T1) that included a resting-state MRI scan and a behavioral visit four years later (T2). Results revealed sex-specific patterns of FC that predicted changes in internalizing and externalizing symptoms from T1 to T2, localized to clusters within the Crus II (t_{47}=5.32, p<.0001, β=.015) and Crus I (t_{47}=7.53, p<.001, β=.031) of the cerebellum, respectively. Sex differences in FC within visceromotor and skeletomotor control regions, including the sgACC and cerebellum, may influence the perception of bodily sensations, offering reliable neural correlates for psychopathological risk. Together, these findings suggest that sex-specific FC patterns in hubs linking diverse functional networks, such as the sgACC and cerebellum, are present in young children and may be predictive of worsening early behavioral risk factors for psychopathology.

Topic Area: EMOTION & SOCIAL: Development & aging

D4 - Altered neural response to emotional faces in infants of mothers with depressed or anxious mood

Joyce Hu[1] (joycexin001@e.ntu.edu.sg), Hui Zhao[1], Cheryl Tan[1], Marchella Smith[1], Marcel Andre Hirt[1], Victoria Leong[1]; [1]Nanyang Technological University

Up to 20% of new mothers experience postpartum mood disorders (Field, 2018) which is associated with 3-4 times elevated mental health risk in their infants (Lawrence et al., 2019). However, the neural mechanisms for intergenerational transmission of risk are still poorly understood, although altered affective cognition has been implicated. This study examines infants' behavioral (gaze) and neural (EEG) responses to emotional faces (Happy, Sad, Fear, Anger) relative to a non-emotional Scrambled face control. Preliminary analyses on the first N=22 (out of 50) participants (mean age 6.73 months, SD 30.8 days, 12 M/10 F) revealed longer looking duration to Fearful relative to other faces (p=.0016). Further, significant group differences between infants of mothers with 'No-depression/anxiety' (CON) versus 'Mild-depression/anxiety' (DEP/ANX) were found. Controlling for baseline differences in individual gaze, infants in the DEP group showed an overall shorter looking than CON infants (p<.001). Pairwise-comparisons indicated significantly shorter looking at Sad faces (p=.0096). Cluster-based permutation analyses on the EEG response to Fearful faces identified an effect of maternal depression (p<0.05), corresponding to differences in the observed data ~300ms at 4-8Hz for the PO7 channel and ~250ms at 24-32Hz for the CP2 channel. To further investigate the neural mechanisms underlying infants' behaviors, ERP and FAA analyses are currently underway. This study builds on prior research on the intergenerational transmission of mood disorders, suggesting a role for altered neural and attentional processing of emotional stimuli from 6 months of age.

Topic Area: EMOTION & SOCIAL: Development & aging

D5 - Greater neural dissimilarity between emotional stimuli in early visual areas is associated with symptoms of psychopathology in adolescents

Yen-Chu Lin[1] (ylin@barnard.edu), Qingyang Meng[1], Hailey Kopp[1], May Conley[2], Lena Skalaban[3], Estée Rubien-Thomas[2], Richard Watts[4], Dylan Gee[2], Arielle Baskin-Sommers[2], BJ Casey[1]; [1]Barnard College, [2]Yale University, [3]Temple University, [4]University of Canterbury

Adolescence is a period of heightened risk for psychopathology. Recent studies suggest shared neural correlates across mental disorders, particularly in frontolimbic networks involved in emotional processes. However, the visual network—crucial for extracting and processing sensory and emotional information—has been less of a focus in these studies. Here, using a transdiagnostic approach, we focus on visual pathways and investigate how individuals with psychopathology represent and differentiate between emotional categories. We utilized imaging and questionnaire data from the Adolescent Brain Cognitive Development StudySM Release 4.0 (11-12 year-old; n=4953 after quality control). Symptoms of psychopathology were based on the Child Behavior Checklist total problem scores. Participants performed an emotional n-back working memory task with three emotional categories (happy, fearful, and neutral faces) with high and low memory loads. Representational similarity analysis was used to examine dissimilarities in neural representations of emotional face categories in the visual network and its subregions. The associations between dissimilarity, levels of psychopathology, and task performance were tested using linear models. The analysis of neural representations of emotional face categories showed greater dissimilarities in individuals with more symptoms of psychopathology in the visual network. Behaviorally, we also found that greater dissimilarities in emotional categories was associated with diminished working memory performance. Moreover, the primary visual cortex exhibited the most robust patterns of dissimilarities between categories. Together, our results suggest distinct patterns of emotional information processing in early visual areas in adolescents with more symptoms of psychopathology, illustrating the importance of the visual network in psychopathology studies.

Topic Area: EMOTION & SOCIAL: Development & aging

D6 - A three-armed bandit task measuring social exploratory/exploitative behavior in older adults

Christian Valtierra[1] (christian.valtierra@ucsf.edu), Lorenzo Pasquini[1], Adam Gazzaley[1], Gabriella Mace[1], Avery Ostrand[1], Maria Auil[1], Patrick McConnell[1], Sydney Griffith[1], Jeremy Hogeveen[2], Nathan Spreng[3]; [1]Neuroscape, Neurology Department, University of California, San Francisco, CA, USA, [2]University of New Mexico, Albuquerque, NM, USA, [3]Montreal Neurological Institute, McGill University, Montreal, Canada

Accomplishing one's goals in life requires a balancing act between exploiting known strategies, and exploring novel options that may be more fruitful down the line. This exploration-exploitation trade-off changes with age, with older adults typically displaying more exploitative behavior when compared to younger adults. Here, we used a social variation of the three-armed bandit task to explore social exploratory/exploitative behavior in older adults. We adapted a three-armed bandit task presenting faces of older adults. Three faces were presented at the same time, each with distinct probabilities of reward. Participants were asked to select the image that is most likely to result in a reward. At regular intervals, a novel image with a new reward probability was inserted pseudo-randomly, thus providing the participant with an opportunity to explore a new source of potential reward. Individual rates for best choice, worst choice, and novel choice were derived from this behavioral data. Participants were significantly more likely to choose the best option than the worst option. Participants were most likely to follow their current best strategy, although they engaged with the novel stimulus at a greater frequency than the known worst option. In a previous study applying a non-social version of the three-arm bandit task in younger adults, participants chose novel stimuli at a much higher rate when compared to older adults. Future research is needed to evaluate whether this reflects an expected effect of age or whether the social nature of our task resulted in a lower exploration rate.

Topic Area: EMOTION & SOCIAL: Development & aging

D7 - Similar Early Life Stress Exposure is Associated with Similar Cortical Neural Representations during the Emotional Go/No-Go in Early Adulthood

Miro Ilomäki[1] (miro.ilomaki@helsinki.fi), Jallu Lindblom[2], Marjo Flykt[1,2], Mervi Vänskä[2], Raija-Leena Punamäki[2], Patrik Wikman[1,3]; [1]University of Helsinki, [2]Tampere University, [3]Aalto University

Early life stress (ELS) and its neurodevelopmental outcomes remain elusive despite extensive research efforts. A key limitation has been the predominant focus on univariate activation analyses, which often fall short in untangling the complex outcomes associated with neurodevelopment. Addressing these limitations, we employed sophisticated computational approaches to explore the nuanced impact of ELS on brain function, emphasizing interindividual differences in neural representational spaces. We analyzed functional magnetic resonance imaging (fMRI) data from 87 young adults during an emotional go/no-go task using intersubject representational similarity analysis (IS-RSA). In the analysis, correlations between interindividual dissimilarities in ELS exposure and interindividual dissimilarities in neural representational similarities across 360 cortical regions were inspected. We observed significant positive correlations for 40 cortical regions, such as the anterior insula and frontal operculum, regions known to be crucial for emotional processing and cognitive control. Furthermore, we utilized multidimensional scaling and Procrustes alignment to examine interindividual differences in neural representational spaces, demonstrating the utility of these computational approaches. The results highlight the effectiveness of IS-RSA, along with spatial and shape analytical techniques, in revealing subtle between-subject differences in neural representational similarities. Our study not only advances our understanding of how ELS influences neurodevelopment but also underscores the importance of innovative computational methods in neurodevelopmental research. By extending techniques traditionally used in the analysis of low-level phenomena, such as in vision studies, we demonstrate the broader applicability and potential of these methods for neuroscientific research.

Topic Area: EMOTION & SOCIAL: Development & aging

D8 - A technology-based randomized controlled trial of self-affirmation and gain-framed health messaging to reduce sedentary behavior in older adults

Caitlin Walker[1,3] (caitlin.walker@mail.mcgill.ca), Meishan Ai[2], Nagashree Thovinakere[1,3,4], Arthur Kramer[2], Maiya Geddes[1,2,3,4,5,6]; [1]McGill University, [2]Northeastern University, [3]Montreal Neurological Institute, [4]Rotman Research Institute, [5]Douglas Mental Health University Institute, [6]Massachusetts Institute of Technology

Sedentary behavior is a significant risk factor for chronic diseases and cognitive decline in aging. Older adults prioritize positive over negative information, and self-affirmation has been shown to reduce sedentary behavior in younger adults. However, the influence of self-affirmation on sedentary behavior change in older adults remains untested. Consequently, we developed a technology-based intervention combining self-affirmation and gain-framed messaging to reduce sedentary time in older adults (DOI:10.1016/j.cct.2021.106405). In a 6-week randomized controlled trial, 48 cognitively unimpaired, sedentary older adults were randomized into intervention (mean age=70.0±5.4) or active control (mean age=68.4±5.0) groups. Both groups received daily messages by smartphone or computer. The intervention group reflected on their highest-ranked value and received gain-framed health messages, whereas the control group reflected on an everyday activity and received loss-framed messages. Feasibility was assessed through adherence, usability ratings, and adherence-demographic relationships. Reward sensitivity and apathy were evaluated as predictors of behavior change. Neural correlates of self-affirmation and gain-framed messaging were examined using task-based fMRI. Results revealed high intervention adherence (0.92±0.08) and usability ratings. Adherence was unrelated to socioeconomic status or technology proficiency. While no group differences in sedentary behavior change were observed, higher reward sensitivity predicted reductions in sedentary behavior across all participants. FMRI results showed ventral striatal activation during gain-framed relative to neutral health messages, to a greater extent than during loss-framed compared to neutral health messaging. This study supports the feasibility of technology-based interventions in aging. Gain-framed health messaging engages the reward network and reward sensitivity predicts sedentary behavior change in older adults.

Topic Area: EMOTION & SOCIAL: Development & aging

D9 - Neural oscillations and risk for internalizing problems from infancy to early adolescence: longitudinal insights using spectral parameterization

Dashiell D. Sacks[1,2] (dashiell.sacks@childrens.harvard.edu), Viviane Valdes[1,2], Carol L. Wilkinson[1,2], April R. Levin[1,2], Charles A. Nelson[1,2], Michelle Bosquet Enlow[1,2]; [1]Boston Children's Hospital, [2]Harvard Medical School

EEG is a powerful tool for investigating neurobiological markers of developmental psychopathology, given its portability and relative affordability. Traditional methods for analyzing baseline EEG power spectral density may conflate periodic, oscillatory activity with aperiodic activity, and obscure developmental trends in oscillatory activity. In this study, we used spectral parameterization to investigate (a) developmental trajectories of EEG power from infancy to early adolescence before and after isolating periodic activity and (b) associations of these trajectories with internalizing psychopathology. Participants (N=401) were enrolled in a longitudinal study of typical development, with baseline EEG collected in infancy (5, 7, or 12 months) and follow-up assessments including EEG and parent-reported child internalizing symptoms at ages 3, 5, 7, and 11 years. EEG power

demonstrated linear decreases beginning at 3 years across delta, theta, alpha, beta, and gamma frequencies. More nuanced developmental trajectories were observed after isolating periodic activity, with variation across frequencies and non-linear trends. When participants were dichotomized into low and elevated internalizing symptom groups based on scores at each age, significant differences were observed in EEG power trajectories, characterized by reductions across all frequency bands in the elevated group at age 7. Although trends appeared similar, there were no significant differences in any frequency band after isolating periodic activity; differences could be explained by a broad shift in aperiodic offset. Spectral parameterization may yield unique insights into early development of neural oscillations. In this community sample, differences in EEG power in relation to internalizing symptoms appear driven by aperiodic activity.

Topic Area: EMOTION & SOCIAL: Development & aging

D10 - Age-dependent predictors of musical reward sensitivity in brain structures

Jinyu Wang[1] (jinyu.wang.csu@gmail.com), Benjamin Kubit[1], Nicholas Kathios[1], Edward Large[2], Psyche Loui[1]; [1]Northeastern University, [2]University of Connecticut

The neural mechanisms of individual differences in musical reward have gained increasing attention in recent years. Previous studies examined the link between musical reward sensitivity and white matter structural connectivity as well as functional activation and connectivity in auditory and reward area. However, the relationship between brain morphometry and individual differences in musical reward sensitivity is less investigated. Here we explored this relationship with brain anatomical and survey data from 161 young and older adults. Individual difference in musical reward sensitivity was measured by Barcelona Music Reward Questionnaire (BMRQ). We extracted cortical thickness and subcortical volumes from FreeSurfer segmentation and parcellation as features to predict musical reward sensitivity, using Random Forest algorithm with 5-fold cross-validation. Musical reward sensitivity was significantly higher in young adults than in older adults group, $t(159)=4.04$, $p<.001$. Feature importance analysis identified brain structures metrics predictive of musical reward sensitivity: in young adults, musical reward sensitivity was best predicted by volume of putamen, and thickness of inferior temporal cortex, parahippocampal cortex, postcentral cortex, and rostral anterior cingulate, primarily associated with reward and sensory processing. In older adults, musical reward sensitivity was best predicted by thickness of frontal pole, parahippocampal cortex, and entorhinal cortex, and volume of putamen and brainstem, more associated with memory processes. These results implicate age-specific pathways for experiencing reward from music: while young adults may engage more with music though reward and sensory areas, older adults may engage with musical reward though memory-associated areas, where music evokes past experiences and emotional responses.

Topic Area: EMOTION & SOCIAL: Development & aging

D11 - Positive Childhood Experiences Support Cognition and Counteract Behavior and Emotion Problems During Early Adolescence

Nicole Logan[1] (nicolelogan@uri.edu), William Lewis-de los Angeles[2,3]; [1]University of Rhode Island, [2]Warren Alpert Medical School of Brown University, [3]Emma Pendleton Bradley Hospital

Objective: This study aimed to identify the independent effects of positive childhood experiences (PCEs) on early adolescents' brain health (cognitive function, behavioral and emotional problems). Methods: Data from the two-year follow-up visit from the Adolescent Brain and Cognitive Development (ABCD) study were analyzed ($N = 5449$, mean age: 12.0 ± 0.7, age range = 10.6-13.4 years). Adverse childhood experiences (ACEs) were measured by parent report at baseline, and PCEs were measured by parent report at the 2-year follow-up. Dependent variables included cognitive function domains (NIH Toolbox) and the child behavior checklist (CBCL) subscales at year two. Multivariate linear regression analyses were performed for each dependent variable, with the number of PCEs and ACEs as independent variables, adjusting for age, sex, race/ethnicity, puberty stage, and family income. Results: PCEs were associated with better cognitive function on tasks of picture vocabulary (b=0.29, 95% CI 0.15 to 0.43), flanker (b=0.14, 0.00 to 0.28), reading recognition (b=0.19, CI 0.08 to 0.31), and picture sequence memory (b=0.44, CI 0.21 to 0.67). The PCEs-ACEs interaction showed that increased PCEs reduced the effect of ACEs on the CBCL subscales: anxious-depressed (b=-0.06, -0.10 to -0.01), withdrawn (b=-0.06, -0.09 to -0.04), aggressive behavior (b=-0.11, -0.17 to -0.06), rule-breaking behaviors (b=-0.06, -0.09 to -0.04), social problems (b=-0.04, -0.07 to -0.01), somatic complaints (b=-0.03, -0.06 to 0.00), and total CBCL problems (b=-0.46, -0.69 to -0.23). Conclusions: Exposure to PCEs supports cognition and is protective against psychopathology, even among children exposed to ACEs.

Topic Area: EMOTION & SOCIAL: Development & aging

D12 - Social Withdrawal is Associated with Widespread Morphological and Topological Differences in the Adolescent Brain

Catherine Stamoulis[1,2], Matthew Risner[2]; [1]Harvard Medical School, [2]Boston Children's Hospital

Social withdrawal during adolescence may have detrimental and currently unclear effects on the developing brain. We investigated the neural correlates of preference for solitude in n = 2809 youth (median (IQR) age = 12.0 (1.1) years; 51.3% females) from the Adolescent Brain Cognitive Development Study. Topologies of task-independent brain circuits and morphological parameters were analyzed. Associations between these characteristics and a self-reported social withdrawal were examined, as well as the latter’s correlations with internalizing/externalizing behaviors and parental mental health (all t-scores). Higher parental mental health issues correlated with preference for solitude (β=0.14, 95% confidence interval (CI)=[0.10,0.19], $p<0.01$), and similarly for internalizing/externalizing behaviors (β=[0.23,0.45], CI=[0.19,0.49], $p<0.01$). Preferring to be alone was associated with lower topological robustness and efficiency of the entire connectome (β=[-0.07,-0.05], CI=[-0.12,-0.01], $p<0.04$), lower connectivity of the right-salience network (β=-0.07, CI=[-0.11,-0.02], $p<0.02$), lower robustness of bilateral somatomotor, left frontoparietal control, and left dorsal attention networks, and lower efficiency of these and the bilateral reward, salience, prefrontal networks and their subcortical projections, and the left social network (β=[-0.07,-0.05], CI=[-0.12,-0.01], $p<0.05$). Preferring to be alone was also associated with lower cortical thickness of bilateral superior temporal, caudal anterior cingulate and right insular gyri, and the pars opercularis (β=[-0.09,-0.05], CI=[-0.14,-0.01], $p<0.05$), white matter intensity in the bilateral parahippocampal, left insular, right lingual, medial orbitofrontal, and posterior cingulate gyri (β=[-0.05,-0.04], CI=[-0.08,-0.004], $p<0.05$), and higher volume of the right parahippocampal gyrus (β=0.05, CI=[0.01,0.10], $p<0.04$). These findings suggest that socially withdrawn youth may have widespread topological and structural brain differences compared to socially engaged peers.

Topic Area: EMOTION & SOCIAL: Development & aging

D13 - Age and Valence Shape the Encoding, Retrieval, and Recapitulation of Emotional Memories in the Brain

Leonard Faul[1] (leonard.faul@bc.edu), Lauren K. Voso[1], Hannah R. Piccirilli[1], Ryan G. Monkman[1], Brianna D. Lenza[1], Elizabeth A. Kensinger[1]; [1]Boston College

A growing body of work has shown that older age is associated with reduced reinstatement of encoding-related neural activity during memory retrieval. To date, no study has examined whether age-related differences in neural activation profiles at both encoding and retrieval differ by emotional valence, despite behavioral evidence of positivity biases in attention and memory among older adults. Here, we analyzed neuroimaging data from a sample of participants across the adult lifespan (19-85 years old) while they incidentally encoded positive, neutral, and negative images. Participants then returned the next day for a recognition memory test, again inside the MRI scanner. At encoding, increased age was associated with reduced activation of occipital and parietal brain regions, particularly for subsequently remembered negative images. At the next-day retrieval test, older adults showed stronger engagement of prefrontal regions than younger adults for remembered, versus forgotten, negative images. Moreover, when compared to neutral memories, reinstated encoding-related activity for positive memories was better preserved with age than for negative memories. This preserved neural recapitulation was primarily located within lateral temporo-occipital regions preferentially responsive to the processing of image content, rather than more general visual or semantic processing, as identified with a functional localizer task. Across participant ages, we also observed that negative and positive memories elicit distinct patterns of recapitulated activity throughout occipital, parietal, and prefrontal regions. Taken together, our findings highlight age-related shifts in how emotional memories are encoded and retrieved, as well as valence biases in the strength of their visuosensory recapitulation.

Topic Area: EMOTION & SOCIAL: Development & aging

D14 - Mindfulness meditation with neurofeedback in older adults experiencing loneliness: a pilot randomised controlled study

Eugenie Roudaia[1] (eroudaia@research.baycrest.org), Nicole D. Anderson[1,2], Malcolm Binns[1,2], Morris Freedman[1], Nasreen Khatri[1], Linda Mah[1,2], Gibbs Jr Ollivierre[1,3], Helena Teng[1], Konka Paul[1], Allison B. Sekuler[1,2,3]; [1]Rotman Research Institute, Baycrest, [2]University of Toronto, [3]McMaster University

Lonely older adults face a greater risk of cognitive decline and depression. More interventions are needed to support mental well-being and cognitive health in this population. Growing evidence suggests that mindfulness meditation can improve mood, enhance cognitive function, and potentially reduce loneliness. Meditation apps offer an accessible way to learn meditation, but more research is needed to evaluate their effectiveness for older adults. This pilot randomized controlled trial assessed the feasibility and preliminary effects of a Muse-based mindfulness intervention (MM) in 26 lonely older adults. Participants were randomized to an 8-week MM program or a brain-training active control (BT) program. Muse is a meditation app that provides real-time neurofeedback during meditation. The MM group completed meditation sessions with neurofeedback and guided meditations, while the BT group engaged in cognitive games on the Peak app and listened to podcasts. Both groups had matched interaction times with staff and program durations. Outcome measures included self-reported loneliness, stress, depression, well-being, quality of life (QOL), sleep, resilience, and mindfulness. Cognitive tasks assessing memory, attention, and breath counting were administered by blinded staff. Assessments occurred at Pre, Mid, Post, and 2- and 4-month follow-ups. Both programs were engaging, and remote assessments were feasible. The MM group demonstrated greater improvements in depressive symptoms and psychological and physical QOL compared to the BT group at Post, which were sustained at the 4-month follow-up. A Muse-based mindfulness program is an acceptable and accessible intervention for older adults. A larger randomized trial is warranted to confirm its efficacy.

Topic Area: EMOTION & SOCIAL: Development & aging

D15 - Social media addiction impacts resting spontaneous cortical activity and relates to transdiagnostic mental health symptoms in adolescence

Nathan Petro[1,2] (nathan.petro.phd@gmail.com), Lauren Webert[1,2], Jake Son[1,2,3], Thomas Ward[1,2,4], Kellen McDonald[1,2,4], Danielle Rice[1,2], Grace Ende[1,2], Anna Coutant[1,2], Erica Steiner[1,2], Cooper Livermore[1,2], Mikki Schantell[1,2,3], Abraham Killanin[1,2,3], Giorgia Picci[1,2,4], Tony Wilson[1,2,4]; [1]Institute for Human Neuroscience, Boys Town National Research Hospital, [2]Center for Pediatric Brain Health, Boys Town National Research Hospital, [3]College of Medicine, University of Nebraska Medical Center, [4]Department of Pharmacology & Neuroscience, Creighton University

Adolescence is a period of profound biopsychosocial development, where peer interactions shape neural reorganization. The dramatic increase in social media access has fundamentally changed social interactions among adolescent peers, creating an urgent need to understand its impact on development. One alarming trend is the rise of addiction-like behaviors on social media, where its use becomes uncontrolled, obsessive, and leads to neglect in other areas of life. This is made possible by the nature of social media, which enables peer-interactions to become ceaselessly accessible and thereby support addiction-like behaviors. Unfortunately, the neurobiological underpinnings of these addiction-like social media behaviors, and their unique relationship with mental health symptoms, are unknown. From 80 typical youths (8-16 years) we assessed mental health symptoms, spontaneous cortical activity based on magnetoencephalography, and self-reported addiction-like social media behaviors (e.g., “I use social media to reduce bad or upsetting feelings”). Controlling for age, sex, and overall social media use, higher addiction-like social media behaviors were related to stronger spontaneous delta in occipitotemporal cortices and theta in prefrontal cortices, as well as weaker spontaneous gamma in prefrontal cortices (all pfwe < .03). In addition, higher addiction-like social media behaviors were related to more severe symptoms of internalizing problems and inattention/hyperactivity (all ps < .05). In sum, developing addiction-like behaviors on social media portend increased risk for transdiagnostic mental health symptoms, and impact the functional activity within developmentally-relevant association cortices. These results point to the deleterious effects of constant access to social interaction and feedback during childhood and adolescence.

Topic Area: EMOTION & SOCIAL: Development & aging

D16 - Neurodevelopment of the frontoparietal network underlying social interactions in common marmosets

Maëva Gacoin[1] (maeva.gacoin@mcgill.ca), Tyler Cook[1], Justine Cléry[2]; [1]Department of Neurology and Neurosurgery, McGill University, Montreal, Canada, [2]Azrieli Center for Autism Research

Primate species, including humans, navigate complex social environments through behaviors like grooming and chasing, which reveal social hierarchies. Understanding these dynamics is essential for adaptive behavior and can shed light on neurodevelopmental disorders like autism. The common marmoset (Callithrix jacchus), a small primate with human-like social skills, offers a unique opportunity to study the neural mechanisms of social cognition due to its family-oriented behavior, rapid development (<24 months), and high reproductive rate. These traits make it an excellent candidate for preclinical autism models and for exploring the impacts of social disruptions across the lifespan. This project investigates social cognition first in neurotypical marmosets from 6 to 24 months old using advanced imaging techniques (functional and structural MRI) and behavioral tasks. We used task-based fMRI in awake marmosets while they are viewing social interactions videos, structural MRI data to monitor cortical myelin development and resting-state functional connectivity in the frontoparietal network, critical for social cognition. Behavioral evaluations included touchscreen and eye-tracking tasks to assess social categorization and gaze preferences. Our preliminary findings (up to 15-month-old) show increased cortical myelination and strengthened frontoparietal connectivity with age. Observing social interactions with varying emotional valence elicited distinct brain responses: hierarchical interactions strongly activated the amygdala, while affiliative behaviors produced minimal activity. Younger marmosets showed less differentiation in prefrontal activation between kinship and friendship, contrasting with adults’ nuanced responses. This research not only deepens our understanding of marmoset neurodevelopment but also establishes its potential as a model for studying autism-related social deficits.

Topic Area: EMOTION & SOCIAL: Development & aging

D17 - Screen time and sleep in autistic children and adolescents

C. Paula Lewis-de los Angeles[1,2], William Lewis-de los Angeles[1,2,4], Jared M. Saletin[1,3], Noah S. Philip[1], Petya D. Radoeva[1,4]; [1]Warren Alpert Medical School of Brown University, [2]Hasbro Children's Hospital, [3]Sleep Research Laboratory, Emma Pendelton Bradley Hospital, [4]Emma Pendleton Bradley Hospital

Sleep disturbances are common in children with autism spectrum disorder (ASD). Studies have shown that poor sleep in autistic youth is associated with daytime behavioral dysregulation. Here, we hypothesized that greater screen time would be associated with lower sleep duration in autistic youth. Participants with a parent-reported diagnosis of ASD (n=201, 86% M, average age 12.2 years) were identified from the Adolescent Brain Cognitive Development Study, a longitudinal study of adolescent development. Screen time by youth report, sleep duration by accelerometer (Fitbit), and age at first cell phone by parent report, were examined using linear regressions adjusting for age and sex. Each hour less of weekday screentime was associated with 4.4 minutes longer sleep nightly (n=96, 95% CI: 0.6-8.2, p=0.02). Likewise, each hour less of weekend screentime was associated with 2.6 minutes longer sleep nightly (n=96, 95% CI: 0.2-4.9, p=0.03). Compared to children who received their first cell phone at or before 9 years,

youth who received a first cell phone at age 10 had 52 more minutes of sleep (n = 45, 95% CI: 4.2 to 100.2; p=0.03) and those who received a phone at ages 11 or 12 years had 81 more minutes of sleep (n = 45, 95% CI: 40.8-121.8; p<0.001). In this study, earlier initiation of phone use and more screen time was associated with less sleep in autistic youth. Characterizing relationships between screen time and sleep in autistic youth may help understand how screen time affects neurodevelopment in autistic youth during critical periods of development.

Topic Area: EMOTION & SOCIAL: Development & aging

D18 - Evaluating the impact of valproic acid and valpromide on histone acetylation and the development of ASD-like traits in zebrafish models

Haven Henry[1], Dr. Denise Flaherty[1]; [1]Eckerd College

The role of histone acetylation on the onset of autism spectrum disorder (ASD) provides important insights into the epigenetic mechanisms underlying neurodevelopmental conditions. Prenatal environmental factors, such as altered histone deacetylase (HDAC) activity, suggest that variations in histone acetylation may contribute to the onset of ASD. Maternal use of the anti-epileptic drug valproic acid (VPA) during pregnancy has been associated with ASD-like behaviors and physical malformations in children. In contrast, valpromide (VPD), a structural analog of VPA, does not inhibit HDACs. Despite this distinction, few studies have examined histone acetylation levels as a potential regulatory mechanism for these effects. This study investigates zebrafish (Danio rerio) physical and behavioral development during larval and adult stages following exposure to VPA and VPD at 5-7 hours post-fertilization (hpf). Histone acetylation levels will be measured in embryos (24 hpf, 48 hpf), larvae (7 dpf), and adults (30 dpf). Physical malformations (e.g., body length, pericardial edema, swim bladder development, spinal curvature) and behavioral traits (e.g., shoaling, social contact, swimming speed, distance traveled, thigmotaxis) will be evaluated in larvae and adults. The results are expected to show more physical malformations, behavioral impairments, and higher histone acetylation levels in VPA-treated zebrafish compared to the VPD group. By comparing the effects of VPA with VPD, this research aims to reveal how these compounds influence ASD development. A better understanding of VPA's mechanisms could encourage physicians to carefully weigh its side effects, including the risk of ASD, and opt for safer alternatives when prescribing medications.

Topic Area: EMOTION & SOCIAL: Development & aging

D19 - Early Life Threat Exposure Moderates Subcortical Functional Connectivity during Emotion Processing and Psychopathology Symptoms in Adolescents

Sophia Martin[1] (smart48@emory.edu), Philip A. Kragel[1], Alexandra O. Cohen[1]; [1]Emory University

Early childhood adversity exposure is linked to alterations in subcortical functional connectivity during emotion processing and greater psychopathology symptoms (e.g., anxiety). Recent studies identify superior colliculus (SC) functional pathways involved in processing aversive stimuli (SC-pulvinar (Pulv)-amygdala (Amyg); Kragel et al., 2021) and looming threats (SC-ventral tegmental area (VTA); Solié et al., 2022). Little work examines SC-subcortical functional connectivity during adolescence or relations to early threat exposure. The current study investigates relationships between SC-subcortical pathway connectivity, childhood threat exposure, and adolescent anxiety. We predicted that stronger task-related connectivity within SC-Pulv-Amyg and SC-VTA pathways would predict greater anxiety symptoms and that these relations would be stronger in individuals with greater childhood threat exposure. Adolescent Brain & Cognitive Development Study participants who completed the Emotional N-Back task during the baseline fMRI scan were pseudo randomly divided into age, sex, and site matched discovery and replication samples. Within the discovery sample (N = 1890), functional connectivity did not predict anxiety. Greater cumulative threat exposure significantly predicted higher anxiety. We observed a significant interaction between threat exposure and Pulv-Amyg functional connectivity whereby those with less threat exposure demonstrated a positive relationship between Pulv-Amyg functional connectivity and anxiety symptoms; however, those with greater threat exposure demonstrated a negative relationship. These results suggest that childhood threat exposure may alter the link between subcortical functional connectivity during threat detection and anxiety symptoms in early adolescence. Future analyses will aim to reproduce findings in the replication sample and investigate longitudinal trajectories of pathway development.

Topic Area: EMOTION & SOCIAL: Development & aging

D20 - Distraction-related Disruption of Ruminative Thoughts

Natalie M. Nielsen[1] (natalie.nielsen@donders.ru.nl), Karolina Figa[2], Ruben van den Bosch[1,2], Guusje Collin[1], Roshan Cools[1]; [1]Radboud University Medical Centre, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, [2]Radboud University, Nijmegen, Netherlands

Rumination, the excessive maintenance of negative information in working memory (WM), is a core symptom of anxiety and depression, both associated with WM deficits. Research on long-term memory shows that retrieval puts memories into an active state, therefore rendering it vulnerable to reconsolidation. By analogy, Mallett and Lewis-Peacock (2019) found that WM content prioritised for attention is disproportionally vulnerable to distraction. This study aimed to replicate these findings and tested whether the distraction effect is stronger for negative than neutral memories. We enriched the double retro-cue paradigm of Mallett and Lewis-Peacock with a valence manipulation. Participants associated negative and neutral autobiographical thoughts with images from separate categories and rated their feelings about them. Subsequently, subjects encoded two images of distinct categories, prioritised one and rated the memory paired with it. Before being cued to stay with or switch items, participants were distracted or not. Finally, subjects again rated the prioritised thought and indicated whether the image matched the probe. About 24 hours later, participants re-rated their thoughts to access reconsolidation effects. We used Bayesian linear mixed effects modelling to analyse reaction times and accuracy. Contrary to expectations, valence did not affect performance. However, participants rated negative thoughts as less negative 24 hours after the task, suggesting that the entire task may have initiated reconsolidation. Moreover, exploratory analyses imply that distraction-related decreases in the negative valence of ruminative thoughts are greater for prioritised than non-prioritised items. This raises questions about the efficacy of combining current treatment of rumination with distraction therapy.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D21 - Emotion regulation generation: Creativity and depression predict strategy choice, diversity, and fluency

Lucas Bellaiche[1] (lucas.bellaiche@duke.edu), Leonard Faul[2], Kayla Lihardo[1], Catherine Flanagan[1], Kevin S. LaBar[1]; [1]Duke University, [2]Boston College

Individual patterns of emotion regulation (ER) are traditionally examined using methods like self-report questionnaires. These approaches, however, largely overlook the generative component underlying ER. That is, participants must generate specific ideas of a given strategy, and the fluency with which such ideas are generated could inform reliance on these strategies in the real-world. In this study, we instructed participants (N=144) to generate situation-specific ideas to manage their emotions in response to hypothetical negative scenarios. All ideas (n=8185) were then coded to one of 14 possible ER strategies. We also measured depressive symptoms and trait-level creativity (i.e., Alternative Uses Task originality scores). Results revealed that greater creativity predicted a higher diversity of strategies represented among the generated techniques ($b = .15$, $p < .001$) even when accounting for current mood and motivation levels. When modeling the specific number of ideas generated for each of the 14 coded strategies, higher creativity predicted a higher likelihood to attempt ($p < .001$) and subsequently generate more ideas ($p = .01$) for a wide range of strategies, most notably problem-solving, cognitive restructuring, and active distraction. Meanwhile, higher depressive symptoms were associated with more generated ideas for social support seeking ($b = .47$, $p = .002$), but a reduced likelihood to generate any ideas pertaining to cognitive restructuring ($b = -.21$, $p < .001$). In sum, we capture ER via a novel methodological lens that clarifies the crucial component of idea generation, a process which seems to correspond in part with creative-thinking ability.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D22 - VR-fMRI reveals greater amygdala activity and fear responses with 3D compared to 2D presentation of fearful movies

Misako Fujino[1,2] (fujino766@gmail.com), Atsushi Wada[2,1], Masahiko Haruno[2,1]; [1]Graduate School of Frontier Biosciences, Osaka University, [2]National Institute of Information and Communications Technology

Previous behavioral studies using VR have suggested that an immersive 3D environment can enhance fear responses; however, the neural basis of this effect has remained unclear due to limitations of conventional fMRI display setups. We developed a 3D VR-fMRI display with a 90-degree field of view, exceeding the standard 20-degrees, and presented phobia-related videos in 3D and 2D. These videos featured various stimuli, including snakes, spiders, and aggressive humans, each appearing to approach the viewer at close range. While in the fMRI scanner, participants (n=17) watched these videos for six seconds, and rated their arousal, valence, and fear levels. Participants completed 80 trials, alternating between 3D and 2D conditions every 10 trials. One subject with consistently low subjective fear levels was excluded from the analysis. The subjective fear levels were significantly higher for the 3D condition compared to the 2D condition (paired t-test, $t(15) = 2.10$, $p = 0.026$). The group-level fMRI analysis revealed that fearful movies (including 3D and 2D) significantly increased activity in the amygdala. Additionally, 3D conditions elicited higher activation in the higher visual areas, the amygdala, parahippocampal gyrus, and anterior cingulate cortex compared to the 2D condition. Notably, most participants did not consciously notice the difference between 3D and 2D videos, yet the 3D videos consistently induced stronger fear responses. Our findings reveal the brain regions activated by 3D stereoscopic vision compared to 2D vision and highlight our innovative method that enables more naturalistic and immersive emotional experiences within the fMRI environment.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D23 - Emotion behind Narratives: How do adolescents perceive emotion during fiction reading? An EEG study.

Panlin Lee[1] (panlin6363@gmail.com), Wen Jui Kuo[1]; [1]National Yang Ming Chiao Tung University

Theory of Mind is a cognitive ability to predict people's actions by understanding their perceptions and beliefs. It is important not only for social interaction but also for reading comprehension. Eye gazes can effectively convey emotions. While directed gazes are often interpreted as positive, averted ones are more negative. To what extent emotions derived from reading can affect gaze emotion interpretation in adolescents, we invited 50 students to participate in this study. This study included behavioral and EEG measurements. Behavioral assessments include “Reading the Mind in the Eyes test (REMT)”, and “Interpersonal Reactivity Index Questionnaire (IRI)”. For EEG measurement, we prepared 72 fiction stories with positive

(36) and negative (36) emotions from 6 literature. Participants were asked to read, focusing on the emotion conveyed by the story, and to rate the character's emotional state and arousal. Each story is followed by a gaze photo, with direct or averted ones. For behavioral measurements, the IRI scores showed significant differences among three age groups. During fiction reading, participants rated negative stories as having higher arousal than positive stories. ERP analysis showed significant story and gaze interaction over the electrodes distributed in left anterior regions at 300-400 msec. Significant story effects were over right anterior and left posterior regions at 700-800 msec. Our findings indicated that the emotions derived from the stories could interact with gaze at an early stage in left frontal regions. The story's emotional effects could last for longer and seemed to be hosted by wildly distributed brain networks.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D24 - The impact of affect prediction errors on episodic memory

Rohini Kumar[1] (rohini.kumar@emory.edu), Anny Huang[1], Mason McClay[2], David Clewett[2], Alexandra O. Cohen[1]; [1]Emory University, [2]University of California, Los Angeles

Enhanced memory for salient events can be driven by emotion and by prediction errors, or mismatches between expectations and outcomes of unfolding events (Rouhani et al., 2023). Recent work has suggested that affect prediction errors – deviations in expected feelings – can influence social decision making (Heffner et al., 2021), but the role of affect prediction errors in memory formation remains unclear. This study aimed to determine how prediction errors elicited by dynamic fluctuations in affective states impact episodic memory. Participants encoded sequences of images while listening to clips of emotionally evocative music. Following encoding, participants listened to each clip again while continuously rating their subjective valence and arousal using the novel 'Emotion Compass' tool. Twenty-four hours later, they completed item recognition and temporal source memory tests for the encoded images. Valence and arousal prediction errors were defined as the difference between actual affect ratings and expected ratings (a weighted average of recent ratings), and calculated trial-wise for each participant. Using linear mixed effects models, we found that unsigned valence prediction errors, or the magnitude of deviation from expected valence, enhanced temporal source memory. By contrast, there were no significant effects of affect prediction errors on item recognition memory. These effects were observed in a reanalysis of a published dataset (McClay et al., 2023) and replicated in an independent dataset. Together, these findings suggest that larger discrepancies between expected and actual valence, regardless of direction, selectively enhance the ability to bind items to their temporal contexts in memory.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D25 - Stepping Into VR: Embodied sense of presence in a virtual environment mediates physiological and behavioral indices of fear

William R. Lopez[1] (w.lopez26@ncf.edu), Christian Daloul[1], Emma Leigh D. Cunningham[1], Cassidy F. Brand[1], Peter F. Cook[1]; [1]New College of Florida

Laboratory studies of emotional arousal and fear have suffered from low ecological validity and small effect sizes. The sense of embodied presence in virtual reality environments may aid in eliciting high-intensity emotional responses. To assess the efficacy of virtual reality environments in studying fear and to determine the importance of embodied presence in those environments, we exposed participants to virtual heights in one of two conditions. All participants took an elevator to the 80th floor of a building and had to walk to the end of a beam extending over the edge. In the control condition, participants were instructed to hold a cane horizontally as a balance aid. In the embodied feedback condition, participants were instructed to use the cane to feel along the ground in the real-world environment. We measured peak EDA relative to baseline during walking, time to reach the end of the beam, and post-hoc self-reported fear on a 7-point Likert scale (10 points in the pilot). In the pilot, self-report data and EDA measures of fear were moderately high, suggesting that experiencing heights in VR produced a genuine fear response in most subjects. EDA values and walking time measures were much lower in participants in the embodied feedback condition, indicating that the sense of embodied presence in VR accounts for a significant portion of the fear response. Strikingly, there was a much smaller effect of the embodied feedback on self-reported fear, indicating a dissociation between conscious experience of fear and physiological and behavioral indicators.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D26 - Affective Framing of Information Influences Engagement, Donations, and Memory

Alyssa Sinclair[1] (sinclair.allie@gmail.com), Danielle Cosme[1], José Carreras-Tartak[1], Emily Falk[1]; [1]University of Pennsylvania

Negativity captures attention and motivates information seeking and sharing. However, negative messaging can also harm mental health and discourage sustained action to address crises like climate change. The imperative/interrogative theory of motivation proposes that emphasizing threat/urgency (imperative motivation) drives immediate goal-relevant behavior, but constrains attention and memory. In contrast, emphasizing reward/future goals (interrogative motivation) increases information seeking and detailed memory formation. To test these predictions, we adapted climate-related news headlines to feature different aspects of each story, emphasizing Crisis (disaster/urgency; imperative) or Action (progress toward future goals; interrogative). Across two experiments (N=687), we found that stronger positive and negative emotions were associated with intentions to read and share articles, and donations to related charities. Crisis and Action framing both increased reading and sharing intentions relative to the

unaltered headlines (as originally published); the effects of framing were mediated by emotion strength. Consistent with theoretical predictions, Crisis framing had the strongest effects on immediate engagement (reading, sharing, and donating), but Action framing enhanced next-day memory for news content. Lastly, we computationally classified Action and Crisis framing in >25,000 climate-related news headlines on social media; the use of both framing strategies was associated with increased likes and reposts, relative to neutrally-framed headlines. Overall, we show that Action and Crisis framing can both increase information seeking and sharing, but have opposing effects on emotions and memory. Our findings are relevant to theories of motivated behavior, effects of neuromodulators on cognition, and mass communication related to important societal challenges like climate change.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D27 - Assessing Traumatic Brain Injury and its Impacts on Emotional Memory in Older Veterans

Heera Kamaraj[1,2] (hkamaraj@bu.edu), Kathy Xie[1,2], Yasemin Yilmaz[1,2], Brenna Hagan[1,2], Emily Waksow[1,2], Andrew E. Budson[1,2], Katherine W. Turk[1,2]; [1]Center for Translational Cognitive Neuroscience, VA Boston Healthcare System, Boston, MA 02130, USA, [2]Alzheimer's Disease Research Center, Department of Neurology, Boston University School of Medicine, Boston, MA 02118, USA

Introduction: Imaging studies show increased amygdala connectivity in individuals with moderate traumatic brain injury (TBI) and depression, as well as Veterans with mild TBI and PTSD. This, alongside the amygdala's key role in retaining negative experiences, underscores the need to study TBI's impact on emotional memory. While TBI is linked to impaired word recall, valence-specific effects on memory - particularly the distinctions between familiarity and recollection for positive versus negative stimuli - remain underexplored. Our research focuses on understanding valence-specific memory differences in Veterans with TBI. Methods: To date, participants include 19 Veterans with TBI, 12 with mild cognitive impairment (MCI), and 12 healthy controls. Participants completed an emotional memory task: studying 60 words (20 neutral, 20 positive, 20 negative). Recognition of old and new words were rated on a 1 - 6 Likert scale (1 = absolutely sure the item is new, 6 = absolutely sure it is old) at test. Familiarity and recollection assessments will be measured using receiver-operator characteristic curves. Additional measures include the Ohio State University TBI Identification Method, mood, PTSD, and depression evaluations. Results: We hypothesize that individuals with TBI and age-matched healthy controls will demonstrate higher familiarity and recollection for words with negative valence than positive valence, with larger differences in the TBI group. The MCI group is expected to have reduced overall recollection and familiarity, but minimal valence-related differences. Conclusion: This study highlights the effects of TBI on valence-specific memory processes, informing future research on the underlying neural mechanisms of recollection and familiarity.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D28 - The role of hyperpolarization-activated cation channel 1 in PTSD-like phenotypes induced by single prolonged stress with post-corticosterone treatment

Chung Sub Kim[1] (ckim5@augusta.edu), Jiwon Kim[1]; [1]Augusta University

Introduction Single Prolonged Stress (SPS) is an animal model frequently employed to investigate the physiological and behavioral effects of acute stress. Glucocorticoids can induce atypical fear memories, including contextual amnesia, characterized by the inability to recall specific events, and emotional hypermnesia, marked by excessive recollection of feelings associated with such events. Hyperpolarization-activated cyclic nucleotide-gated 1 (HCN1) channels are highly expressed in the dorsal CA1 region of the hippocampus, where they modulate both intrinsic and synaptic neuronal properties. The role of HCN1 channels in maladaptive fear memories is not well understood. Methods 8–to-9-week-old male mice underwent SPS followed by post-treatment with vehicle or corticosterone (CORT). Y-maze and contextual fear conditioning were conducted. Following behavioral tests, whole-cell current- and voltage-clamp recordings were performed in the dorsal CA1 neurons. HCN1 overexpression in dorsal CA1 neurons was achieved through pLenti-CaMKIIα-HCN1 injections. Results SPS-CORT-treated mice displayed decreased spatial working memory, contextual amnesia, and impaired fear extinction compared to control-vehicle or -CORT groups. Dorsal CA1 neurons from SPS-CORT-treated mice displayed decreased input resistance (Rin) and reduced action potential (AP) firing compared to control-CORT group. Hyperpolarization-activated current (Ih) was significantly increased. ZD7288, HCN channels blocker, reversed the observed changes in Rin, AP firing, and Ih. Mice with HCN1 gene overexpression exhibited the phenotype seen in SPS-CORT-treated mice. Conclusion Our findings suggest that SPS with post-CORT treatment induces PTSD-like symptoms, which were reproduced by overexpression of HCN1 gene in dorsal CA1 neurons, highlighting the role of HCN1 channels as potential contributors to PTSD-like phenotypes.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D29 - Electrophysiology Correlates of Face Recognition in a Population of Individuals with Early Course Psychosis

Prachi Patel[1] (ppatel44@bidmc.harvard.edu), Nicolas Raymond[1], Emma Oss[1], Willa Molho[1], Brendan Stiltner[1], Chelsea Kiely[1], Paulo Lizano[1,2], Rebekah Trotti[1,2]; [1]Beth Israel Deaconess Medical Center, [2]Harvard Medical School

Event-related potentials (ERPs) reveal emotional processing deficits in individuals with psychosis spectrum disorder (PSD). While previous studies have examined alterations in emotional face processing in chronic PSD, deficits in early course psychosis (ECP) remains unexplored. Here, we determine group differences between ECP and healthy controls (HC) in ERP components (P100, N170, P300) during emotional face processing and their associations with social-cognitive symptoms. 48 participants viewed static emotional face stimuli and identified emotions with a button press during EEG recording. EEG data was analyzed to identify significant effects of group and emotion on P100, N170, and P300 amplitude. Spearman correlations assessed for relationships between social-cognitive measures (Social Functioning Scale (SFS), Brief Assessment of Cognition App (BAC App)) and face processing measures (accuracy and component amplitudes). Amplitudes differed between ECP and HC in P100 [$F(1,134)=12.01$, $p=0.001$], N170 [$F(1,134)=7.93$, $p=0.006$], and P300 [$F(1,134)=15.44$, $p<0.001$]. Emotion recognition accuracy was lower in ECP [$F(1,130)=19.30$, $p<0.001$]. While no significant correlations were found for ERP amplitude, accuracy significantly correlated with BAC total ($r=0.39$, $p=0.01$) and SFS total ($r=0.41$, $p=0.004$). Overall differences in P100, N170, and P300 amplitude between groups suggest neurophysiological impairments during face processing in individuals with ECP. Altered ERPs in ECP indicate that emotional facial processing deficits appear early in the phase of psychotic illness. Moreover, these electrophysiological underpinnings could act as potential biomarkers or treatment targeting using non-invasive brain stimulation in ECP.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D30 - Lower perceived stress enhances neural synchrony to naturalistic stimuli in attention and emotion regions

Joshua Craig[1] (joshua.craig@uleth.ca), Keva Klamer[1], Christina Haines[1], KiAnna Sullivan[1], Peter Seres[2], Chelsea Ekstrand[1]; [1]University of Lethbridge, [2]University of Alberta

Previous research highlights the widespread impact of stress on brain regions involved in attention and emotional processing, including the superior parietal lobule, prefrontal cortex, insula, and superior temporal gyrus (Gu et al., 2018; Liston et al., 2009). Traditional methods for studying the neural correlates of stress often rely on simplified stress-induction techniques that overlook the complexity of real-world challenges. In this study, we aimed to examine how perceived stress modulates neural synchrony in response to naturalistic stimuli. To investigate this, we conducted a functional magnetic resonance imaging (fMRI) experiment using audiovisual films. Each participant viewed three distinct films during fMRI: a high-arousal negative valence film, a high-arousal positive valence film, and a low-arousal neutral valence film. Using a median split of Perceived Stress Scale (PSS; Cohen et al., 1983) scores, we categorized participants into low- and high-perceived stress groups. We then assessed differences in inter-subject correlations between these groups using linear mixed-effects modeling. Results revealed that, across all three films, individuals with lower perceived stress exhibited greater neural synchrony than those with higher perceived stress in regions associated with attention and emotion regulation, including the bilateral superior temporal gyrus, lateral occipital cortex, and superior parietal lobule. These findings suggest that individuals with lower stress levels process dynamic, real-world stimuli more consistently across participants, regardless of the emotional valence of the film. This study provides valuable insights into how perceived stress shapes neural processing, offering a more ecologically valid understanding of the impact of stress on the brain and emotional regulation.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D31 - Differential fMRI neural synchrony associated with migraine during emotionally arousing naturalistic stimuli

Keva Klamer[1] (klamer@uleth.ca), Joshua Craig[1], Christina Haines[1], KiAnna Sullivan[1], Peter Seres[2], Chelsea Ekstrand[1]; [1]University of Lethbridge, [2]University of Alberta

Migraine is a common neurological disorder that impacts approximately 12% of the population and is characterized by moderate to severe headaches, nausea, mood changes, and fatigue. It impacts lower-level visual and auditory processing, causing hypersensitivities that lead to heightened audiovisual multisensory integration. However, the impact of migraine on the processing of complex, audiovisual stimuli remains unclear. Additionally, migraine may induce hypersensitivities to emotional arousal and valence, though the relative significance of these factors remains unknown. The current study seeks to identify how migraine impacts synchronous neural processing of complex audiovisual stimuli and how this differs based on the emotional arousal and valence of the stimulus. We collected functional magnetic resonance imaging (fMRI) data from 17 migraineurs and 26 healthy controls while they viewed three audiovisual films (high arousal, positive valence; high arousal, negative valence; low arousal, neutral valence). Intersubject correlation analysis was used to identify shared time-locked brain activity across participants. In response to high arousal emotional stimuli, the migraine group showed greater neural synchrony in regions associated with multisensory integration, including the posterior superior temporal gyrus (pSTG). In response to the negative valence film, the migraine group had heightened neural synchrony in the pSTG, bilateral cuneus and right angular gyrus. These findings suggest that migraine influences processing of naturalistic stimuli that varies based on emotional arousal and valence. Specifically, high arousal may drive greater synchrony in multisensory integration regions, while negative valence may enhance visual hypersensitivities. This research highlights how emotional stimuli drive distinct neural processing patterns in migraine.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D32 - Identification of four dialogue modes in daily conversations and their neural responses: an fMRI study

Yin May Zin Han[1] (yin.may.zin.han.q3@dc.tohoku.ac.jp), Yichuan Huang[1], Sachihiro Shirahama[1], Ayumi Takemoto[2], Hyeonjeong Jeong[2], Motoaki Sugiura[2]; [1]Tohoku University, [2]Institute of Development, Aging and Cancer, Tohoku University

In our daily communication, we have different social motivations to interact with others including intrinsic and extrinsic factors. For instance, engaging in social interaction may be rooted in intentions of personal joy or seeking approval from others. However, major social motivations for continued conversation in daily life and the neural mechanisms associated with motivation have not been identified. In this study, the dialogue modes (DM) which are characterized by social motivations for daily enjoyable conversations and the neural mechanisms of each dialogue modes were identified by conducting two steps of experiments, behavioral and functional magnetic resonance image (fMRI) experiments. First, to identify DMs, an online qualitative survey was conducted to generate the potential item survey measuring enjoyable daily conversations. This was followed by a quantitative survey and identified four DMs through factor analysis, including Relief (finding common worries with others), Novelty (talking with strangers), Comfort (chitchats with close people) and Interest (sharing hobbies). Secondly, the fMRI study was conducted with the short interactive conversational tasks with human-like avatars. The neural patterns across four DMs revealed distinct results. Precuneus associated with metacognition in Relief and social cognition processing areas e.g. SMG and left IPL in Comfort were more activated than other modes. However, decreased neural activities were found in mentalizing areas such as bilateral IPL for Novelty, and right TPJ and MTG etc. for Interest. This study suggests that there are four principal dialogue modes for daily chats, and various intrinsic-extrinsic motivations are involved in enjoyable daily conversations.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D33 - How Emotional Regulation Contributes to Tsunami Evacuation: An fMRI Study

Masato Takubo[1,2] (takubo.masato.s4@dc.tohoku.ac.jp), Ryo Ishibashi[3], Naoki Miura[4], Azumi Tanabe-Ishibashi[2,5], Motoaki Sugiura[2,5]; [1]School of Medicine, Tohoku University, [2]Institute of Development, Aging and Cancer, Tohoku University, [3]Center for Information and Neural Networks, National Institute of Information and Communications Technology, [4]Faculty of Engineering, Tohoku Institute of Technology, [5]International Research Institute of Disaster Science, Tohoku University

Effective evacuation decision-making during tsunamis is essential for minimizing casualties. Emotional regulation traits are known to be associated with prompt evacuation behaviors; however, the neural mechanisms underlying this relationship remain unclear. This fMRI study aimed to explore these mechanisms by investigating the relationship between emotional regulation traits and neural responses during evacuation decisions. 58 subjects in their 20s undertook an evacuation decision-making task (earthquake scenarios consisting of earthquake information of various risk levels and current location information, followed by decisions to evacuate from a possible subsequent tsunami), and their brain activity during the task was scanned. During decision-making, individuals with higher emotional regulation scores exhibited reduced activity in the insula and medial prefrontal cortex (mPFC). Additionally, reaction-time-dependent brain activity for scenario responses was negatively correlated with activity in the parahippocampal place areas (PPA). In individuals with lower emotional regulation scores, activation of the insula, associated with emotional processing, and the mPFC, linked to defensive mechanisms, may contribute to a tendency to reject catastrophic scenarios. The PPA may support spatially realistic mental simulations during the task, justifying their decision not to evacuate. In contrast, individuals with higher emotional regulation traits may lack such inappropriate bias mechanisms, as suggested by lower responses in these regions, enabling prompt evacuation decisions. Understanding this relationship provides valuable insights for disaster preparedness strategies tailored to individual differences in emotional regulation.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D34 - The Montreal Cognitive Assessment of Middle Aged and Older Aged Adults with Bipolar Disorder

Melissa Harris[1], Hannah Edelstein, Sheri Ryoko Hiroi, Rebecca Marks[1], Hannah Poeng[1], Susan Quatrano[1], Noa Katz Shroitman[1], Brian Pittman[1], George S. Alexopoulos[1], Christopher van Dyck[2], Hilary P. Blumberg[1]; [1]Department of Psychiatry, Yale School of Medicine, New Haven, CT, USA, [2]Department of Psychiatry, Weill Cornell Medical College, New York, NY, USA

Older adults with bipolar disorder (BD) have been observed to have cognitive deficits; however, some studies failed to replicate these findings perhaps because the tests used had inadequate sensitivity. It is important to identify a test that can be administered at the bedside that can detect the cognitive dysfunction of BD patients. Abnormal test results can prompt close monitoring of cognitive functions to identify the risk for dementia which is prevalent in persons with BD. Cognitive deficits detected during middle-age could identify individuals at risk who might benefit from intervention during this age period. To address these questions, we administer the Montreal Cognitive Assessment (MoCA), a widely used screening test for mild cognitive impairment, to participants aged 40 to 80 years. Scores of 47 BD were compared with those of 52 psychiatrically healthy (NC) participants. The main and interaction effects of age were assessed. The BD group had significantly lower MoCA total scores than the NC group. This difference persisted when euthymic BD participants were compared with NC participants. There were no significant main or interaction effects of age. The lower MOCA scores observed among middle- and older-aged adults with BD compared to NC participants suggests that MoCA can detect cognitive impairment in BD disorder. In the current analysis, results didn’t differ according to age. The cognitive deficits of euthymic BD raise the question of a trait feature of BD. Cognitive difficulties of BD may emerge by middle adulthood, suggesting the need for detection and development of treatment strategies.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D35 - Psychological Risk Factors Associated with Objective and Subjective Pre-treatment Cancer-Related Cognitive Impairment: A Systematic Review

Aideen Scriney[1], Lorna Gurren[1], Lisa Loughney[2], Pamela Gallagher[1], Lorraine Boran[1]; [1]Dublin City University, [2]Royal College of Surgeons in Ireland

Introduction: Cancer-related cognitive impairment (CRCI) describes issues patients can experience with attention, memory and focus. The aetiology of CRCI currently remains unclear. Despite approximately 10-30% of patients experiencing CRCI before treatment, there is a paucity of research on this timepoint. Exploring the role of anxiety and depression can aid in understanding how psychological variables may interact with CRCI. This review aims to explore the prevalence of objectively measured and subjectively reported pre-treatment CRCI and its association with anxiety and depression across cancer types. Methods: The review was conducted in line with PRISMA guidelines. Included databases: PsychINFO, CINAHL, MEDLINE, PubMed and EMBASE. Abstract and full text screening was conducted alongside a second reviewer. Final texts were assessed for quality using the JBI appraisal tools. Results: Database search resulted in 4,757 texts. After abstract screening,118 texts remained. Eighteen texts remained after full-text screening. Papers varied widely across cancer types and study design. Ten included a healthy control arm. Eleven directly reported the prevalence of pre-treatment CRCI. Most common subjective measures: FACT-Cognition, Attentional Function Index. Most common objective measures: The Trail Making Test, Digit-span, The Stroop colour-word. Preliminary synthesis of included studies indicates that there exists a positive association between the psychological factors of anxiety and depression and subjective CRCI. Conclusion: To our knowledge, this is the first review to assess the prevalence of pre-treatment CRCI across cancer types and associations with psychological factors. It is hoped that this review will highlight the potential role of psychological factors in CRCI.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D36 - Examining Fear Conditioning/Extinction and the Role of the Amygdala Using High Resolution Neuroimaging

Olivia Cook[1], Karisa Hunt[1], Brendan Depue[1]; [1]University of Louisville

Neuroimaging literature focused on fear conditioning and extinction is constrained to spatial resolution of fMRI. This limitation has posed significant challenges to understanding the contribution of the amygdala's core nuclei with consistency and precision. Recent advancements in neuroimaging technology have begun to address these challenges by enabling higher spatial resolution and accurate fine parcellation of the amygdala; however, the application of high-resolution imaging and amygdala parcellation maps specifically to fear conditioning and extinction paradigms remains largely unexplored. This study used high resolution functional magnetic resonance imaging (hrfMRI) combined with ultra-high resolution (7T) amygdala parcellation maps to explore fear learning and extinction in participants with varying levels of self-reported anxiety to provide new insights into the precise neural mechanisms underlying fear extinction, specifically within the amygdala. During fear acquisition when comparing fear and neutral stimuli, the fear condition showed increased activity in the central nucleus of the amygdala (CE), the dorsal anterior cingulate cortex (dACC), and the anterior insula, as well as decreased activity in the ventral medial prefrontal cortex (vmPFC). There was also increased connectivity between the dACC and the basolateral amygdala (BLA) and decreased connectivity between the vmPFC and CE. In extinction, there were no significant differences in activity or connectivity between fear and neutral. The results support findings from rodent literature that have detailed amygdala activity during fear acquisition and extinction. The output region of the amygdala (CE) appears to be modulated by the vmPFC to inhibit fear responses during extinction similarly to the processing of neutral stimuli.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D37 - The Effects of Verbal Instructions on Fear Extinction and Extinction Retrieval in Patients with Anxiety Disorders and Healthy Controls

Armin Zlomuzica[1] (armin.zlomuzica@rub.de), Annalisa Lipp[1], Christian Merz[1], Beray Macit[1], Marcella Woud[2], Oliver Wolf[1], Jürgen Margraf[1]; [1]Ruhr University Bochum, [2]University of Göttingen

Patients with anxiety disorders exhibit heightened conditionability, reflected in either an accelerated acquisition and/or a slower extinction of conditioned fear responses. Pathological anxiety is further associated with an attentional bias to negative stimuli. Verbal instructions (VI) stating that during fear extinction no UCS would be applied might be able to change this bias and help increase extinction learning. Several studies have shown that VI about CS–UCS contingencies administered prior to extinction training promote both fear extinction learning and extinction retrieval, although the effects of VI on extinction retrieval are inconclusive. We investigated whether VI provided prior to extinction training would lead to superior extinction learning in healthy controls as well as patients with anxiety disorders. We further explored whether VI provided after extinction training would improve extinction retrieval by diminishing conditioned fear responses and lead to superior effects in combination with VI delivered prior to extinction. N= 122 healthy controls and N=120 participants diagnosed with anxiety disorder were subjected to a 3-day fear conditioning paradigm and VI instructions were administered at several time points throughout the extinction learning and retrieval phase. Healthy controls as well as anxiety disorder patients seem to profit from VI and show superior extinction learning. Extinction retrieval was also improved by post-extinction VI while pre-extinction VI do not improve extinction retrieval. VI effects during reinstatement test were either diminished or vanished. Our findings provide potential implications for cognitive approaches aimed to increase current treatment options for anxiety disorders.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D38 - Relationships between Curiosity and Eye Movement Indicators of Information Seeking in Adolescents

Cassandra Ivie[1] (ci2383a@american.edu), Sarah Wene[1], Elshadai Melkam[1], Sophia Stull[1], Emily Peterson[1]; [1]American University, Washington, D.C.

Curiosity has been shown to enhance learning and memory, playing a key role in cognitive engagement and motivation. By acting as a motivator to seek information to fill a knowledge gap, curiosity increases information seeking behavior and later recall. However, few studies have explored this pattern in adolescents, particularly in authentic learning tasks. Moreover, this connection has not been thoroughly studied using eye-tracking. The current study aims to bridge this gap and investigate curiosity in the context of science learning using maps. Participants (N=21) enrolled in a high school GIS course were presented with descriptive information about three maps depicting climate science related phenomena and rated their curiosity to see each map. Their eye movements were tracked as they described things they noticed and wondered about each map. Trait curiosity was also measured prior to the experiment. In preliminary analysis, state curiosity predicted median saccade amplitude, a measure of diversity of information seeking. However, other eye movement measures of information seeking behavior showed trends in their association with state curiosity but did not reach significance. Trait curiosity was not related to any measure of information seeking. These findings provide a foundation for the further exploration of trait and state curiosity in adolescents, evaluation of the specific eye movement indicators associated with curiosity-driven information seeking, and the role task and stimuli play in that relationship. The use of a classroom applicable task and adolescent population also increases the generalizability of results to classroom applications.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D39 - Characteristics of the hemodynamic response during social exclusion in the Cyberball task.

John Foley[1] (john.foley@louisville.edu), Brendan Depue[1]; [1]University of Louisville

Social exclusion is an innate and powerful elicitor of negative affect and can be debilitating for those being excluded. Previous research has found that the anterior cingulate cortex (ACC) and insular cortex (IC) are reliably activated during social exclusion, as is evidenced by research using the cyberball task. However, the temporal order of these regions and the characteristics of the hemodynamic response function (HRF) during social exclusion are unknown. In this study we used finite impulse response (FIR) modelling to freely model the HRF in the ACC and IC during social exclusion using open source cyberball task data. We analyzed fMRI data using FSL with FIR basis sets to model the HRF in ten 1.5sec bins (t=15secs). HRF modeling comparing the time to peak (TtP) in the inclusion and exclusion conditions differed, such that TtP occurred earlier during the exclusion condition (t=4.5secs), compared to the inclusion condition (t=10.5secs). Paired samples T-tests conducted on the beta estimates of the HRF at 4.5 seconds were significantly different in the IC during exclusion compared to inclusion: right IC $T(35) = 3.17$, $p < 0.01$, left IC $T(35) = 3.33$, $p < 0.01$. Our results probing the temporal dynamics of the neural substrates of social exclusion indicate, that the IC may be activated earlier and thus, may be responsible for contributing to the internal representation of being excluded.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D40 - Similarities and differences in alcohol consumption and neural responses to alcohol images in underaged and legal-aged college students

Madison Risner[1], Chloe Davis[1], Justice Corbett[1], Alex Garcia[1], Amelya Rivera[1], Idali Casas[1], Caydin Hazziez[1], Natalie Ceballos[1], Reiko Graham[1]; [1]Texas State University

This study examined legal drinking age, alcohol-related attitudes and consumption, and neural responses. Thirty students completed surveys assessing alcohol-related attitudes/behaviors and a go/no-go task while EEG was recorded. The task had 2 runs: in one, respond to alcohol images, withhold responses to non-alcoholic ones; in the other, contingencies were reversed. Afterwards, participants wore a transdermal alcohol sensor for 12 days. Differences in alcohol-related behaviors/attitudes in underaged ($n = 17$) and legal drinkers ($n = 13$) were compared. Next, ANOVAs focused on the latencies/amplitudes of the N2 and P3 with drinking status, stimulus (alcohol vs. non-alcohol), and response (go vs. no-go) as factors. Groups did not differ in consumption patterns or attitudes and had the same proportion of regular drinkers with similar ages of onset (17.9 underage vs. 18.8 years legal). N2 latencies did not differ due to group, stimulus, or go/no-go status, but amplitudes were enhanced during alcohol no-go relative to go trials (but not non-alcohol trials). The P3 peaked later during no-go trials, but only for underage drinkers. It was also delayed for alcohol no-go vs. go trials (not non-alcoholic), regardless of legal status. P3 amplitudes were larger for no-go vs. go trials, regardless of group and P3 amplitudes to alcohol were enhanced in underaged drinkers, regardless of go/no-go status. Although preliminary, results indicate more similarities than differences in underaged

and legal drinkers in alcohol consumption, attitudes, and neural correlates, suggesting that these are established prior to university. Differences may be due to taboos associated with underaged drinking.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D41 - Neural mechanisms of attentional bias toward social concepts in alexithymia

Shu-Hui Lee[1], Kuan-Te Lee[2], Yu-Ching Chen[3]; [1]National Tsing Hua University, [2]National Chengchi University, [3]National Taiwan University

Effective executive control in social stress situations is crucial for maintaining mental health, as inflexible coping strategies can harm well-being. Individual responses to social stressors vary, and traits such as alexithymia are risk factors that increase vulnerability to mental health challenges and social stress. However, the neural mechanisms underlying attentional biases toward unpleasant social information in alexithymia remain unclear. This functional magnetic resonance imaging (fMRI) study utilized a socio-emotional Stroop task with a 2 (social/nonsocial) × 2 (negative/neutral) factorial design to examine attentional biases toward social concepts in individuals with alexithymia. Twenty-four Taiwanese adults (aged 18–25, 12 females) completed the socio-emotional Stroop task and the Mandarin version of Toronto Alexithymia Scale (TAS-20). We investigated the neural correlates of the social-by-emotion interaction and their association with TAS scores. Results revealed that the social-by-emotion interaction activated socio-emotional regions, including the orbitofrontal cortex (OFC), amygdala (AMG), and temporoparietal junction (TPJ), as well as executive control areas such as the inferior frontal gyrus (IFG) and anterior cingulate cortex (ACC). Moreover, higher TAS scores were associated with reduced activation in the OFC and AMG, suggesting difficulties in processing social information. Overall, our findings suggest that disruptions in emotional and attentional systems may contribute to difficulties in allocating attention to unpleasant social information among individuals with alexithymia.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D42 - Examining the Role of the Time Delay Between Acquisition and Extinction in Fear Extinction Mechanisms with Virtual Reality

Shreya Rajagopal[1] (shreyara@umich.edu), Shuhao Cao, Elizabeth Lockwood, Ananya Menon, Oreen Morag, Olivia Terry, Elizabeth Duval, Thad Polk; [1]University of Michigan

Exposure therapy, a common treatment for anxiety and stress disorders, relies on Pavlovian fear extinction. However, its mixed long-term success underscores the need to understand the mechanisms underlying fear extinction in humans. One key factor may be the timing of extinction relative to fear acquisition. Animal studies suggest that immediate extinction disrupts the consolidation of fear memories, reducing fear renewal, while delayed extinction preserves fear memory and increases renewal. To test this hypothesis in humans, we use a virtual reality paradigm. Participants acquire fear responses to two stimuli (colors of a virtual lamp) paired with loud bursts of white noise. Fear is measured through skin conductance responses. Extinction occurs either immediately (10 minutes after acquisition) or after a delay (3 days after). Half of the participants undergo extinction in the same virtual environment as acquisition, while the other half undergo extinction in a different environment. Fear renewal, measured as the difference in fear responses between same- and different-context groups, indicates the persistence of fear memory. We hypothesize that immediate extinction will reduce renewal by disrupting memory consolidation, while delayed extinction will lead to greater renewal due to preserved fear memory. These findings aim to advance our understanding of fear extinction and inform improvements in exposure therapy to reduce relapse rates.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D43 - Vocal Emotion Recognition in Cochlear Implant Users: An over-Reliance on Semantic Cues

Cassandra Neumann[1,2] (cassandra.neumann12@gmail.com), Jade Carrière[1,2], Mickael Deroche[1,2]; [1]Concordia University, [2]The Centre for Research on Brain, Language and Music – CRBLM

The ability to infer emotions in speech is linked to improved social development, communication, and empathy. Listeners typically use prosodic (loudness, pitch, rhythm) and semantic (literal meaning) cues to discern emotions in speech. These cues can conflict in daily conversation, e.g., sarcasm, where the prosody contradicts the literal content. Cochlear implant (CI) users face challenges in interpreting sarcastic speech, as CIs deliver degraded acoustic cues, especially pitch, which is crucial for recognizing emotional prosody. As a result, CI users might rely more on semantic cues when these cues conflict, missing vital information. This study aims to better understand the difficulties experienced by CI users by presenting sentences that are either congruent (e.g., semantically happy sentence with happy prosody) or incongruent (e.g., semantically happy sentence with sad prosody) in two experiments: 1. identify the emotion conveyed by prosody, ignoring semantics; 2. identify the emotion from semantics, ignoring prosody. We hypothesize that CI users would struggle to identify emotions using prosody (Experiment 1), resulting in a larger interference effect (greater performance difference between congruent and incongruent trials) but would more easily identify emotions using semantics (Experiment 2), resulting in a smaller interference effect, compared to normal hearing controls. Preliminary findings confirm that CI users have overall poorer performance than NH controls, and perhaps larger interference effects in both experiments, suggesting a rather general difficulty to direct their attention to the intended cue.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D44 - Exposure to statistical regularities in music influences preference for novel melodies

Alberto Ara Romero[1], Marie-Eve Lisak[1], Neomi Singer[2], Josep Marco-Pallarés[3], Robert J. Zatorre[1]; [1]McGill University - MNI (Montreal, Canada), [2]Sagol Brain Institute (Tel Aviv, Israel), [3]University of Barcelona (Barcelona, Spain)

Music reward has been described as emerging from the predictive dynamics that characterize perception. When listening to music, bottom-up signals interact with top-down predictions and in the presence of a mismatch, surprise signals are generated and assigned value. The nature of these predictions is two-fold: veridical expectations are based on familiarity with specific materials, while schematic expectations are based on regularities learned across different materials. While experimental results about the effect of veridical expectations on music reward are extensive, empirical evidence for the effect of schematic expectations is lacking, with most investigators relying on theoretical assumptions. In this experiment we studied whether incidental learning of regularities in music does indeed influence preference for novel materials representative of said regularities. We modified the statistical contingencies that characterize Western music to create two artificial musical grammars. Participants were exposed to novel melodies representative of either grammar in a counterbalanced design. Before and after exposure, participants completed a two-alternative forced-choice task with counterbalanced materials where on each trial they decided on their preference between novel melodies representative of either grammar. We expected an increase in preference for the target grammar after exposure. Overall, we observed a significant increase in preference for the target musical grammar after exposure, independent of baseline preference. Furthermore, computational modeling of the responses with an ideal observer process corroborated the findings. These results empirically confirm theoretical accounts that musical pleasure emerges from predictive dynamics based on schematic expectations. The neural underpinnings that may underlie this phenomenon will be discussed.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D45 - Prefrontal fNIRS-based cortical activity patterns differ during negative emotional recall in young adults with complex PTSD

Prisha Goyal[1] (prishagoyal2@my.unt.edu), Anthony Ryals[1], Steph Camacho[1], Diana Towe[1]; [1]University of North Texas

Complex post-traumatic stress disorder (cPTSD) is a neuropsychiatric disorder resulting from prolonged/chronic trauma exposure leading to nuanced symptoms distinguishing it from PTSD. Despite its prominence in modern society, cPTSD remains unrecognized in the DSM-5, leaving the disorder to be critically under-researched. In the present study, N=27 young adult participants completed tasks coupled with fNIRS recording to assess cortical blood flow patterns in the frontal lobe. Seven individuals were excluded for scoring near the middle of the Complex Trauma Inventory (CTI) and motion-artifacts. The CTI, a newly developed and validated screener, differentiated 10 individuals exhibiting high cPTSD symptoms from a control group of 10 exhibiting low to no cPTSD symptoms. Participants then completed cognitive assessments relating to inhibition, working memory, and a novel emotional short-term recall task. Results indicate the cPTSD population exhibited significantly higher scores of depression and anxiety in comparison to the healthy control group. Additionally, the cPTSD group performed significantly better than the healthy controls on the positive and negative emotional recall. We observed a significantly higher level of oxygenated hemoglobin in a two-channel optode cluster corresponding with Brodmann Areas 45 and 47 in the right hemisphere for the cPTSD group compared to controls during the negative emotional working memory task. These initial results suggest that individuals reporting cPTSD symptoms may recruit additional cognitive resources to perform negatively charged memory tasks, which may reflect enhanced recruitment of prefrontally-mediated resources devoted to higher attention to (or enhanced attempted inhibitory control of) negatively-valenced memory information in short-term recall.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D46 - Behavioral and EEG investigations of inter-generational collaborative emotional memory

Marie Diagne[1], Leonard Faul[1], Ido Davidesco[1], Suparna Rajaram[2], Elizabeth Kensinger[1]; [1]Boston College, [2]Stony Brook University

When adults collaborate when remembering information, their memories become similar to one another (e.g., Greeley & Rajaram, 2023). However, most research has examined collaboration among younger adults and has examined the collaborative remembering of non-emotional information. Our planned research examines how intergenerational collaboration affects emotional memory. We plan to adapt a collaborative emotional memory paradigm previously tested with younger adults (Choi, Kensinger, & Rajaram, 2017) and extend it to investigate the effects of intergenerational (young [ages 18-35] and older [60+] adult) collaboration. When tested individually, memory patterns often show an age x valence interaction: Younger adults show a negativity bias while older adults show a positivity bias (e.g., Mather & Carstensen, 2005). We hypothesize that intergenerational collaboration will lead to a reduced interaction between age and valence, consistent with collaboration bringing individuals' memories into alignment with other members of their collaborative group. We additionally plan to incorporate electrophysiological (EEG) monitoring during the collaboration phase. We will examine how the brain-to-brain synchrony (BBS) of the group relates to the effects of intergenerational collaboration on memory. Our primary hypothesis is that the pattern of behavioral results just described (i.e., collaboration minimizing age x valence interactions in intergenerational groups) will arise in those intergenerational collaborative groups that have high BBS. These results will be important to the field, by providing the first insights into how intergenerational collaboration affects the emotional memories that individuals retain.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D47 - Rejection Sensitivity and Cognitive Control: Evidence beyond social context

Rachel Gaynor[1], Bradley Buchanan[1], Sofia Laporte[1], Geoffrey Potts[1]; [1]University of South Florida

Individuals vary in their tendency to expect, perceive, and respond to potential social rejection. These differences are indexed by Rejection Sensitivity (RS), a construct which longitudinal data has found to be predictive of the development of mood disorders. Psycho-physiological evidence has linked increased RS with reduced activity associated with cognitive control, yet most research has been conducted focusing only on affective stimuli which evoke rejection. The current study investigates whether the relationship between RS and cognitive control persists beyond social-affective context. Fifty-seven participants completed three blocks of a modified Flanker task; a social-affective block using facial images, an affective block containing IAPS images selected to have no social components, and a neutral block which consisted of normed fractal images. RS was measured using the 18-item Rejection Sensitivity Questionnaire (RSQ), and cognitive control was measured using the conflict N2, an Event-Related Potential (ERP) measure associated with the recruitment of higher-level inhibition. Analysis conducted with Hierarchical Linear Modeling found that increasing RS is associated with overall reduced accuracy, and with attenuated N2 amplitude on incongruent trials. These findings suggest that high RS individuals exhibit a more generalized cognitive control deficit transcending social context. This broader reduction could contribute to maladaptive outcomes associated with RS, including heightened vulnerability to mood disorders.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D48 - Individual Differences in Sleep Quality Shape the Strength of Vividness-Related Neural Signaling During Emotional Memory Retrieval

Lauren K. Voso[1] (vosol@bc.edu), Leonard Faul[1], Hannah R. Piccirilli[1], Elizabeth A. Kensinger[1]; [1]Boston College

Vividness is a crucial aspect of how we remember the past, but it is unclear how vividness is represented in the brain for different valanced emotions. Additionally, while some work indicates that sleep enhances visuosensory activation for vivid memories, others have found that sleep is associated with diminished physiological reactivity to remembered emotional content (sleep-to-forget, sleep-to-remember hypothesis; SFSR) (van der Helm & Walker, 2011). To examine these relationships, we analyzed fMRI data from a sample of young-to-middle aged adults (19-49 years old). Participants encoded negative, neutral, and positive images, each preceded by a degraded line-drawing version. The next day, participants provided a comprehensive evaluation of the prior night's sleep quality before an fMRI retrieval task, with line-drawings seen at encoding intermixed with new line-drawings. If remembered as old, participants rated the subjective vividness of their mental reconstruction of the full image. We analyzed whether neural activation during recognition was parametrically modulated by subsequent vividness ratings. Individual differences in sleep quality were also included in group-level analyses. Findings show the initial recognition of line drawings was associated with robust activation distributed throughout primary and secondary visuosensory regions whereas modulation by vividness was evident in default network regions including the precuneus, medial PFC, and angular gyrus, as well as the cerebellum. Better sleep quality was associated with reduced vividness-related activation in the cerebellum for negative memories. These results align with the SFSR hypothesis in suggesting that sleep can diminish the emotional reactivity to highly vivid negative memories.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D49 - Decreased Connectivity between Anterior Cingulate Cortex & Right Inferior Parietal Lobule May Predict Reduced Suicidal Ideation in TMS Patients

Hia Ghosh[1], Samadrita Chowdhury[1], Kevin Tristan Donaldson[1], Megan O'Connor[1], Olivia Newman[1], Shane Walsh[1], Tracy Barbour[1], Kristen Ellard[1], Lipeng Neng[1], Joan Camprodon[1]; [1]Department of Psychiatry, Massachusetts General Hospital

Electroconvulsive therapy (ECT) reduces suicidal ideation by altering the brain's functional connectivity. Our lab's previous experiments have demonstrated that after ECT, increased functional connectivity between the anterior cingulate cortex (ACC) and the right inferior parietal lobule (IPL) is correlated with reduced suicidal ideation. We hypothesize that focally targeting the IPL with transcranial magnetic stimulation (TMS) will (1) increase ACC-IPL connectivity and (2) reduce suicidal ideation. Here, we present clinical and neuroimaging results from an open-label TMS study and from an ongoing mechanistic randomized controlled trial (RCT). We recruited 10 patients exhibiting moderate/high suicidality. Patients received accelerated intermittent theta-burst stimulation (iTBS) to the right IPL cluster of the Executive Control Network (ECN). We identified patient-specific right IPL coordinates using fMRI connectomics. Patients received 10 iTBS sessions over one day (18000 pulses; 120% of MT). We collected clinical and resting-state fMRI data before and after administering iTBS. The RCT utilizes the same neuromodulation protocol, but patients are randomly assigned either active or sham TMS. We observed a 48% reduction on the ideation subscale of the Columbia-Suicide Severity Rating Scale ($t=2.71$; $p=0.024$) and an increase in ACC-IPL functional connectivity (Cohen's $d=0.78$), which supports our response biomarker hypotheses. Analyses for the ongoing RCT will be presented. We present an accelerated precision neuromodulation protocol that effectively engages the target biomarker (increase in ACC-IPL functional connectivity) and shows clinical efficacy (48% reduction in suicidal ideation) after a single day of treatment. Results from the larger RCT will further explore this hypothesis.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D50 - Cognitive reappraisal influences the organization of emotional episodes in memory

Bailey Harris[1] (baileybharris@ucla.edu), Mason McClay[1], David Clewett[1]; [1]University of California, Los Angeles

Fluctuations in emotional states regulate a dynamic interplay between memory integration and separation, shaping the organization of distinct episodes in memory. Evidence suggests that a shift towards negative emotions may initiate event segmentation processes, leading to greater separation between memories of adjacent events. Here, we examined if emotion regulation strategies can modify these divisive effects of negative emotions. Participants viewed sequences of neutral objects interspersed with a single negative image and were cued to either reappraise their emotional response or passively view those images. Event segmentation was operationalized as impairments in temporal order memory and expanded distance ratings between different neutral object pairs in the sequences. As expected, passively viewing a negative image elicited event segmentation in memory, with emotion-spanning pairs rated farther apart in time and recalled with lower order accuracy than pairs spanning only neutral objects. However, contrary to our hypothesis, greater reappraisal success for the specific negative images also predicted increased memory separation effects. Alongside these behavioral results, pupillometry revealed two distinct features of negative image-evoked pupil dilations that were associated with either passively experiencing negative responses or cognitively reappraising them. Further, analyses of individual differences showed that a stronger tendency to segment memories during passive-viewing trials versus reappraisal trials was correlated with lower overall ratings of positive affect. Together, these findings suggest that there may be separate emotional and cognitive routes to facilitating event segmentation in memory, with negative emotions potentially inducing a maladaptive form of memory fragmentation that relates to poor mental health.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D51 - Naturalistic movie-viewing paradigms reveal distinct patterns of cognitive-linguistic processing across clinical populations

Manuel Marte[1] (mjmarte@bu.edu), Bryce Gillis[2], Rowan Faris[3], Colin Galvin[4], Laura Rigolo[5], Yanmei Tie[6], Swathi Kiran[7], Einat Liebenthal[8]; [1]Center for Brain Recovery, Boston University, [2]Institute for Technology in Psychiatry, McLean Hospital, Harvard Medical School, [3]Department of Neurosurgery, Brigham and Women's Hospital, Harvard Medical School

Background: While standardized assessments remain diagnostic standards, naturalistic paradigms that mirror real-world processing may provide valuable complementary information. We investigated whether a movie-viewing paradigm combining continuous affect ratings with contextual language tasks could differentiate between healthy controls (HC, n=50), persons with aphasia (AP, n=30), and individuals with mild cognitive impairment (MCI, n=17). Methods: Participants watched movie clips while providing continuous valence ratings (-4 to +4) and completed post-clip comprehension and antonym generation tasks. We analyzed valence rating deviation patterns (Root Mean Squared Z-scores) and complexity across timescales (multiscale sample entropy), and language performance, to assess their diagnostic utility using LASSO classification models. Results: HC outperformed both clinical groups on language tasks ($p < 0.05$), with MCI showing an intermediate performance. AP showed greater valence rating deviation ($p \geq 0.004$) and lower rating complexity at longer timescales ($p < 0.001$). Classification models distinguished AP from HC (AUC = 0.928) and the combined patient groups from HC (AUC = 0.859), with weaker classification of HC versus MCI (AUC = 0.721). Poor performance on both language tasks with high deviation of valence rating most strongly predicted AP classification, whereas poor antonym generation performance with reduced valence rating complexity most strongly predicted MCI classification. Conclusions: Naturalistic movie-viewing revealed distinct patterns of cognitive-linguistic processing across clinical populations. The combination of movie-based language performance and valence rating measures provided robust diagnostic utility, particularly in distinguishing marked (AP) and subtle (MCI) differences from HC, suggesting its potential as an ecologically valid tool that could inform targeted interventions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D52 - Neural synchrony during movie-watching predicts mixed feelings

Rishab S Iyer[1,2] (rsiyer@princeton.edu), Anthony G Vaccaro[2], Helen Wu[2], Shruti Shakthivel[2], Jonas T Kaplan[2]; [1]Princeton University, [2]University of Southern California

In our everyday lives, we experience a rich, complex set of emotions. Understanding the neural basis of these emotions is a central goal of affective neuroscience, but progress has been slowed by experimental designs that do not evoke the multidimensional, interwoven emotions we experience every day. Using naturalistic movie-watching paradigms, we can induce such a range of emotions, allowing us to probe not only univalent but also mixed emotions that are a critical yet understudied part of the human experience. We used functional magnetic resonance imaging (fMRI) to study 27 participants who watched two animated short videos that were selected for their ability to consistently elicit strong emotions in a separate sample. After scanning, the same participants reported their emotional responses: "positive", "negative", or "mixed", continuously during a rewatch. We hypothesized that if multiple participants reported the same emotion at the same point in time, we should be able to observe shared neural processing underpinning this subjectively reported consensus. We tested whether neural synchrony in predefined cortical and subcortical regions of interest predicts positive, negative, and mixed emotional consensus. Using intersubject correlation, we found that neural synchrony in the auditory cortex, ventromedial prefrontal cortex, anterior cingulate, posterior cingulate, insula, and amygdala is predictive of the group's consensus on univalent emotions. Furthermore, neural synchrony in the ventromedial prefrontal cortex and amygdala was predictive of mixed emotional consensus. These results suggest that mixed emotions are represented variably across cortical and subcortical regions and provide support for hierarchical emotional processing in the brain.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D53 - Effects of aging and valence on emotional response inhibition: Conclusions from a novel stop-signal task

Jill D. Waring[1] (jill.waring@health.slu.edu), Stephanie N. Hartling[1]; [1]Saint Louis University

Aging is associated with declining cognitive control and inhibition abilities alongside improvements in emotional control and regulation. However, little is known about how aging impacts response inhibition for emotional contexts. The current study asked how typical aging processes influence emotional response inhibition, specifically whether older and younger adults differ in ability to stop responses to emotional scene images. To address these questions we developed a novel stop-signal task, with pleasant and unpleasant scene images each serving as task-relevant rare Stop cues, in turn. Results revealed that, overall, older adults had less efficient stopping compared to younger adults. However, there were no significant differences in stopping for pleasant versus unpleasant images for either group. Thus, aging impacts response inhibition generally, but stopping ability does not differ by emotion from younger to older adulthood. The innovative design also permitted exploratory analyses of responses to images that were not the current stop-signal, i.e., responses correctly executed in 'Go-image' trials. In contrast with results of response inhibition on Stop trials, emotion and aging significantly interacted to impact correct response execution on Go-image trials. Taken together, we concluded that aging significantly interacts with valence only for response execution but not response inhibition for complex emotional scenes. The present study offers the first insights into the effects of aging on response inhibition in emotionally complex contexts, increasing ecological validity over prior standard tasks of response inhibition. It also highlights distinct effects of aging and emotion on response execution versus response inhibition to task-relevant emotional information.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D54 - Eudaimonic and Hedonic Rewards Differentially Modulate Neural Engagement During Stressful Cognitive Task Performance

Yi-Fan Fu[1] (r10454013@ntu.edu.tw), Jie-Rong Lin[1], Joshua Oon Soo Goh[1]; [1]National Taiwan University, Taipei, Taiwan

Studies suggest that prospective rewards can buffer task-related mental stress and thereby enhance psychological resilience. However, the neural mechanisms underlying how rewards modulate stress responses during cognitive processing remain unclear, limiting applications for mental health. This study examines neural responses during task performance without extrinsic reward compared to performance with incentives, which can be hedonic with self-centric outcomes or eudaimonic with non-self-centric outcomes. In a functional magnetic resonance imaging (fMRI) experiment, 17 participants (9 females) solved arithmetic problems under (a) no time constraints, (b) time pressure with score ranking (non-incentivized), (c) time pressure with performances linked to charity donations (eudaimonic reward), and (d) time pressure with remunerated performances (hedonic reward). With eudaimonic rewards, arithmetic calculation accuracies were higher and self-reported stress levels were lower, compared to the case with non-incentivized pressured performance. Critically, neural responses increased in the anterior cingulate cortex and declined in the default mode network (DMN) during incentivized relative to non-incentivized task performance. In addition, neural responses in the putamen were highest during non-incentivized pressured processing, followed by performance with hedonic reward, then performance with eudaimonic reward, and were lowest under the non-constrained case. These findings suggest that eudaimonic rewards are effective motivators for circumventing stress-related effects induced by task demands. Moreover, the provision of different task reward types modulates activity in corticostriatal and DMN regions implicated in value-based and self-related processing, respectively. Having non-self-centric motivations might afford more resilient neurocomputional strategies in these brain areas that bypass stressful reactions when facing challenging problems in life.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D55 - Cognition in Flexibility is Associated with Elevated Salience Network Activation During Emotion Regulation in Depression

Archita Tharanipathy[1], Desiree Webb[1], Sarah Zapetis[1], Ellie Xu[1], Jiani Li[1], Margarid Turnamian[1], Xinyan Tao[1], Emily Givens[1], Jonathan Stange[1]; [1]University of Southern California

Cognitive flexibility is thought to facilitate effective emotion regulation, and may be particularly relevant to cognitive strategies such as reappraisal. Impaired cognitive flexibility is present in mood disorders such as depression, and may disrupt neural processes in regions of the brain responsible for emotion processing and regulation. This study explored brain regions implicated in both cognitive flexibility and reappraisal-related emotion regulation. We examined the relationship between cognitive flexibility and neural activation during cognitive reappraisal in a sample of 87 participants, including

47 with remitted major depressive disorder (rMDD) and 40 healthy comparisons (HC). Cognitive flexibility was assessed through a set-shifting task conducted in the lab, while reappraisal was measured during an emotion regulation task (ERT) in the MRI scanner using the reappraise-maintain contrast. Our results revealed that individuals with poorer performance on the set-shifting task exhibited greater activation of the salience network (SN), particularly the anterior cingulate, during reappraisal ($k>57$, $p<.005$). This could suggest that individuals with reduced cognitive flexibility may struggle to downregulate the SN when regulating emotions using reappraisal. These results highlight the importance of cognitive flexibility in emotion regulation, particularly for strategies like reappraisal that require the coordination of emotional and cognitive processes. Heightened SN engagement in individuals with poorer cognitive flexibility may contribute to ineffective emotion regulation. Enhancing cognitive flexibility might improve the ability to downregulate SN activity during reappraisal, offering a potential avenue for interventions aimed at improving emotion regulation in mood disorders.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D56 - Emotional Congruence of Musical Primes and Target Words Between and Within Valence: An N400 Study

Anna Gruzas[1] (annag721@gmail.com), Alina Davison[1], Takako Fujioka[1]; [1]Center for Computer Research in Music and Acoustics, Department of Music, Stanford University

Semantic information in music has been shown to perceptually prime the interpretation of target words, with their congruency influencing the N400 ERP. For instance, listening to “happy” music followed by viewing a “sad” word elicits greater negativity. This study examined whether N400 effects occur with contrasting emotional intensity levels within the same valence category (e.g., “gravely sad” vs. “mildly sad”). EEGs were recorded from 18 young adults as they heard 8-10 second non-lyrical music excerpts paired with words, presented in two block types: (1) between-category context blocks, mixing happy and sad stimuli, and (2) within-category blocks, mixing stimuli at varying emotional intensities within the same valence. Negativity between 340-654 ms at centro-parietal electrode sites showed the main effect of Congruence, as the more negative amplitude occurred for incongruent pairings compared to congruent ones ($F(1,17)=5.68$, $p=.029$). The Context x Congruence interaction was significant ($F(1,17)=5.46$, $p=.032$) due to the enhanced congruent vs. incongruent difference for the between-category context ($p=.018$), while the contrast was not significant for the within-category context ($p=.756$). However, the interaction Intensity x Congruence was significant ($F(1,17)=4.69$, $p=.045$). This means that when the musically expressed emotion was intense, the difference was exaggerated regardless of the context, but not vice versa. These findings indicate that musical priming can enhance the intensity contrast, and that listening to music over several seconds is advantageous for encoding the nuanced levels of emotional expression.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D57 - Neural correlates of anxiety and perfectionism during reinforcement learning under imperative vs. interrogative motivation

Jacqueline Bao[1] (jackie.bao@duke.edu), Yuxi Candice Wang[1], Alyssa H. Sinclair[2], R. Alison Adcock[1]; [1]Duke University, [2]University of Pennsylvania

Motivated behaviors reflect distinct neural mechanisms, influencing downstream consequences for learning and memory. Imperative motivation helps address urgent goals and immediate actions but leads to sparse memories. Interrogative motivation fosters exploration and information seeking behavior for longer term goals, supporting the formation of expansive long-term memories. We investigated how individual differences in anxiety and perfectionism under imperative vs. interrogative motivational states might influence learning and memory outcomes and their relations to underlying neural substrates. Participants ($N = 58$) were randomly assigned to read a cover story to induce either imperative or interrogative motivation (“executing” or “planning”, respectively). They then completed the same reinforcement learning task in an fMRI, repeatedly choosing among four doors to reveal trial-unique images paired with reward values. Incidental memory for these images and their associated reward values were assessed the following day. We replicated findings that the imperative group made more optimal choices during reinforcement learning, whereas the interrogative group showed better memory recognition of the images. Within the interrogative group, higher trait perfectionism was associated with making more optimal choices, and higher state anxiety was associated with impaired memory performance, exhibiting behavioral similarities as the imperative group. fMRI results for the interrogative group revealed that higher perfectionism correlated with greater amygdala and hippocampus activation during decision-making, and higher state anxiety correlated with greater amygdala activation for remembered items. These findings highlight the influence of psychological traits in shaping the neuro-cognitive impacts of goal-driven behaviors and learning contexts.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D58 - The interplay between temporal memory coding and affect dynamics

Mengsi Li[1] (mengsili@ucsb.edu), Barry Giesbrecht, Regina C Lapate; [1]University of California, Santa Barbara

Everyday life is characterized by frequent shifts between emotional and neutral events. Emotional responses often ‘spillover’ beyond their context to bias appraisals of later-processed events (Lapate et al., 2017). Growing evidence suggests that emotional responses sculpt the temporal organization of memories (Wang & Lapate, 2024). However, the flip of the coin—whether temporal coding is associated with emotional-response dynamics—remains unclear. To address this, we designed a novel EEG event-boundary task. Participants ($N=51$) viewed emotional-event sequences of four positive or negative images, which were interleaved with novel-neutral face presentations. Following each sequence, participants rated neutral-face likeability (indexing affective spillover). Memory for temporal order and distance of emotional-image pairs sampled from within and across sequences was tested. We used factorial representational similarity analysis to unveil the structure of emotional valence and sequence processing, and the image-locked late-positive potential (LPP) to index emotional valence/arousal. Negative images were represented more similarly than positive ones. Images presented at closer sequence positions were also represented more similarly, an effect that increased with later sequence positions. Replicating event-boundary effects, emotional-image pairs sampled from across (vs. within) sequences were associated with longer temporal-distance judgements and poorer order memory. Critically, sequences producing shorter temporal distance judgments and better temporal-order memory elicited larger affective spillover, suggesting that emotional-event integration is associated with more pervasive emotional responses. Finally, larger LPPs predicted shorter temporal-distance estimates and larger affective spillover following negative sequences. Collectively, these findings underscore the bidirectional interplay between emotion and temporal memory—and suggest an affect-regulatory role for high-fidelity temporal coding.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D59 - Distinct and Shared Neural Mechanisms Underlying Dark Triad Traits During Facial Emotion Identification

Roshni Lulla[1] (lulla@usc.edu), Jonas T Kaplan[1]; [1]Brain & Creativity Institute, University of Southern California

The Dark Triad is a complex of personality traits that includes Machiavellianism, narcissism, and psychopathy. These traits are associated with affective dysfunctions, including impaired empathic processing, inappropriate emotional responses, and inaccurate identification of emotional stimuli. Though it is expected that these behaviors are accompanied by functional differences across the brain, few have explored neural correlates of the Dark Triad. In investigating the traits separately, there is evidence for different neural systems at work within each trait despite all three associating with impairments in emotion identification, particularly across facial emotions. Here we analyze neuroimaging data from 52 participants while they viewed emotional faces. In separate blocks, participants were asked to either name the emotion or identify the intensity of the emotion of each face. We investigate differences associated with the Dark Triad composite score as well as with each trait individually. Activity during the naming condition contrasted with the intensity condition showed correlations with the composite score as well as with psychopathy and narcissism scores, but not Machiavellianism. Activity was positively correlated with the composite score and narcissism scores in the left supplementary motor area, and only with narcissism in a region of the left inferior frontal gyrus. Activity was negatively correlated with narcissism scores in the left precuneus and with psychopathy in the left insula. These findings illustrate similarities and differences in emotion identification amongst the traits, suggesting a compensatory response in integrative and motor processing regions as well as decreased activity in regions related to affective processes.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D60 - The impact of the complexity of the experimental design on the ability to detect individual differences in fear learning

David Johnson[1,2] (davejohnson7@mac.com), Evelyn Arpi[1], Alexandra Tannenbaum[1]; [1]York College (CUNY), [2]The Graduate Center (CUNY)

Trait measures of negative emotionality have sometimes been shown to play a role in shaping fear learning, however, these effects have not been observed consistently. It's been suggested that individual differences are more likely to surface in "strong" situations, referring to unambiguous experimental designs that uniformly guide response sets across individuals, and less likely to surface in "weak" situations, which are less well-defined events, where stimuli are more numerous and/or less predictable, leading to less uniform effects, heightened inter-individual variability and increased sensitivity to capture individual differences. However, minimal research has directly tested this idea in the context of fear learning. Here, we used a traditional Pavlovian fear learning design (n = 105) to test if individual difference effects are mediated by experimental complexity, which was manipulated by using a two-cue (strong) vs three-cue (weak) design. We observed a negative association between inhibitory Intolerance for Uncertainty (I-IU) and threat-safety discrimination in the weak, but not in the strong, situation. This data highlights several key takeaways. For one, fear researchers interested in studying individual differences should consider optimizing their studies for detection of individual differences by avoiding overly simplistic designs. Second, characteristics of the experimental design might constitute a crucial factor that can partly explain disparate individual differences results observed in the relevant literature. Finally, these findings may extend beyond fear/threat learning to other cognitive domains and paradigms. Further research will be needed to delineate precisely what elements of the experimental design this effect is dependent upon.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D61 - The Role of the Left DLPFC and VLPFC in Positive and Negative Emotional Memory: An rTMS Study

Sandry M Garcia[1], Preston Thakral[2], Elizabeth A Kensinger[1]; [1]Boston College, [2]Smith College

Studies using repetitive transcranial magnetic stimulation (rTMS) have suggested a causal role of the left dorsolateral (DLPFC) and left ventrolateral (VLPFC) prefrontal cortices in positive and negative memory, respectively. We tested this valence-specificity by stimulating both regions in the same participants, and testing emotional and non-emotional memory within the same task. 26 young adults underwent 10-min 1Hz rTMS sessions on separate days, once over DLPFC and once over VLPFC. Immediately after rTMS, participants viewed positive, negative, and neutral nouns and decided whether they were abstract or concrete. Two versions of the encoding task varied presentation duration (1.5-sec or 3-sec per word). Group 1 had the short-presentation duration paired with DLPFC and the long-presentation duration with VLPFC; Group 2 had the opposite pairing. 30-mins after encoding, participants completed a recall and a recognition task. For recall, an ANOVA with PFC (DLPFC, VLPFC), Group (1, 2) and Valence (Negative, Positive, Neutral) revealed a PFC X Valence interaction [$F(2, 48) = 4.953$, $p = .011$]; DLPFC (but not VLPFC) rTMS led to a decrease in positive relative to negative recall ($p = .02$). With recognition, a 3-way interaction [$F(2,48) = 8.833$, $p < .001$] revealed that only Group 1 had a PFC X Valence interaction [$F(2, 24) = 10.669$, $p < .001$], driven by VLPFC rTMS leading to lower neutral recognition than DLPFC ($p = .011$). While the recall results partially support the role of the DLPFC in positive memory, the recognition results reveal a more complex picture and suggest a role of presentation duration.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D62 - The Impact of Placebo Cues and Transcranial Direct Current Stimulation on Pain Sensation

Amin Dehghani[1] (amin.dehghani@dartmouth.edu), David Gantz[1], Tor Wager[1]; [1]Dartmouth College

The subjective experience of pain integrates sensory, affective, and cognitive components, with placebo and nocebo effects modulating these perceptions through contextual and social influences. This study examined how pain and monetary cues influence pain sensation, anticipated pain intensity, and fairness, as well as the effects of transcranial direct current stimulation (tDCS) on these outcomes. Three sub-studies investigated: (1) placebo effects of pain and monetary cues, (2) their influence on anticipated pain and fairness, and (3) the interaction between tDCS (anodal, cathodal, and sham of left motor cortex) and these placebo effects. Study 1 ($N = 22$) found that pain and monetary cues significantly influenced pain ratings ($p < 0.05$, Cohen's $d = 0.72, 0.23$). Study 2 ($N = 44$) demonstrated a strong effect of pain cues on anticipated pain intensity ($p < 0.01$, $d = 0.83$), while monetary cues had no effect. Mediation analysis indicated that "guess temperature" mediated the pain cue-pain rating relationship. Study 3 ($N = 50$) showed anodal tDCS reduced pain ($p < 0.001$), while cathodal tDCS increased pain ($p < 0.01$). Pain and monetary cues remained significant ($p < 0.01$), with cathodal tDCS amplifying pain cue effects ($p < 0.05$). These findings reveal the interplay between social-contextual cues, tDCS, and pain perception, highlighting how neuromodulation interacts with placebo mechanisms in pain management.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D63 - The Impact of Affect and Age on Facial Expression Predictions

Eva Cortés Velasco[1], Lorena Chanes[1]; [1]Universitat Autònoma de Barcelona

Prior research investigated predictive processing in individuals with depression, revealing decreased predictability of facial expressions, roughly reflecting increased prediction errors, particularly in negative emotion contexts. We here extend such investigation to healthy individuals, exploring the relationship between predictability and positive (PA) and negative (NA) affect. We hypothesized that lower PA and higher NA scores would be associated to decreased predictability ratings (i.e., increased prediction errors), notably for negative-valence emotion contexts. Additionally, exploratory analyses were performed to investigate the potential influence of age on predictability ratings. A database of 288 participants having completed a predictive processing and social perception task and the Positive and Negative Affect Schedule (PANAS) was used. The task involved scenarios (texts) designed to evoke emotions (fear, sadness, or happiness) followed by a facial expression that could either match or mismatch the evoked emotion. Participants were asked to predict the facial expression (predictability rating). The data was analyzed using hierarchical linear modeling, with predictability ratings as the outcome variable and match condition or evoked emotion and affect or age as predictors. Lower PA scores were associated with decreased predictability ratings, the effect being stronger for negative- than positive-valence emotions, in line with what was observed for depression. NA scores did not show significant effects. The exploratory analysis for age suggested an association with predictability ratings, possibly in interaction with match condition, pointing at decreased predictability or stereotypicality of predictions with age. These findings extend the observations made for depression and suggest potential modulations of predictions across the lifespan.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D64 - Neural Correlates of Intellectual Pleasure - Perception and Appreciation of Creative Street Art

Aleksandra Domagalik[1,2] (aleksandra.domagalik@uj.edu.pl), Patrycja Scislewska[3,4], Halszka Oginska[2]; [1]Centre for Brain Research, Jagiellonian University, Kraków, Poland, [2]Department of Cognitive Neuroscience and Neuroergonomics, Institute of Applied Psychology, Jagiellonian University, Kraków, Poland, [3]Department of Animal Physiology, Institute of Experimental Zoology, University of Warsaw, Poland, [4]Laboratory of Emotions Neurobiology, Nencki Institute of Experimental Biology, Polish Academy of Sciences, Poland

The reward system of the brain is responsible for various aspects of reward-related cognition, including motivation, reinforcement learning, and pleasure processing. While much research has focused on sensory and monetary rewards, less is known about the neural mechanisms underlying intellectual pleasure— the satisfaction derived from cognitive insights and witty design. Building on the framework proposed by Kringelbach and Berridge (2009, TrendsCognSci), we investigated whether the brain's 'pleasure paths' (wanting, liking, and conscious pleasure circuits) are engaged during the appreciation of creative and thought-provoking stimuli. In our study, participants (n=27, 23.5±3.7yo) viewed photographs of street art and graffiti from various European cities while undergoing fMRI scanning in 3T scanner. The artworks were categorized either as 'pleasant' (intellectually and aesthetically satisfying) or 'neutral' based on subjective ratings (photo was followed by question: How do you like it? with 5-pt Likert scale). Independent Component Analysis was used to identify neural networks associated with task processing and componets' time-course were averaged across trials and compared for highly and low-rated. Findings revealed differences in two networks that involved key pleasure-related regions, including the orbitofrontal cortex, anterior insula, and anterior cingulate cortex, alongside areas typically associated with attentional processing. These regions were significantly ($p<0.001$) more active for pleasant stimuli. These results suggest that the appreciation of witty design and creative expression engage brain circuits commonly implicated in aesthetic experience, humor, and social communication. This study provides insight into neural mechanisms of intellectual pleasure and highlights the importance of cognitive engagement in the perception of visual art.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

D65 - Amygdala subnuclei in processing of approaching in/outgroup others in 360 videos

Iiro Jaaskelainen[1] (iiro.jaaskelainen@aalto.fi), Gloria Mendoza Franco[1], Olli Tammilehto[1], Ville Harjunen[2], Niklas Ravaja[2], Matilde Tassinari[2], Inga Jasinskaja-Lahti[2]; [1]Aalto University, Espoo, Finland, [2]University of Helsinki, Helsinki, Finland

Ample evidence from neuroimaging studies indicates that processing of various types of threats with respect to personal space involves the human amygdala. Previous fMRI studies have shown that the human amygdala is activated both in threatening situations and situations involving members perceived as belonging to a threat-outgroup, suggesting a link between threat and prejudice. However, neuroimaging studies taking multiple outgroups and amygdala subregions into account have been wanting. Here, we investigated the relationship between outgroup types and amygdala responses by using machine learning to classify fMRI responses during 360-video encounters with protagonists belonging to ingroup vs. different outgroups. In these encounters, the protagonists were initially at a distance then approached the subject finally encroaching their personal space. The classifiers were able to decode above chance level the interpersonal distance between the protagonist and the subject in the virtual space in all subregions of the amygdala, suggesting that amygdala subregions are involved in processing of interpersonal space. Notably, the classifiers were also able to distinguish outgroups above chance level using data from specific regions of the amygdala, yet only during approach of the protagonist towards the subjects. Basal subnucleus of amygdala and the situation involving an outgroup member starting to approach the perceiver were found particularly important for the successful classification. Methodologically, our results imply that it is possible to use MVPA methods to analyse amygdala subnuclei. Neuroscientifically, our result suggest that especially basal amygdala subnuclei are involved in perceiving the in/outgroup status of others who are approaching oneself.

Topic Area: EMOTION & SOCIAL: Emotional responding

D66 - Neurophysiological correlates of awe

Lorenzo Pasquini[1] (lorenzo.pasquini@ucsf.edu), Joseph Chen[2], Gabriella Mace[3], Avery Ostrand[4], Christian Valtierra[5], Sydney Griffith[6], Danny Brown[7], Luca Mazzucato[8], Nicole Swann[9], Xin Hu[10], Christopher Timmermann[11], Theodore Zanto[12], David Ziegler[13], Adam Gazzaley[14]; [1]University of California San Francisco, [2]University of Oregon, [3]University of Pittsburgh, [4]Imperial College London

Awe is a complex emotional experience typified by perceived vastness and promoting well-being as well as social cohesion. Yet, few studies have investigated the neurophysiological basis of awe. The overarching aim of this study was to identify EEG-based neurophysiological signatures of awe. A 30-minute nature film was shown to 19 participants twice. The 1st viewing was uninterrupted and recorded with 64-channel electroencephalography (EEG), heart rate, electrodermal activity, and respiration. In the 2nd viewing, participants paused the video whenever they remembered feeling awe and rated their awe on a 1-10 point scale. Awe event timestamps from the 2nd viewing were projected onto the 1st viewing and neurophysiological correlates of awe were ascertained at ±3 seconds relative to each awe event. Non-awe events were randomly chosen and used as control events. Awe events caused EEG alpha and theta decreases, increases in Lempel-Ziv complexity (LZC), and decreased skin conductance levels. Alpha and theta desynchronizations were most evident in midfrontal and bilateral occipital areas, whereas LZC increases were most prominent in the left lateral occipital areas (peak effect at P9 electrode, $t(18)=2.6, p=0.02$). Electrophysiological measures correlated with the self-reported intensity of awe. Our findings concur with limited, prior reports of awe neurophysiology. Confirmatory analyses in independent, cross-cultural datasets with pharmacological or audiovisual stimuli are ongoing. This characterization may aid in identifying signatures of the awe experience and also for monitoring feelings of awe in therapeutic interventions.

Topic Area: EMOTION & SOCIAL: Emotional responding

D67 - Whole brain decoding of common and type-specific positive affect

Tejas Savalia[1] (tejas.savalia@emory.edu), Sophia Martin[1], Sagarika Devarayapuram Ramakrishna[1], Alexandra Cohen[1]; [1]Emory University

Experimental research often uses distinct types of reinforcers interchangeably. However, different reinforcers engage different brain systems and may evoke varying levels of affect. Recent findings show that negative affective experiences are encoded via both modality specific and modality general representations in the brain (Ceko et al. (2022)). It is not known whether positive affective experiences are represented in the same way. In a fMRI scanner, 53 adult participants aged 18-25 experienced 4 types of positive affective stimuli: monetary rewards, social media clips, short music clips, and positive autobiographical memories. After each experience participants rated how much they wanted to experience the same situation again. Interestingly, winning money, and recalling past positive memories were rated as more positive experiences than participant preferred short social media clips and music. We then use predictive modeling with five-fold cross validation to assess multivariate whole-brain patterns which encode participants' subjective experiences. Classification models successfully decode each stimulus type, though not intensity levels. We then used a whole brain partial least squares (PLS) regression model to jointly predict subjective ratings of each stimulus type and for a common affective system including all subjective ratings. PLS regression indicates a reliable stimulus type-specific systems which predict subjective ratings but provides mixed evidence for a common system – music and video experience ratings were predicted better than ratings for pleasant autobiographical memories and winning money. Preliminary analyses suggest that positive affective experiences may be distinctively encoded depending on stimulus modality.

Topic Area: EMOTION & SOCIAL: Emotional responding

D68 - The association between physiological arousal and sleep EEG microstructure in young adulthood and middle age

Xinran Niu[1] (xniu2@nd.edu), Kristin Sanders[1], Elizabeth Kensinger[2], Jessica Payne[1]; [1]University of Notre Dame, [2]Boston College

Sleep microstructure, particularly during slow-wave and rapid eye movement (REM) sleep, is known to influence physiological arousal through the parasympathetic nervous system activity. This study examines the association between microstructure features during slow-wave and REM sleep and heart rate deceleration (HRD) in response to emotional stimuli. A total of 133 healthy young (ages 18–35) and middle-aged (ages 36–59) adults viewed a series of negative (e.g., a vicious looking snake) and neutral objects (e.g., a chipmunk), superimposed on neutral backgrounds (e.g., an avenue). During scene viewing, HRD was recorded to measure physiological arousal to negative and neutral scenes. All participants underwent one night of laboratory-monitored polysomnography (PSG), where REM count (total number of REMs across all REM sleep) and slow-wave count (total number of slow waves across all slow-wave sleep) were recorded. In middle-aged adults, a higher slow-wave count was associated with an increased HRD response to negative scenes ($r=0.29$, $p=.051$), but not neutral scenes ($r=0.15$, $p=.319$). In contrast, a higher REM count was linked to increased HRD responses to both negative ($r=0.34$, $p=.044$) and neutral scenes ($r=0.40$, $p=.017$). However, in young adults, neither slow-wave nor REM count were correlated with HRD responses (ps>.7). Microstructure features during slow-wave and REM sleep may differentially influence physiological arousal responses in middle-aged adults. Slow-wave activities may enhance the discrimination between negative and neutral information, whereas REM sleep seems to exert a more generalized parasympathetic influence. These findings highlight age-related changes in the association between sleep and emotional processing.

Topic Area: EMOTION & SOCIAL: Emotional responding

D69 - ERP and behavioral responses to social touch among autistic and non-autistic young adults

David Anaki[1] (david.anaki@biu.ac.il), Meyrav Gaziel-Gutman[1], Nira Mashal[1]; [1]Bar-Ilan University

Although much has been written on the association between touch hypersensitivity and the social functioning of autistic individuals (Ludlow et al., 2015; Lundqvist, 2014; Wilhelm et al., 2001), no research has examined the neural responses to social touch stimuli and their association with this group's touch sensory dysregulation. In the current study, we explored, in 25 young autistic adults and 29 non-autistic adults, the earlier P1 and late positive potential (LPP) responses, two event-related potential components that reflect early- and late-directed attention to non/non-human touch/no-touch images. Results showed, among the non-autistic group, increased LPP responses to visualized human stimuli (e.g., two people touching or not touching each other) than non-human stimuli (e.g., two socks touching or not touching each other). In contrast, LPP responses in the autistic group did not differ between human and non-human stimuli. In addition, LPP responses to social touch images were negatively associated with touch avoidance in autistic participants. These findings contribute to prior evidence exploring the neural mechanism underlying social cognition in autism, providing a broader perspective regarding its relationship with sensory processing abnormalities.

Topic Area: EMOTION & SOCIAL: Emotional responding

D70 - FC between the cingulate cortex and amygdala during an attention to threat task as a predictor of increased self-reported anxiety in teenagers

David Garnica[1,2] (dga@email.unc.edu), Camila Vallebona[1,2], Ani Bryce[1], Idil Baran[1], Joshua Bizzel[1], Cope Feurer[1], Ty Ridenour[3,4,5], Diana Fishbein[6], Jessica R. Cohen[2], Aysenil Belger[1]; [1]Department of Psychiatry, University of North Carolina at Chapel Hill, USA, [2]Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill, USA, [3]RTI International, Research Triangle Park, North Carolina, USA, [4]Cecil G. Sheps

Center for Health Services Research, University of North Carolina at Chapel Hill, USA, [5]Center for Education and Drug Abuse Research, University of Pittsburgh, USA, [6]Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, USA

Introduction: Anterior cingulate cortex (ACC) and amygdala (AMY) activations during attention and affective processing are considered biomarkers of social anxiety in adults. We examined whether functional connectivity (FC) between the ACC or posterior cingulate cortex (PCC) and AMY during attentional control over threatening stimuli associates with self-reported anxiety in teenagers. Methods: 30 participants (age=12.23-15.44) completed an attention-to-threat (ATT) task during 3T MRI scanning. Six ROIs (bilateral AMY, bilateral rostral-ACC, subgenual-ACC, PCC) were selected based on Neurosynth-derived coordinates. After preprocessing with fMRIprep, mean BOLD signal change was calculated with FSL. After pre- and post-processing with CONN, weighted ROI-to-ROI (wRR) FC was analyzed. An FWE-TFCE correction was applied over all possible connections. Multiple regressions assessed the FC predictive value for MASC-2 anxiety scores, including age as covariate. Results: BOLD signal change differed significantly between high- and low-load threat stimuli for the PCC (p=0.027) and subgenual-ACC (p=0.035). The high-load condition showed significantly decreased PCC-right AMY FC compared to the low-load condition, including all stimuli (T=3.59, p-unc=0.0013, pFDR=0.0065, pFWE=0.023) or threat faces only (T=4.77, p-unc=0.0001, pFDR=0.0003, pFWE=0.001). The regression models significantly predicted PCC-right AMY FC under conditions of high attentional load (R2=0.32, adjusted-R2=0.24, p-unc=0.02, pFDR=0.08) and low attentional load (R2=0.29, adjusted-R2=0.21, p-unc=0.03, pFDR=0.08) including all stimuli but not threat stimuli only. Conclusion: The preliminary findings suggest that self-reported anxiety in teenagers may be associated with FC between the PCC and right AMY. This may be a predictor of anxiety disorder diagnosis and drug-use in teenagers. Results changes are expected along the longitudinal study course.

Topic Area: EMOTION & SOCIAL: Emotional responding

D71 - EMOTIONAL PROCESSING IN COLDHEARTED FEMALES: AN ERP PSYCHOPATHY STUDY

Ingrid Lopez[1] (ingridglopezz@gmail.com), Yuhan Sun[1], Valerie Vengerov[1], Jill Grose-Fifer[1,2]; [1]John Jay College, CUNY, [2]The Graduate Center, CUNY

Psychopathy research has largely focused on males, and traits like coldheartedness have been understudied. To address these gaps, we investigated how coldheartedness in undergraduate women influences event-related potentials (ERPs) to emotional faces. We conducted a secondary analysis of data from 30 female participants categorized into high (n = 15) and low (n = 15) coldheartedness groups based on scores from the Psychopathic Personality Inventory-Revised (PPI-R). Participants viewed fearful, happy, and sad facial expressions in two tasks: passive viewing and emotion upregulation. We measured LPP amplitudes at six electrode sites and used a mixed ANOVA for analysis. We found a significant Emotion x Coldheartedness Group interaction. Coldhearted women exhibited larger LPP amplitudes for fearful faces compared to the low coldheartedness group, suggesting heightened attention or arousal. In contrast, they demonstrated reduced LPP amplitudes for happy and sad faces, indicating blunted emotional reactivity. Additionally, LPP amplitudes were task-dependent, with larger LPP during upregulation in earlier but not later windows. This suggests difficulties in sustaining upregulation. Our findings suggest that although coldheartedness in women is linked to blunted emotional processing for happy and sad faces, we found enhanced processing of fearful faces. The latter might reflect a compensatory mechanism to overcome difficulties in recognizing fearful expressions. Alternatively, it may indicate a heightened interest in fear stimuli. Further research is necessary to understand if these patterns are gender-specific and to differentiate between possible explanations for enhanced LPPs to fearful faces.

Topic Area: EMOTION & SOCIAL: Emotional responding

D72 - Revisiting Defensive Motivation and the Error-Related Negativity: A Multi-Site Replication Study

Amy Bland[1] (a.bland@mmu.ac.uk); [1]Manchester Metropolitan University

The Error-Related Negativity (ERN), a well-studied event-related potential, is implicated in error processing and is thought to be modulated by emotional and motivational factors. Hajcak and Foti (2008) demonstrated that errors elicit increased defensive reactivity, as indicated by potentiated startle responses, and that the magnitude of the ERN predicts individual differences in this reactivity. As part of #EEGManyLabs, a project addressing the replication crisis through a rigorous, multi-site international collaboration, we are testing the replicability of the results from Hajcak and Foti's influential study. Our study involving eight laboratories across the UK, USA, Germany, France, and Belgium closely adheres to the original study's methods, employing standardised EEG and startle response protocols. The primary hypotheses test whether (1) ERN magnitude predicts startle potentiation following errors and (2) startle responses are greater following errors compared to correct responses. A meta-analytic approach will integrate data across sites to estimate effect sizes and assess the replicability of these findings. By collecting data from a global sample, this replication aims to strengthen the evidence base for the relationship between the ERN and defensive reactivity and inform its potential utility in clinical and theoretical applications. We are actively recruiting labs to join our replication, particularly from low-middle-income countries. Expanding participation to underrepresented regions will increase the diversity of our data and generalizability of the findings therefore interested researchers are encouraged to contact the project team to join this collaborative effort.

Topic Area: EMOTION & SOCIAL: Emotional responding

D73 - Resilience through regulation?: Inhibitory control and early-life socioeconomic context shape neural responses to ostracism

Minwoo Lee[1] (dl858@cornell.edu), Marlen Z. Gonzalez[1]; [1]Cornell University

Ostracism is an ecologically salient negative experience that impacts health and well-being. Individuals with effective emotional regulation may better mitigate its adverse effects. We thus examined how the capacity for inhibitory control, a key component of emotional regulation, modulates neural and psychological responses to ostracism. We also tested whether developmental contexts contribute to these individual differences to explore sources of variability in emotional resilience. Thirty-four healthy college students (Mean Age: 21.4±2.4) completed a color-word Stroop task, followed by two rounds of the Cyberball task during multi-echo fMRI scans. Participants' childhood socioeconomic privilege was assessed with self-report questionnaires. Brain areas tracking individual differences in inhibitory control were identified using Stroop interference on %Hit. These neural indices and developmental context were tested for predictive value in brain responses to ostracism during Cyberball. Stroop interference correlated with BOLD fMRI signals in the dorsal anterior cingulate cortex (dACC) during incongruent vs. congruent conditions. Heightened dACC activity predicted greater dorsolateral (dlPFC) and ventrolateral prefrontal cortex (vlPFC) recruitment during exclusion vs. inclusion in Cyberball, which was associated with greater self-reported distress due to ostracism. Childhood socioeconomic privilege was linked to reduced dlPFC and vlPFC activation during exclusion, mediated by the magnitudes of Stroop interference in the dACC. Our findings show that inhibitory control shapes neural and psychological responses to ostracism, with developmental contexts influencing these processes. Heightened prefrontal responses during ostracism may reflect a more costly self-regulation, which may be more pronounced among students with lower socioeconomic privilege navigating distinct social environments in a private university.

Topic Area: EMOTION & SOCIAL: Emotional responding

D74 - Investigating the Effects of tDCS on Autonomic Arousal in Major Depression: Insights from Electrodermal Activity

Alexa Gorman[1] (alexamgorman@gmail.com), Alexandra E. Kelly[1], Evangelia G. Chrysikou[1]; [1]Drexel University

Major depressive disorder (MDD) is characterized by impairments in emotion regulation and is often accompanied by dysregulated autonomic arousal. Transcranial direct current stimulation (tDCS) has emerged as a potential therapeutic intervention for MDD, yet its effects on physiological markers of emotional processing remain underexplored. In this study, we analyzed electrodermal activity (EDA) data collected during a combined fMRI-tDCS session to investigate the impact of unilateral anodal (excitatory) stimulation over the left prefrontal cortex (PFC) on EDA responses during an emotion regulation task. Nineteen MDD patients and seventeen age- and gender-matched healthy control participants completed a cognitive reappraisal task involving emotionally salient stimuli under sham and active tDCS over left PFC. The results indicated differential modulation of EDA between MDD patients and control participants, with MDD patients exhibiting a decrease in the number of skin conductance responses (SCR) and a significant decrease in the mean amplitude of SCR when receiving active (vs. sham) stimulation over left PFC. These findings provide insights into the relationship between cortical stimulation, autonomic arousal, and emotion regulation, highlighting the potential of EDA as a biomarker for assessing the efficacy of tDCS for PFC modulation in mood disorders. These results underscore the importance of integrating physiological measures in noninvasive brain stimulation studies to better understand the mechanisms underlying the therapeutic effects of tDCS in MDD and other neuropsychiatric disorders.

Topic Area: EMOTION & SOCIAL: Emotional responding

D75 - Resting Parasympathetic Activity Moderates Loneliness-Related Approach Behaviors Across Populations

Mary S. Mousa[1], Anita Restrepo[2], Emily Silver[2], Alexander C. Henoch[1], Kelly E. Faig[3], Karen E. Smith[1]; [1]Rutgers University-Newark, [2]University of Chicago, [3]Hamilton College

Loneliness, or perceived social isolation, is thought to simultaneously motivate individuals to seek social engagement (approach) while avoiding potential further rejection. However, the extent to which individuals flexibly leverage these competing motivations varies. The parasympathetic nervous system (PNS) is innervated by prefrontal cortical and subcortical circuits that facilitate motivated responding. Resting PNS activity has been linked to variability in self-regulatory processes. Here, we examine whether resting PNS activity moderates the effects of loneliness on approach and avoidance behaviors in two U.S. populations recruited from Madison, WI, and Newark, NJ. Methods: 191 participants (Madison: 74; Race: majority White Non-Hispanic: 52.7%; Newark: 117; Race: majority Black/African American: 32.7%) aged 18 to 53 years completed a task in which they saw neutral shapes paired with either a positive or negative stimuli and were asked to make decisions about whether to approach or avoid the stimuli. Participants also completed measures of resting PNS activity and self-reported loneliness. Results: Resting PNS activity moderated the effects of loneliness on approach and avoidance behaviors. However, these effects differed across the samples. In the Madison sample, higher loneliness and higher resting PNS activity were associated with increased approach of stimuli regardless of valence. In the Newark sample, higher loneliness and higher resting PNS were associated with increased approach of positive stimuli but increased avoidance of negative stimuli. Conclusions: The findings suggest that while high resting PNS consistently moderates approach and avoidance behaviors in response to loneliness, its effects may differ across contexts and populations.

Topic Area: EMOTION & SOCIAL: Emotional responding

D76 - The Effect of Acetaminophen on Cognitive and Emotional Pain Empathy

Casey Vojcek[1] (cvojcek@usca.edu), Tyler Robbins[1], Brittany Wrisley[2], Brittany Jones[3], Laura Jelson-Swain[4]; [1]USCA

Empathy, encompassing cognitive and emotional components, is the capacity to interpret and even feel others' emotions, respectively. Empathy is critical for socialization and plays a fundamental role in human interactions. Acetaminophen, the active ingredient found in Tylenol, has been implicated in modulating social behaviors, potentially including empathy for pain. However, it is unknown if this effect translates to nociceptive pain, and whether there is a differentiation between cognitive and emotional facets of pain empathy. Therefore, participants (n = 127) were randomly assigned to either an experimental (1000mg acetaminophen) or control (sugar) group in a double-blind experimental design aimed to measure cognitive and emotional empathy in response to validated images depicting hands and feet in painful or non-painful scenarios. Trait empathy was also measured, and we verified data was not confounded by daily acetaminophen use or group assignment. A priori comparisons controlling for trait empathy found overall lower mean averages for emotional and cognitive empathy ratings. However, these were not significantly different between groups. Based on previous research suggesting sex differences in empathy, further analyses explored sex as an additional variable in the model. This revealed an interaction effect during the cognitive empathy task, such that males in the acetaminophen group reported less pain perceived from the images compared to males in the placebo group. Females did not differ in their responses between groups. This may suggest a sex-specific empathic effect in response to acetaminophen, and may further tease apart the potential differentiation between cognitive and emotional empathy neural processes.

Topic Area: EMOTION & SOCIAL: Emotional responding

D77 - Dynamic emotional states captured by a novel mobile tool relate to affective disorder symptoms and memory organization

Mason McClay[1] (masongmcclay@g.ucla.edu), Jiayang Li[1], Matthew Sachs[2], Christina Sandman[1], David Clewett[1]; [1]UCLA, [2]Columbia University

The ability to express appropriate emotional reactions in response to one's environment is hypothesized to be impaired in emotion disorders like depression and post-traumatic stress disorder (PTSD). Further, recent work reveals that fluctuating emotional states help structure episodic memories. However, there are limited tools available for measuring real-time emotion dynamics and their relation to depression, trauma, and memory organization. In this pre-registered study (n=373), we tested if fluctuations in emotional reactions to custom musical pieces relate to symptoms of depression and trauma as well as the semantic structure of autobiographical memories. To capture real-time changes in felt emotional valence and arousal during music listening, we developed a novel mobile phone web-app called the Mobile Emotion Compass. We then measured event segmentation of autobiographical memories by measuring semantic variance within memories using natural language processing. Our results revealed that higher semantic variability, or segmentation, of autobiographical memories was correlated with more normative emotional responding. Further, hidden markov modeling of the valence and arousal time-course data revealed that higher intrusive-thinking symptom severity was related to a higher likelihood of being in high-movement transitory, or "frenetic", emotional states. Memory segmentation, on the other hand, was related to a higher likelihood of leaving low-movement stationary, or "stickier", emotional states. These findings suggest that certain PTSD symptoms are related to less stable and less normative emotional responding, while more structured memories relate to more normative emotional responding. They also demonstrate the efficacy of the Mobile Emotion Compass for assessing emotion dynamics in naturalistic contexts.

Topic Area: EMOTION & SOCIAL: Emotional responding

D78 - Embarrassment as a Model for Socio-Affective Prediction Error—A Pilot Study

Nicole Serino[1] (tut38747@temple.edu), Linda J. Hoffman[1], Lily Prendergast[1], Steven Martinez[1], Maya Kilcullen[1], Johanna Jarcho[1], Vishnu Murty[2], Ingrid R. Olson[1]; [1]Temple University, [2]University of Oregon

Social emotions, such as embarrassment, provide information to conspecifics that one understands and accepts social norms of the tribe. Embarrassment is a critical component of human affect that arises in response to threats to one's social integrity. Induction of embarrassment requires there to be a prediction error wherein the brain's self-monitoring system detects deviations from social decorum and norms. In the laboratory, induction of embarrassment is difficult. To overcome this, we devised a novel embarrassment induction task. In a pilot study (N=14), we asked naïve participants to perform in various creative modalities (i.e., singing, dancing, storytelling) while being video recorded. They were asked to rate their performance on a 1-7 scale, with 7 being the best, after each trial. One week later, they returned for a surprise self-observation task in which their videos were played back to them. They were again asked to rate their performance. We predicted that participants' ratings would decrease due to the embarrassment evoked upon self-viewing. Results showed that subjects rated themselves as higher at Session 2 than at Session 1 ($t=2.2$, $p<.05^*$). This was surprising, since 9 of 11 participants who completed the end-of-study questionnaire at Session 2 endorsed feelings of embarrassment. A larger sample size plus analysis of psychophysiological data (collected but not analyzed) will help to illuminate whether this surprising finding is due to sample characteristics or how we ascertained their emotional state. Later, we will use this embarrassment manipulation to study neural circuits underlying socio-affective prediction error.

Topic Area: EMOTION & SOCIAL: Emotional responding

D79 - Interaction Between Age of First Interpersonal Violence Exposure on Emotion Processing and Neural Network Activation

Paige Broski[1], Luna Malloy[1], Hamza Suhail[1], Ali Arain[1], Elizabeth A. Bauer[1], John Leri[1], Josh Cisler[1]; [1]University of Texas at Austin Dell Medical School

Previous research demonstrates that trauma exposure alters neurocircuitry patterns in response to emotional faces, with differences observed between adolescents and adults. We hypothesized that the age of first Interpersonal Violence (IPV) exposure would predict heightened neural activity to fearful faces in the salience network. Participants aged 21-50 (N =134) completed a facial emotion processing task while undergoing an fMRI scan. They were presented with faces varying in duration (overt/500ms, covert/33ms) and valence (fearful, neutral). Support vector machine (SVM) classifiers, combined with a leave-one-out approach, were used to build models that differentiated fearful faces from neutral faces based on the salience network. These models provided individualized fear predictions (IFP) for the left-out subject's data. Linear mixed-effects models were then used to test the effects and interactions between age at first IPV exposure, valence, and duration on IFP. Within the salience network, an interaction between duration and age of first IPV exposure, $t(4892)=2.67$, $p=.008$, demonstrated that individuals who experience their first IPV exposure at or after age 16 exhibit greater IFP. Specifically, individuals who experienced their first IPV at or after age 16 show a significantly increased IFP for overt faces, regardless of valence, compared to those with no IPV or IPV before 16, $t(2448)=2.41$, $p=.016$. These findings suggest that IPV exposure at or after age 16 influences fear processing in the brain, with heightened fear responses linked to this timing. These results also highlight a broader nuance of developmental timing of trauma exposure on subsequent neurocircuitry changes.

Topic Area: EMOTION & SOCIAL: Emotional responding

D80 - Impact of Clinical Complexity on Fear Prediction and Face Recognition in Emotional Processing

Hamza Suhail[1], Ali Arain[1], Paige Broski[1], Luna Malloy[1], Elizabeth A. Bauer[1], John Leri[1], Josh Cisler[1]; [1]The University of Texas at Austin Dell Medical School

This study examined how psychiatric comorbidity—including multiple diagnostic categories and cumulative disorder burden—modulates neurocircuitry engagement as predicted by support vector machine (SVM) classifiers. Given evidence of threat-related hypervigilance in anxiety and posttraumatic stress disorder, we hypothesized that comorbidity would predict higher neurocircuitry engagement in emotion-processing regions towards social threat signals. Adult participants (N=134) completed an emotional face processing task during fMRI, viewing facial stimuli of distinct valence (fearful, neutral) and duration (overt/500ms, covert/33ms). SVM were used to build classifiers to predict fear vs. neutral faces, or neutral faces from fixation, based on multivariate patterns of brain activity within three networks of interest: bilateral amygdala, salience, and ventral visual network. Linear mixed-effects models were used to assess interactions between psychiatric diagnoses, stimulus duration, and valence on neural activation. Higher comorbidity, anxiety disorders, and cumulative disorder burden were associated with reduced fear predictions from the SVM classifier using multivariate patterns from the bilateral amygdala network ($p<0.05$). In the salience network, a duration × comorbidity interaction ($p=0.040$) demonstrated diminished SVM fear predictions in highly comorbid individuals for overt fear faces. Anxiety disorders predicted greater amygdala and salience network SVM face predictions ($p<0.05$). These findings indicate that comorbidity is associated with altered neural responses to emotional faces and face processing, such that distinct comorbidity profiles were associated with diminished fear-related amygdala engagement. However, heightened amygdala and salience engagement was demonstrated toward social stimuli. These results provide insight into disorder-specific neural mechanisms underlying emotional dysregulation in psychiatric populations.

Topic Area: EMOTION & SOCIAL: Emotional responding

D81 - Linking Individual Differences in Emotion Regulation to Neural Engagement in Fear Predictions and Face Processing

Ali Arain[1], Elizabeth A. Bauer[1], Paige Broski[1], Hamza Suhail[1], John Leri[1], Luna Malloy[1], Kierra Morris[1], Josh Cisler[1]; [1]University of Texas Dell Medical School

We investigated how individual differences in emotion regulation skill moderated neurocircuitry engagement during an emotional face-processing task. We predicted that worse emotion regulation skills would be associated with greater neurocircuitry engagement during emotional face processing. Adult participants (N =134) completed an emotional face processing task during fMRI, which presented facial stimuli that varied in valence (fearful, neutral) and duration (overt/500 ms, covert/33 ms). A support vector machine (SVM) was used to calculate individualized fear predictions (IFP) by building a classifier to distinguish fearful faces from neutral faces using leave-one-out cross-validation. We selected four networks to build the classifiers: bilateral amygdala, salience network, medial prefrontal cortex (mPFC) and ventral visual network. Linear mixed-effects models were used to assess the interactions between total difficulty in emotional regulation scale (DERS) scores, valence, and stimulus duration on IFP. Greater difficulties in emotion regulation were associated with reduced face predictions by the SVM classifier in the salience network ($p<0.05$). In the mPFC network, a three-way interaction between valence, duration, and DERS score demonstrated that better emotion regulation was associated with greater face processing for overt neutral faces ($p<0.05$). Furthermore, an interaction between valence and DERS score demonstrated that when looking at fearful faces, better emotion regulation was associated with increased IFP in the mPFC ($p<0.05$). These findings indicate that worse emotion regulation is associated with altered neural responses, particularly diminished neural engagement in the salience and mPFC networks. These results also suggest that alternative networks may contribute to emotion regulation and facial processing.

Topic Area: EMOTION & SOCIAL: Emotional responding

D82 - Neural architecture of moral reasoning in the human brain

Jinglu Chen[1,2] (jinche@utu.fi), Severi Santavirta[1,2], Vesa Putkinen[1,2,3], Paulo Boggio[4,5], Lauri Nummenmaa[1,2,6]; [1]Turku PET Centre, Turku University Hospital and University of Turku, Turku, Finland, [2]Turku University Hospital, Turku, Finland, [3]Turku Institute for Advanced Studies, University of Turku, Finland, [4]Social and Cognitive Neuroscience Laboratory, Mackenzie Presbyterian University, São Paulo, Brazil, [5]National Institute of Science and Technology on Social and Affective Neuroscience (INCT-SANI), São Paulo, Brazil, [6]Department of Psychology, University of Turku, Turku, Finland

Moral foundations theory proposes a framework for universal themes of moral across populations, yet the brain basis of processing different moral dimensions remains unclear. Here we mapped brain networks involved in moral reasoning during naturalistic movie viewing. A total of 104 participants watched a Finnish film Käsky during functional MR imaging. The movie depicts an emotional and morally complex story about the Finnish civil war. Dynamic ratings of 20 emotions and moral dimensions, derived from the moral foundations theory, were collected from 43 viewers. Dimensionality reduction was employed to identify the dependencies among the moral dimensions, while general linear model and intersubject correlation (ISC) analysis identified associations between high-order moral dimensions and brain activity. Four primary moral dimensions emerged: virtue (positive morality), hierarchy (collective respect), rebellion (self-interest), and vice (moral wrongs). The ACC and insula responded specifically to vice, indicating roles in processing conflict monitoring, and emotional salience of moral violations. Rebellion and hierarchy showed mixed BOLD responses, possibly due to the complex, socially regulated nature. The frontal pole showed negative activation for hierarchy, suggesting it may play a role in regulating hierarchical reasoning. Virtue had no distinct brain signature. ISC analysis and cumulative mapping highlighted widespread brain activation during moral scenes, encompassing extensive cortical areas, thalamus and PCC. Our results support a four-dimensional neural and psychological space for moral reasoning. Moral reasoning engages extensive brain regions and reveals distinct patterns across moral dimensions, with the TPJ, temporal-occipital fusiform and angular gyrus constituting the hubs of general-purpose moral processing.

Topic Area: EMOTION & SOCIAL: Other

D83 - Exploring dimensional neural and behavioral predictors of global functioning in psychosis: A structural equation modeling analysis

Taryn Berman[1,2] (tberman1@mgh.harvard.edu), Louis Vinke[1,2], Daphne Holt[1,2]; [1]Psychiatric Neuroimaging Research Program, Department of Psychiatry, Massachusetts General Hospital, [2]Harvard Medical School

Psychotic disorders affect many aspects of daily functioning and can be highly disabling. Some of the factors previously linked to impaired functioning in psychosis are dimensionally expressed across populations with different levels of psychosis liability. Therefore, the current study aimed to identify predictors of functioning in a sample that included healthy individuals with ($n=32$) and without ($n=58$) a first degree relative with a psychotic disorder, as well as individuals with a psychotic disorder ($n=36$). All participants underwent an assessment of social cognition, social motivation, social disconnection-related biases, and neural and behavioral correlates of personal space preferences (an automatic, non-verbal social behavior that has been linked to social functioning). Structural equation modeling was employed to investigate the relative contributions of these variables to global functioning cross-sectionally. Activity in two key nodes of the personal space cortical network, the inferior parietal ($\beta = .377$ [.170, .585], $p < .001$) and dorsal premotor ($\beta = .236$ [.016, .449], $p = .026$) cortices, predicted personal space size, which predicted the latent variable of social disconnection ($\beta = .294$ [.100, .484], $p = .006$). Moreover, social disconnection ($\beta = .340$ [.137, .564], $p = .006$), as well as social cognition ($\beta = .363$, 95% CI = [.106, .614], $p = .037$) and motivation ($\beta = .341$ [.063, .563], $p = .032$) were each significant predictors of global functioning across the sample. Overall, these results highlight the contributions of social disconnection, motivation, social cognition, and an objective neural marker of social behavior, to day-to-day functioning.

Topic Area: EMOTION & SOCIAL: Other

D84 - Delta-frequency EEG synchrony tracks shared audience engagement with live dance performances.

Laura Rai[1] (laura.rai@ucl.ac.uk), Haeeun Lee[2], Emma Becke[3], Carlos Trenado[3], Sonia Abad-Hernando[2], Matthias Sperling[4,5], Diego Vidaurre[6], Melanie Wald-Fuhrmann[3], Daniel C Richardson[7], Jamie A Ward[8], Guido Orgs[1,2,3]; [1]Institute of Cognitive Neuroscience, University College London, Alexandra House, 17 Queen Square, London, UK, [2]Department of Psychology, Goldsmiths, University of London, Lewisham Way, New Cross, London, UK, [3]Department of Music, Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany, [4]Independent Artist & Choreographer, London, UK, [5]Siobhan Davies Studios, 85 St George's Rd, SE1 6ER London, UK, [6]Department of Clinical Medicine - Center of Functionally Integrative Neuroscience, Aarhus University, Denmark, [7]Department of Experimental Psychology, University College London, [8]Department of Computing, Goldsmiths, University of London, Lewisham Way, New Cross, London, UK

Evolutionary theories claim that the performing arts – dance, music and theatre – transmit culture though live social interactions between groups of people. Yet, neuroscientific studies of these inherently social art forms are almost exclusively conducted on individual people watching video or sound recordings alone in a laboratory. Across three live dance performances, we simultaneously measured real-time dynamics between the brains of large audience groups of up to 23 members using mobile wet-electrode EEG (N = 69). We computed inter-subject correlations and phase lag values between the EEG of audience members relative to an active resting-state baseline. In a separate study (N = 28), individuals watched a recorded video of the performance alone in a laboratory condition. Interpersonal neural synchrony (INS) in the delta band (1-4 Hz) varied systematically with the dancers' movements and the audiences' collective engagement as predicted by the choreographer. INS was reduced when people watched a video of the performance on their own in a laboratory. Choreographic sections with higher INS were also rated as more engaging by an independent sample of viewers. Our study shows that live experiences are measurable as dynamic brain synchrony between co-present spectators and reflects artistically directed engagement with a live dance performance.

Topic Area: EMOTION & SOCIAL: Other

D85 - BEHAVIORAL AND NEURAL CORRELATES OF INTERPERSONAL MOTOR COORDINATION: A HYPERSCANNING-EEG STUDY IN MILITARY PERSONNEL

Nicolas Bourguignon[1], Nicolas Coucke[2], Salvatore Lo Bue[3], Emilie Caspar[4]; [1]Royal Military Academy of Belgium (1,3), [2]Ghent University (2,4)

Many military activities require precise interpersonal motor coordination for safe and efficient task performance. Synchronized sharpshooting or so-called 'Vic' formations in military flights illustrate the requirement for skillful motor synchronization. A relevant question is whether military selection and training enhances cooperation skills in soldiers compared to civilians and what the neural mechanisms are that underlie interpersonal motor coordination? We addressed these issues by comparing performance in twenty pairs of military subjects and twenty-four pairs of age- and education-matched civilian controls in a computer-based patrolling task while their EEG was simultaneously recorded (hyperscanning EEG). Subject pairs were required to navigate obstacle courses on their own (SOLO condition) or by synchronizing their motor actions (TEAM condition). Trials in the TEAM condition where subjects failed to synchronize had to be started over until completion. Synchronization performance, computed as the average number times PAIR trials had to be restarted before completion, was significantly higher in military compared to civilian subjects, indicating superior motor coordination abilities. Analyses of hyperscanning EEG data revealed that this higher performance in military subjects coincided with higher interbrain synchrony in the alpha-mu frequency band in the right centro-parietal cortex – an effect identified in previous studies as reflecting situations of social interactions. This difference was particularly marked when one pair member had to inhibit his/her own motor actions in order to let their partners take the initiative. Besides replicating neural indices of motor synchronicity, these results help elucidate the relevance of social mechanisms involved in activities requiring teamwork and solidarity.

Topic Area: EMOTION & SOCIAL: Other

D86 - Semantic Space Organization of Fifteen Emotional States Decoded from Task fMRI Data

Yaohui Ding[1] (yaohui.ding@duke.edu), Nathan M. Muncy[2], Leonard Faul[3], John L. Graner[1], Joel S. White[1], John M. Pearson[1], Kevin S. LaBar[1]; [1]Duke University, [2]University of Nebraska-Lincoln, [3]Boston College

We investigated the organization of fifteen decoded emotional states (amusement, anger, anxiety, awe, calmness, craving, disgust, excitement, fear, horror, joy, neutral, romance, sadness, and surprise) in the semantic space. We collected fMRI data from 115 participants (67 female, mean age =30.21 (8.47)) while they underwent emotion induction from movie clips and text scenarios, presented in blocks of five stimuli for each emotion and induction modality. Mass univariate general linear models were used to identify block-level activation (emotion stimuli > washout) in all grey matter voxels, which were subsequently used for classification using partial least squares discriminant analysis (PLS-DA). The PLS-DA classifiers achieved significant above-chance performance for all fifteen emotions from both movies (accuracy = 37.2 %, $p < 0.05$, CI = [35.5 %, 38.9 %]; AUC = 0.82, $p < 0.05$, CI = [0.81, 0.87]) and scenarios (accuracy =16.0 %, $p < 0.05$, CI = [14.8 %, 17.3 %]; AUC = 0.65, $p < 0.05$, CI = [0.63, 0.67]). The number of classification errors negatively correlated ($r = -0.29$, $p = 0.0026$) with the pairwise Euclidean distances among all emotions in a categorical 15-dimensional space, but they were not significantly correlated ($r = - 0.18$, $p = 0.062$) with the distances in a 2-dimensional arousal-valence space. Clustering analyses revealed both distinct and grouped structures, e.g., a fear, horror, and anxiety cluster, and a joy and amusement cluster. Taken together, our results contribute to an understanding of the dimensionality and distribution of these fifteen emotions in the semantic space.

Topic Area: EMOTION & SOCIAL: Other

D87 - Decoding of arousal and valence from fMRI data obtained during emotion inductions.

Joel White[1] (jsw82@duke.edu), Yaohui Ding[1], Nathan Muncy[2], John Graner[1], Leonard Faul[3], Kevin LaBar[1]; [1]Duke University, [2]University of Nebraska-Lincoln, [3]Boston College

We are investigating the neural representations of valence and arousal, two central constructs in affective neuroscience signifying pleasantness and level of activation, respectively. Previous machine learning studies have successfully identified valence states from brain activation patterns observed during task-based fMRI, but the results have varied across studies, and the decoding of arousal states has been less successful. Moreover, prior studies have been limited in sample size, emotion induction methods, and extent of emotions sampled. Here we plan to decode arousal and valence from whole-brain fMRI data collected from 115 participants (67 female, mean age =30.21 (8.47)) during exposure to 300 unique emotional stimuli, presented in blocks of five stimuli. These stimuli were originally classified into one of 15 intended emotions, which span a broad range of emotional experience, and they were evenly distributed between short movies (Cowen & Keltner, 2017) and text scenarios (Faul, Baumann, & LaBar, 2023) taken from normed databases. Following MRI scanning, participants rated arousal and valence of the stimuli. Mass univariate general linear models will identify block-level activation (emotion stimuli > washout) from all grey matter voxels. Multivariate regression analysis will be used to predict post-scan valence and arousal ratings based on these grey matter activations. Preliminary results from 83 participants using partial least squares regression show promise in decoding both valence and arousal. Future work will utilize data from all 115 participants, further test and tune a greater range of parameters, and identify the voxels implicated in the neural representations of arousal and valence.

Topic Area: EMOTION & SOCIAL: Other

D88 - Behavioral correlates of honesty and deception

Andrew Kayser[1,2,3], Julia Bertolero[1,2], Sangil Lee[2], Jan Peters[4], Ming Hsu[2]; [1]UC San Francisco, [2]UC Berkeley, [3]San Francisco VA Health Care System, [4]University of Cologne

Deception is a universal social behavior. Past work to explore the cognitive basis of deception has used various paradigms to understand both individual variation in deceptive tendencies and the dependence on factors such as reward magnitude. However, understanding deception also requires determining how it varies with characteristics of the deceiver and the deceived. Using an online sample (N=808), we investigate the hypotheses that the frequency of deception decreases with perceived warmth, and increases with perceived competence, of the partner, and the magnitudes of these dependencies decline with altered social function. Here we use an incentivized signaling game in which participants act as the signaler to different assigned partners identified only by professions, such as “pediatrician”. Besides the “deception” condition, in which participants are given the opportunity to lie to their partners, we also include a “preference” condition, where they simply express their preference without the ability to lie. As predicted, deceptive behavior occurs less often than selfish behavior, and the tendency for both deception and selfishness decreases with perceived warmth, and increases with perceived competence, of the partner. Additionally, using the Alcohol Use Disorders Identification Test (AUDIT-C) to divide signalers into low- and high-risk groups for alcohol misuse, we find a significant interaction between warmth and AUDIT-C score, such that decisions by the high-risk group are less sensitive to warmth despite mean ratings suggesting they view the recipients as warmer. Together these results link deception to individual-level characteristics, and they demonstrate that higher AUDIT-C scores correlate with altered social decision-making.

Topic Area: EMOTION & SOCIAL: Other

D89 - Comparing event-related potentials and frontal midline theta to motivationally relevant stimuli as markers of approach and avoidance tendencies.

Taehoon Kang[1] (langtaehoon@naver.com), Madison Risner[2], Natalie Ceballos[3], Reiko Graham[4]; [1]Texas State University

Reinforcement Sensitivity Theory proposes that the Behavioral Inhibition and Activation Systems (BIS/BAS) coordinate motivational processes to regulate avoidance and approach behaviors (Gray, 1987). BIS/BAS activation may be detectable in electroencephalographic indices, especially the frontocentral N2 ERP component (attention/cognitive control) and possibly frontal midline theta (FMT), which may be a manifestation of FMT elicited by motivationally-relevant stimuli (Cavanaugh & Shackman, 2016). However, evidence of this relationship is inconsistent, especially with respect to the BIS/BAS. To investigate this, 28 undergraduates (mean age = 19.6 years) completed the BIS/BAS and then viewed images of snakes, snarling dogs, puppies, and kittens, indicating whether they would approach or avoid them. ERPs to the 2 different classes of stimuli were derived, which were also subjected to Morlet wavelet analysis. The N2 was enhanced for snakes and dogs but unrelated to the BIS/BAS. For approach stimuli, N2 amplitudes were positively correlated with BAS scores. FMT peaked during the same time frame with the same distribution as the N2 but did not differentiate between approach- and avoidance-related stimuli. However, follow up regressions indicated that as approach-FMT increased, approach-N2 amplitudes were decreased. Approach-FMT was positively associated with BIS, suggesting that the BIS also moderates responses to approach-related stimuli. Similarly, avoidance-FMT was negatively associated with avoidance-N2 amplitudes, while BIS was marginally and positively related to avoidance-FMT. These results do not support the notion that the N2 is a manifestation of FMT, although the two are not completely dissociable. Findings will be discussed in the context of Reinforcement Sensitivity Theory.

Topic Area: EMOTION & SOCIAL: Other

D90 - Exploring the neural mechanisms of preference for sad music

Momoyo Tsuchiya[1] (tsuchiya.momoyo.t2@dc.tohoku.ac.jp), Ayumi Takemoto[1], Jeyoon Choi[1], Motoaki Sugiura[1]; [1]Tohoku University, Japan

Music has long been a part of our lives, shaping our culture, history, and relationships. One reason for this is that music can evoke emotions. Music can elicit both positive and negative emotions, such as sadness. Some people love sad music even though it can elicit sadness. Previous research suggested that listening to sad music makes people feel not only sadness, but also pleasure and aesthetic feelings. However, it remains unclear how those who prefer sad music perceive and enjoy sad music, especially in terms of sadness and aesthetic emotions. This study aimed to identify the neural correlates of listening to sad music in people who prefer sad music using functional magnetic resonance imaging (fMRI). Forty-two healthy individuals participated in this study. Participants listened to fourteen sad music and fourteen non-sad music for twenty seconds randomly. Meanwhile, brain activity was collected by fMRI. After that, they completed a questionnaire to assess the extent to which each stimulus applied to each of certain emotional categories and to measure personality traits, such as the degree of preference for sad music (SMP). Results of whole-brain analysis revealed that a significant positive correlation between the right insula activation and SMP scores in sad music. In region of interest analysis, the bilateral ventral striatum activity, which is associated with reward, was positively correlated with SMP scores in sad music. We interpreted that the brain activity in the insula in people who prefer sad music while listening to sad music reflected their experience of aesthetic emotions.

Topic Area: EMOTION & SOCIAL: Other

D91 - Structural codependence between deep brain nuclei and sensorimotor cortical regions differs between people with depression and unaffected individuals

Siraj Lyons[1], Isak Beck[2], Brendan Depue[1]; [1]University of Louisville, [2]Arizona State University

Depression impacts nearly 3% of the global adult population. Symptomatology is likely related to regions encompassing frontoparietal, somatosensory, and salience networks. Questions regarding deep brain nuclei (DBN), including the subthalamic nucleus (STN), substantia nigra (SN), and red nucleus (RN) remain unanswered. Using an existing structural neuroimaging dataset including 86 individuals (37 diagnosed with depression; Baranger et al., 2021), frequentist and Bayesian logistic regressions assessed whether DBN volumes predict diagnosis. Furthermore, we completed structural covariance analyses in FreeSurfer tested diagnostic differences in deep brain volume and cortical morphometry covariance. Correlations tested if relationships between implicated cortical regions and depression symptomatology. We obseved that simple DBN volumes did not predict diagnostic group. However, group differences emerged in deep brain/cortical covariance. Right RN volume covaried with right frontal operculum and left parietal operculum thicknesses, while left RN and right STN volumes covaried with right occipital pole volume. Positive relationships were observed within the unaffected group and negative relationships among those with depression. These effects did not correlate with depression symptomatology. Structural codependence between DBN and cortical regions may be important in depression, potentially for sensorimotor features. Future work should focus on causal mechanisms of DBN involvement with sensory integration.

Topic Area: EMOTION & SOCIAL: Other

D92 - Pupils, Hotties and Hormones: A Modern Replication of the Hess Pupillary Reactivity Study.

Katie Cooke[1], Hannah Kershner[2], Carole Scherling PhD.[3]; [1]Belmont University, Department of Psychological Science and Neuroscience

Physiological responses to stimuli vary between groups and individuals, providing objective and quantitative behavioral measures (Gheorghe, 2023). Notably, pupillary measures probe subconscious reactions to stimuli (Matukin, 2016). Hess (1960) revealed sex disparities in pupil dilation to photos of naked adults and babies, with all showing increased dilation for the opposite sex, and females additionally dilating for babies. This work modernizes the above study with updated images and pupillary technology and considers hormones. Sixty-four undergraduates (41F; age (SD)=20.56(1.33)) viewed forty photographs of babies, landscapes, scantily-clad females and males; 10 each) while pupillary indices were recorded. Saliva was collected for hormonal analyses, and menstrual cycle and sexual preference were self-reported. Like Hess, we hypothesize increased pupil dilation for all when viewing the opposite sex, but only for females when viewing babies. Preliminary results do not reveal sex differences when viewing landscapes and adult pictures ($p>0.05$). However, increased pupillary responses were only seen for females when viewing babies ($t(5)=2.279$, $p=0.54$). Notably, a trend suggests larger responses when viewing female pictures, regardless of participant biological sex ($p=0.74$). Further, we hypothesize that estrogen will modulate female pupil size, with higher levels yielding greater dilation to babies. Salivary estrogen and menstrual cycle data are being analyzed. Last, we hypothesize that pupil dilation will be higher when viewing adult pictures that correspond to self-reported sexual preference. Data processing and analysis is ongoing, with preliminary findings indicating some nuances to the stereotypical biases related to sex, which were prominent at the time when the Hess study was published.

Topic Area: EMOTION & SOCIAL: Other

D93 - Exploring Microglial Morphology and PFKFB3 Oxidative Stress in Depressive-like Behavior

Courtney M. Chochol[1] (courtney.chochol@quinnipiac.edu), Colleen D. Ford[1], Kezzia Jones[1], Courtney Whitelock[1], Adrienne J. Betz[1], Martine M. Mirrione[1]; [1]Quinnipiac University

Glial dysfunction is thought to contribute to disrupted neuronal circuits in mood disorders. Here, we explore microglia morphology and neuronal metabolism, using the Chronic Unpredictable Stress (CUS) and Maternal Separation (MS) rat models. We hypothesized that increased microglia activation and proliferation would be evident in the brain following CUS or MS compared to controls, and these increases would correlate with metabolic damage in neurons measured using the marker 6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 3 (PFKFB3). This glycolytic enzyme is thought to accumulate with excitotoxicity, possibly contributing to oxidative stress and cell death. Following CUS and MS behavioral testing, brains were fixed and sectioned prior to immunofluorescence and confocal microscopy. Microglia number and morphology were quantified within the amygdala, hypothalamus, retrosplenial cortex, and dorsal and ventral hippocampus using ionized calcium-binding adapter molecule 1 (Iba1), along with markers for PFKFB3, and neuronal nuclei (NeuN). In CUS, we measured an increase in PFKFB3 in the ventral hippocampus CA1 and a decrease in cell body size of microglia, but no change in total counts of microglia. In MS males, our results reveal that the ventral hippocampus is more vulnerable than the dorsal hippocampus due to higher levels of phagocytic microglia. In MS females we found phagocytic microglia in the dorsal hippocampus. PFKFB3 was found to be relatively higher in the hypothalamus and amygdala compared to cortex and hippocampus. Together our data suggests evidence of early stages of neuronal dysfunction resulting from CUS and MS exposure in adolescent animals, which may be associated with altered microglia function.

Topic Area: EMOTION & SOCIAL: Other

D94 - Acute Stress Increases Functional Brain Network Integration

Chelsea C. Ajunwa[1] (ajunwa.c@northeastern.edu), Philip A. Kragel[2], Lawrence L. Wald[3,4], Marta Bianciardi[3,4], Tor D. Wager[5], Ji-Kyung Choi[6], Jiahe Zhang[1,4], Ajay B. Satpute[1,4], Karen S. Quigley[1], Lisa Feldman Barrett[1,4], Jordan Theriault[1,3]; [1]Northeastern University, [2]Emory University, [3]Martinos Center for Biomedical Imaging, Massachusetts General Hospital, [4]Massachusetts General Hospital and Harvard Medical School, [5]Dartmouth College, [6]University of California, San Francisco

Brain modularity refers to the brain's functional organization into densely connected subnetworks. High modularity (i.e., low network integration) is thought to facilitate efficient and adaptable localized information processing; yet, within individuals, the brain can temporarily shift towards a more integrated (i.e., less modular) state, both during cognitive load and after acute social stress. We used 7 Tesla (1.1 mm isotropic) whole-brain imaging to examine brain modularity during (as opposed to after) acute social stress, and to quantify within-individual reliability of brain modularity (across multiple resting state scans). Participants (N = 92) were scanned during three consecutive resting state runs and a social stress task. For each participant and run, we constructed Pearson correlation connectivity matrices (using the 264 Power Atlas; correcting for multiple comparisons) and recorded the average modularity index (Q) across 100 iterations of the Louvain community detection algorithm. During acute social stress, brain modularity decreased from levels at rest ($t = 6.377$, $p = 7.35 \times 10^{-9}$). Modularity did not significantly differ across the three resting state runs ($F = 0.969$, $p = 0.382$). Within individuals, modularity was moderately reliable across resting state scans (interclass correlation coefficient of 0.486). At the same time, inter-individual differences in resting modularity were moderately large (rest SD = 0.147, stress SD = 0.173). In sum, acute social stress elicited reliable changes in modularity, and inter-individual differences were stable across scans. Additional planned analyses include examining cortical/subcortical differences in stability of network modularity, and correlating baseline and stress-induced modularity changes with behavioral performance.

Topic Area: EMOTION & SOCIAL: Other

D95 - Maternal Postpartum Resting-state Functional Connectivity Associated with Disrupted Mother-infant Interaction

Yingying Ye[1,2,3] (psyyeyingying@163.com), Kyoko Ohashi[2,3], Alaptagin Khan[2,3], Michelle Bosquet Enlow[2,4], Karlen Lyons-Ruth[2,5], Martin Teicher[2,3]; [1]Department of Psychology and Behavioral Sciences, Zhejiang University, Hangzhou 310058, China, [2]Department of Psychiatry, Harvard Medical School, Boston, Massachusetts, USA, [3]Developmental Biopsychiatry Research Program, McLean Hospital, Belmont, Massachusetts, USA, [4]Department of Psychiatry and Behavioral Sciences, Boston Children's Hospital, Boston, Massachusetts, USA, [5]The Family Studies Laboratory, Cambridge Hospital, Cambridge, Massachusetts, USA

Introduction: Multiple theories have proposed hypothetical circuits influencing maternal behavior, emphasizing connections between the prefrontal, orbitofrontal, and cingulate cortices, and subcortical regions. However, these circuits or functional connectivity have rarely been examined in humans. This is a crucial question, as it may reveal the neural mechanisms shaping maternal disrupted behavior, offering insights for the development of future interventions. Method: Mothers of newborns and their infants were recruited from the Boston area. At four months postpartum, mother-infant dyads participated in the Still-Face Paradigm. Resting-state MRI scans were obtained on 92 mothers, with high-quality resting-state scans and still-face data available for 83 mothers. Nineteen a-priori defined ROIs were selected to calculate ROI-to-ROI connectivity, and FDR correction was applied at the ROI level. Result: The results showed that maternal disrupted behavior was significantly associated with connectivity between the anterior cingulate gyrus (ACG) and the insular cortex (IC; ps = 0.005~0.031), the right superior frontal gyrus (SFG; $p = 0.028$), right putamen ($p = 0.028$), as well as the left caudate ($p = 0.030$). Meanwhile, significant connectivity between the right putamen and both sides of the IC (ps = 0.028~0.035) was also associated with maternal disrupted behavior. Conclusion: These findings reveal that the circuit involving regions such as the anterior cingulate gyrus, insular cortex, putamen, and caudate is altered in association with maternal disrupted behavior.

Topic Area: EMOTION & SOCIAL: Other

D96 - Photobiomodulation therapy-induced volumetric brain changes on patients with depression

Puneet Velidi[1,2] (pvelidi@uvic.ca), Guillermo Gonzalez-Garibay[1,2], Carlos Lohmann[1,2], Borja Ferreras[1,2], Fabio Luchese[1,2], Akila Weerasekera[1,2], Stefani Kalli[1,2], Paolo Cassano[1,2]; [1]Massachusetts General Hospital, [2]Harvard Medical School

Background: Major Depressive Disorder (MDD) is a common mental health condition associated with mood disturbances, cognitive impairment, and structural brain abnormalities in critical regions for emotional regulation. Transcranial Photobiomodulation (t-PBM), which uses non-ionizing light wavelengths to stimulate brain function, has shown potential in enhancing mitochondrial activity, increasing cellular energy, and supporting neuroplasticity. Its effects on brain structure in MDD remain largely unexplored. Methods: As a part of the TRIADE R61 trial, t-PBM was delivered to 34 total subjects with MDD across two sites (NYU & MGH) with a randomized dose (including sham) at four time points, each one week apart. T1 images were acquired using a Siemens Magnetom 3.0T Trio MRI at each time point; after image QC, 23 subjects' scans were included. We used Voxel-based Morphometry (VBM) in SPM12 to capture longitudinal structural changes between the first and last scans of the included subjects. Pre-processing and segmentation was performed using CAT12's longitudinal segmentation pipeline optimized for detecting small changes. Results: Significant ($p<0.05$) volumetric changes before FWE-correction were observed in the left cerebellum, with no significant alterations detected in cortical or subcortical regions. No voxels survived FWE-correction. Conclusion: These findings suggest that t-PBM may promote neuroplasticity in the cerebellum, potentially through mechanisms involving mitochondrial enhancement and synaptic remodeling. The left-lateralized changes suggest the cerebellum's role in mood regulation and its potential as a target for neuromodulation. This study provides preliminary evidence supporting t-PBM as a promising therapeutic intervention for MDD, warranting further investigation into its clinical significance.

Topic Area: EMOTION & SOCIAL: Other

D97 - Examining Asymmetric Amygdala Activity in Adolescents with Anxiety Using fMRI

Ava Moore[1] (amoore86@fordham.edu), Amy Roy, Tracy Dennis-Tiwary; [1]Fordham Univeristy, [2]CUNY Hunter College

Previous studies using EEG suggest that anxiety may be associated with hemispheric asymmetries. However, MRI allows for the examination of asymmetry in subcortical structures such as the amygdala, which plays an important role in regulating fear responses. Two theories exist regarding amygdala lateralization and emotion: 1) the right amygdala is associated with emotion regardless of valence, and 2) the right amygdala is associated with negative emotions and the left amygdala with positive emotions. Interestingly, recent meta-analyses of amygdala lateralization show left-sided amygdala activity to be associated with emotional tasks more often than right-sided amygdala activity, regardless of valence (Baas et al., 2004; Wager et al., 2003). Participants were 52 children (ages 12-14) with symptoms of anxiety recruited from the New York City area. Both parents and children completed the Screen for Child Anxiety Related Disorders (SCARED). Resting-state fMRI scans were conducted, and hemispheric asymmetry was assessed using fractional amplitude of low-frequency fluctuation (fALFF). Asymmetry in the amygdala was calculated ([L-R]/[L+R]), based on previous research. Regression analysis, controlling for sex, revealed greater left-than-right amygdala activation to be significantly associated with higher total scores on the child report of the SCARED, as well as the generalized anxiety disorder and social anxiety disorder subscales. This is the first study to examine amygdala asymmetry in this age group using fALFF. These findings challenge traditional theories of amygdala lateralization, which have primarily focused on right-sided dominance for negative emotions, suggesting that left-sided amygdala activation may also be integral to emotional responses in anxiety.

Topic Area: EMOTION & SOCIAL: Other

D98 - Cognitive-Affective Variability in TMS for Depression: Investigating Anxiety Exacerbation as a Treatment Outcome

Morgan Healey[1], Lamaan Haq[1], Joshua Brown[1,2]; [1]Division of Depression and Anxiety Disorders, McLean Hospital, [2]Department of Psychiatry, Harvard Medical School

Transcranial Magnetic Stimulation (TMS) targeting the left dorsolateral prefrontal cortex (DLPFC) is a well-established treatment for major depressive disorder (MDD), with evidence suggesting it enhances cognitive control over emotion by modulating the cognitive control network (CCN). While TMS has been demonstrated to have anxiolytic effects, clinical reports suggest some patients experience increases in anxiety, raising questions about individual differences in treatment response and the neural mechanisms underlying emotional variability. Despite these observations, TMS-emergent anxiety remains poorly characterized, limiting its integration into treatment optimization. This retrospective study examined 23 adults with MDD who completed ≥29 sessions of high-frequency (18Hz) TMS targeting the left DLPFC. Anxiety severity was assessed using the Generalized Anxiety Disorder-7 (GAD-7) scale at baseline and post-treatment, with percentage change analyzed to assess symptom trajectories. While anxiety improved on average, 9 of 23 patients (39%) experienced increased GAD-7 scores post-treatment, with 4 patients of these patients showing a >30% worsening and 3 exhibiting a 100% increase. Baseline anxiety severity was weakly negatively correlated with percentage change in GAD-7 ($r = -0.21$), suggesting that TMS-induced anxiety changes may not be solely explained by initial symptom severity. These findings highlight variability in the emotional response to TMS, suggesting that some individuals may be more prone to anxiety worsening during treatment. Future research should examine whether baseline symptom patterns, cognitive-affective profiles, or alternative TMS parameters (e.g., right low-frequency stimulation) could help predict and mitigate anxiety exacerbation. Identifying these predictors could improve treatment personalization and optimize patient outcomes in TMS for depression.

Topic Area: EMOTION & SOCIAL: Other

D99 - Toward first-person social perception: actively engaging in an interaction boosts sensitivity to social information

Qi Liang[1] (qi.liang@dartmouth.edu), Zishan Su[1], Rekha Varrier[1,2], Eshin Jolly[1,3], Emily Finn[1]; [1]Dartmouth College, [2]University of Bonn, [3]University of California San Diego

Humans are adept at processing social information and understanding interactions not only between others (third-person perspective), but also—and more importantly—between themselves and others (first-person perspective). Previous work has mostly focused on the former, leaving first-person scenarios under-explored. In this study (n=288), we created simple visual scenes with varying levels of evidence for a social interaction by creating scenes with one dot programmed to chase another dot to a more or less obvious degree ("chase directness"). We presented these in two conditions for 48 trials each to address possible differences between perspectives. Participants either watched two moving dots for 6s (third-person) or controlled one dot with a mouse and explored the scene for 6s (first-person). Afterwards, they chose whether one dot was chasing the other dot (third-person) or the dot they controlled (first-person) and reported their confidence. We then quantified each participant's sensitivity to social information in both conditions by fitting their responses with a psychometric function of chase directness and comparing curve parameters between conditions. Results showed that participants' point of subjective equality (how direct a chase needed to be for someone to switch their perception from non-social to social) was significantly smaller in the first-person condition, suggesting that actively engaging in interactions boosts sensitivity to social information. Furthermore, participants were more confident in the first-person condition, especially when the presence or absence of interactions was obvious. Findings highlight the importance of studying first-person social perception and introduce a quantitative approach to capture the differences between perspectives.

Topic Area: EMOTION & SOCIAL: Other

D100 - Exploring the Role of Emotion Intensity and Context on Face Emotion Recognition

Yuanyi Peng[1], Alex Kafkas[1], Karen Lander[1]; [1]University of Manchester

The extent to which faces and contexts influence emotion recognition remains unclear. Previous studies have focused exclusively on the significance of either the face or the context but overlooked the role of emotion intensity. We hypothesised that the relative contribution of face and context on emotion recognition fluctuates depending on valence intensity levels (how strongly the emotion is expressed). In a behavioural study, 103 participants were recruited online to identify happy, sad, and neutral facial expressions presented within positive, negative, and neutral contexts (background images). Happy and sad faces were morphed to depict both high and low intensity levels. Participants rated face emotion from -4 (strongly sad) to 4 (strongly happy). Results showed that context influenced emotion recognition when the face was ambiguous (i.e., low intensity). However, as face intensity increased, it became the dominant factor, diminishing the context's influence. Experiment 2 employed eye-tracking to examine mechanisms involved in face emotion recognition, while type and intensity of context varied. Context stimuli were static or dynamic (movies) in a between-participants design. Preliminary analyses from Experiment 2 showed that type and intensity of context also affected gaze probability within facial regions, further supporting and extending the behavioural effects from Experiment 1. Overall, the findings indicate that context intensity and type play an important role in face emotional recognition. Faces with low emotional intensity rely more on context for accurate emotion recognition, a reliance that is heightened in dynamic contexts.

Topic Area: EMOTION & SOCIAL: Person perception

D101 - Human-like social and emotional perception with GPT-4V

Severi Santavirta[1,2] (svtsan@utu.fi), Yuhang Wu[1,3], Lauri Suominen[1], Lauri Nummenmaa[1,2,4]; [1]Turku PET Centre, University of Turku, Turku, Finland, [2]Turku University Hospital, Turku, Finland, [3]Department of Psychology, Renmin University of China, Beijing, China, [4]Department of Psychology, University of Turku, Turku, Finland

Humans navigate the social world by rapidly perceiving social features from others and social interactions. Social interactions evoke emotions that subsequently influence social interactions highlighting the tight link between social and emotional processes. Recently, artificial intelligence (AI) and large-language models (LLMs), have achieved high-level visual capabilities for object and scene content recognition and description. This raises the question whether LLMs can perceive nuanced and tacit social and emotional information from visual stimuli, or simulate the emotions that humans experience in their everyday life. To answer these questions, we collected rich social (136 features) and emotional (48 features) human annotations

from hundreds of images and videos and compared those to the similar annotations produced by a prominent visual LLM, GPT-4V. Additionally, we recreated the neural representations for social perception based on GPT-4V social perceptual evaluations in a fMRI study where 97 subjects viewed socioemotional movie clips to investigate the practical reliability of simulated annotations within cognitive neuroscience. The preliminary results revealed that GPT-4V can produce human-like social perceptual evaluations (r_image = 0.61, r_video = 0.53) and their neural representations (PPV = 0.76) demonstrating the practical potential of LLM derived socioemotional responses. Reliable simulation of social-emotional processes would have wide range of real-life applications ranging from health care to business and would open exciting new avenues for cognitive research through automated high-dimensional stimulus annotations.

Topic Area: EMOTION & SOCIAL: Person perception

D102 - Neural Processing of Dynamic Facial Emotion in Early Course Psychosis

Rebekah Trotti[1,2] (rtrotti@bidmc.harvard.edu), Nicolas Raymond[1], Prachi Patel[1], Emma Oss[1], Daphne Ying[1], Brendan Stiltner[1], Paulo Lizano[1,2]; [1]Beth Israel Deaconess Medical Center, [2]Harvard Medical School

Background: Facial emotion recognition underlies social disability in psychotic spectrum disorders, but most studies of emotion processing rely on unmoving stimuli with limited ecological validity. Examining neural activity in response to naturalistic, changing facial expressions could better probe the real-time neural underpinnings of socioemotional deficits. Thus, we aim to use dynamic face stimuli and event-related neural oscillations to examine this possibility in early course psychosis (ECP). Methods: 4-second videos of faces changing from a neutral to a happy, sad, or other neutral expression were presented to 48 participants (24 ECP, 24 healthy controls [HC]) while electroencephalography was recorded and participants identified emotions with a button press. Analyses will be performed by applying Fast Fourier transforms to extract frequency data. Oscillatory power in 1-second windows after stimulus presentation will be examined with ANOVAs to assess effects of emotion and group (α=.05). Results: A prior magnetoencephalography study in chronic schizophrenia demonstrated reduced alpha power at central sensors and delayed emotion recognition during dynamic face processing. We expect to replicate these effects and extend this analysis to other frequency bands and clinical correlates. Conclusions: Support for hypotheses would indicate that disruptions in real-time visuo-emotional processing are present early in psychotic illness and are trait-like biomarkers, rather than a downstream result of chronic illness or medication. Additional future analyses will examine relationships between oscillatory activity and socio-emotional behavior in ECP. Frequency and spatial qualities of impairments will guide a future trial of transcranial alternating current stimulation to enhance social functioning in ECP.

Topic Area: EMOTION & SOCIAL: Person perception

D103 - Understanding Empathy Toward Dissimilar Others in Daily Social Contexts

Rui Watanabe[1,2], Hironobu Kuruma[2]; [1]Turku PET Centre/ University of Turku, [2]Tokyo Metropolitan University

Empathy is essential for social interaction, yet extending empathy toward individuals with dissimilar characteristics facing daily challenges can be difficult. This study examined how people without disabilities empathize with individuals with stroke-induced hemiplegia during manual interactions with objects or other people. Using functional magnetic resonance imaging and multi-voxel pattern analysis (MVPA), we investigated the neural and behavioral mechanisms of empathy. Participants observed video stimuli featuring individuals with hemiplegia performing tasks such as grasping a human hand or an object (a plastic bottle) using their hemiplegic or non-hemiplegic hands. Behavioral responses revealed stronger negative empathic feelings (e.g., awkwardness, irritation) toward hemiplegic movements compared to non-hemiplegic ones, regardless of the target. Positive feelings (e.g., relief) were more pronounced during interactions with human hands than objects, particularly when performed by the hemiplegic hand. Classification approaches in MVPA identified regions in the mirror neuron system and mentalizing networks that distinguished empathic responses across hemiplegic and non-hemiplegic hands. Additionally, the dorsal medial prefrontal cortex (MPFC) more accurately classified responses for hemiplegic movements, reflecting the complexity of empathizing with unfamiliar actions. Representational similarity analysis revealed that brain regions associated with affective empathy, including the anterior insula and inferior frontal gyrus, were specifically attuned to feelings of relief across conditions. These findings suggest that empathizing with individuals who face complex challenges engages both affective and cognitive empathy systems, with the dorsal MPFC playing a critical role. This study advances understanding of the neural mechanisms underlying empathy in diverse social contexts.

Topic Area: EMOTION & SOCIAL: Person perception

D104 - Common and distinct neural correlates of social interaction perception and theory of mind

Zizhuang Miao[1] (zizhuang.miao.gr@dartmouth.edu), Heejung Jung[1], Philip A. Kragel[2], Patrick Sadil[3], Martin A. Lindquist[3], Tor D. Wager[1]; [1]Dartmouth College, [2]Emory University, [3]Johns Hopkins University

Social cognition spans from perceiving agents and their interactions to making inferences based on theory of mind (ToM). Despite their frequent co-occurrence in real life, the commonality and distinction between social interaction perception and ToM at behavioral and neural levels remain unclear. Here, participants (N = 231) provided moment-by-moment ratings of four text and four audio narratives on social interactions and ToM engagement.

Social interaction and ToM ratings were reliable (split-half r = .98 and .92, respectively) but only modestly correlated across time (r = .32). In a second sample (N = 90), we analyzed co-variation between normative social interaction and ToM ratings and functional magnetic resonance (fMRI) activity during narrative reading (text) and listening (audio). Social interaction perception and ToM activity maps generalized across text and audio presentation (r = .83 and .57 between unthresholded t maps, respectively). When ToM was held constant, merely perceiving social interactions activated all regions canonically associated with ToM under both modalities (FDR q < .01), including temporoparietal junction, superior temporal sulcus, medial prefrontal cortex, and precuneus. ToM activated these regions as well, indicating a shared, modality-general system for social interaction perception and ToM. Furthermore, ToM uniquely engaged lateral occipitotemporal cortex, left anterior intraparietal sulcus, and right premotor cortex. These results imply that perceiving social interactions automatically engages regions implicated in mental state inferences. In addition, ToM is distinct from social interaction perception in its recruitment of regions associated with higher-level cognitive processes, including action understanding and executive functions.

Topic Area: EMOTION & SOCIAL: Person perception

D105 - The Influence of Social Exclusion on Perceptions of Facial Trustworthiness

Sabina Raja[1] (sraja1@uchicago.edu), Anita Restrepo[1], Elizabeth P. Gaillard[1], Emily M. Silver[1], Greg J. Norman[1]; [1]University of Chicago

Inferred social attributions, such as perceived facial trustworthiness, are rapidly and reliably formed based on static structural features of the face, helping us navigate complex social environments. While perceptions of facial trustworthiness have been extensively studied in neutral social contexts, their stability under non-neutral social contexts, such as social exclusion, remains less understood. The present study explored whether judgments of facial trustworthiness remain stable after experiences of social exclusion, a form of social threat empirically demonstrated to alter social information processing. Participants (n = 92) were recruited and randomized into exclusion or inclusion conditions using the Ostracism Online Paradigm. Trustworthiness ratings of low-, medium-, and high-trust faces were collected pre- and post-manipulation. A 3×2 mixed-design ANOVA evaluated changes in facial trustworthiness ratings from pre- to post-manipulation as a function of condition (inclusion vs. exclusion) and facial trustworthiness category (low, medium, high). As expected, social exclusion increased negative affect, decreased positive affect, and diminished feelings of belonging. However, the exclusion manipulation had no impact on facial trustworthiness ratings. These findings suggest that judgments of facial trustworthiness, driven by automatic and ingrained perceptual heuristics, remain stable even under conditions of social threats like exclusion. These results highlight the robustness of facial trustworthiness judgments in non-neutral social contexts, underscoring their reliance on static facial features and rapid social-cognitive heuristics. Future research should explore whether these findings generalize to more dynamic or diverse facial stimuli and investigate how exclusion influences other social attributions and subsequent behavior.

Topic Area: EMOTION & SOCIAL: Person perception

D106 - Neural Mechanism for Preference/Unpreference Perception of Virtual Avatar Appearance in Human-Computer Communication

Ayumi Takemoto[1] (ayutakemo@gmail.com), Motoaki Sugiura[1]; [1]Tohoku University

The development of human-computer interaction systems has accelerated over the past decade, especially since the beginning of COVID-19. However, as you did, users quickly get bored and stop using such new technologies. To develop a human-computer communication system using virtual avatars without losing the user's interest and attention, the neural mechanisms in the perception of virtual avatars that users want to talk to again were tackled in this research. Forty-two healthy individuals participated in the experiment. Participants watched two videos in sequence in which two virtual avatars introduced themselves, then they reported which avatars they wanted to talk to again. Meanwhile, brain activities were corrected by 3 Tesla-functional magnetic resonance imaging (fMRI). After that, personality traits and avatar impressions were reported. The results indicated that the left middle temporal gyrus which is associated with reacting toward familiar faces, was more activated in the selected avatars than in the non-selected. Furthermore, a few personality traits based on Big-5 personality traits correlated with the brain activity of the right frontal eye field in the superior frontal gyrus which is associated with emotional valence. We will introduce the differences in neural networks and the effects of individual differences when virtual avatars do or do not hold the user's attention in the presentation, and the possibility of measuring preference or non-preference for virtual avatars using brain activity.

Topic Area: EMOTION & SOCIAL: Person perception

D107 - Hormonal Contraceptive Use Predicts Increased Salience Network Activity During Face Detection

Luna Malloy[1] (luna.malloy@austin.utexas.edu), Paige Broski[1], Hamza Suhail[1], Ali Arain[1], Elizabeth Bauer[1], John Leri[1], Josh Cisler[1]; [1]The University of Texas at Austin Dell Medical School

Research has demonstrated a positive association between ovarian hormones and face and facial emotion detection. The present study investigated the impact of hormonal contraceptive (HC) use on neural activation patterns, utilizing support vector machine (SVM) classifiers to predict neural activity during an fMRI face detection task. We hypothesized that HC use would predict increased activity in neural networks associated with face and/or facial emotion detection. Female participants aged 21-50 (N=89; 39 using HCs and 50 naturally cycling) completed an fMRI task in which they were asked to discern between neutral and fearful faces displayed for varying "covert" (33ms) and "overt" (500ms) durations. First, we employed SVM classifiers to build a model that predicted face vs. no face stimuli viewing based on salience network activity. Then, we used the model to generate individualized face predictions (IFPs) for each participant through a leave-one-out cross-validation approach. Finally, we employed linear mixed-effects models to explore the effects of HC use, valence (fearful/neutral), and duration (covert/overt) on IFPs. There was a main effect of HC use such that compared to naturally cycling women, women using HCs demonstrated greater salience network-based IFPs regardless of valence and duration, $t(2635)=2.483$, $p=.013$. This finding indicates that HC use may be associated with increased salience network activity when detecting faces, adding to the body of research suggesting that HC use might impact the neurocircuitry underlying face detection.

Topic Area: EMOTION & SOCIAL: Person perception

D108 - Brain activation during suicide specific cognition: Insights from the S-IAT in Post-9/11 Veterans

Audreyana Jagger-Rickels[1,2,3,43,] (acrickel@bu.edu), Jaclyn Kearns[1,2,4], Travis Evans[3], David Rothlein[1,2,3,4,5], Craig Bryan[6], William Millberg[7,8,9], Catherine Fortier[7,8,9], Joe DeGutis[1,3,7,8], Michael Esterman[1,2,3,4,5,7]; [1]VA Boston Healthcare System, [2]National Center for PTSD, [3]Boston Attention and Learning Lab, [4]Boston University Chobanian and Avedisian School of Medicine, [5]Neuroimaging Research for Veterans, [6]Ohio State University, [7]Translational Research Center for TBI and Stress Disorders, [8]Harvard Medical School, [9]Geriatric Research, Education, and Clinical Center

The Suicide Implicit Association Test (S-IAT) captures the strength of the implicit identification between oneself and death (i.e., death – me identification), and is one of the only behavioral tasks that is uniquely predictive of future suicide risk. Identifying brain regions involved in death – me identifications may provide important insights into the neural mechanisms underlying suicidal thoughts and behaviors. However, few studies have investigated brain activity during the S-IAT, and none have done so in a clinical or trauma-exposed veteran population. To address this question, this study measured brain activation during the S-IAT with concurrent fMRI in a clinical, post-9/11 trauma-exposed veteran sample. Behaviorally, participants were slower to categorize words during incongruent (death – me) contexts relative to congruent (life – me) contexts ($p < 0.001$), reflecting greater implicit identification of oneself with life than death. Whole-brain voxelwise fMRI contrasts revealed a brain network that was significantly more active during incongruent trials (death - me) than congruent trials (life – me) that included the bilateral occipital, posterior parietal, insula, and cerebellum (corrected $p < 0.05$), potentially supporting the resolution of the conflict between representations of oneself and death. These results suggest that death – me identifications involve resolving implicit conflict between self and death representations in the brain and marks an important step towards characterizing neural mechanisms that contribute to suicidality.

Topic Area: EMOTION & SOCIAL: Self perception

D109 - Self-Referential Processing Biases in Help-Seeking Youth with Internalizing Problems: Preliminary Insights from Baseline Data of the PRYME Study

Maud Schepers[1,2,3] (maud.schepers@donders.ru.nl), Paul Lagerweij[1,2,3], Marije Zwaneveld[1], Roshan Cools[1,3], Anne Speckens[2,3], Guusje Collin[1,2,3]; [1]Donders Institute for Brain, Cognition, and Behavior, Radboud University, Nijmegen, the Netherlands, [2]Expertise Center for Mindfulness, Department of Psychiatry, Radboud University Medical Center, Nijmegen, the Netherlands, [3]Department of Psychiatry, Radboud University Medical Center, Nijmegen, the Netherlands

Internalizing problems, such as worrying, anxiety and low mood are increasingly common in youth and may signal early stages of mental illness development. Negativity biases in self-referential processing are a potential mechanism contributing to the development of internalizing symptoms. Such biases have been linked to sadness and self-dislike in adults with depression (Beevers et al., 2019) and in youth with (subclinical) depression (Auerbach et al., 2015; Connolly et al., 2016). The currently ongoing Promoting Resilience in Youth through Mindfulness mEditation (PRYME) study (https://classic.clinicaltrials.gov/ct2/show/NCT05916651) investigates the effects of a mindfulness-based early intervention on internalising symptoms and associated cognitive and neural processes in 155 help-seeking youth (16-25 yo). I will present preliminary findings on self- and other-referential processing at baseline, assessed using a Self-Referent Encoding Task (SRET; cf. Derry & Kuiper, 1981). This task measures endorsement of and memory biases for positive and negative trait adjectives. Preliminary results revealed a positive association between the proportion of negative words endorsed as self-relevant and internalizing problems, such that higher negative self-endorsement was associated with higher levels of internalizing problems. While participants generally endorsed positive trait adjectives as self- and other-relevant more than negative trait adjectives, subgroup analysis revealed that individuals diagnosed with depression were more likely to associate negative traits with themselves compared to those without a depression diagnosis. These findings were not evident during the recall or recognition phases. In addition to presenting preliminary baseline findings, I will discuss hypotheses regarding the effects of mindfulness training on self-referential processing and associated neural mechanisms.

Topic Area: EMOTION & SOCIAL: Self perception

D110 - Within-individual neural patterns differ for memories of self- and other-generated interpretations of the same stimuli

Clara Sava-Segal[1], Tory Benson[2], David Igbalajobi[1], Emily Finn[1]; [1]Dartmouth College, [2]Rutgers University

Ambiguous information can be interpreted and remembered in multiple ways, providing a tool for studying subjective memory. Social contexts, like considering others' opinions, often expose us to interpretations different from our own. The role of source (self- or other-generated) in subjective recall remains underexplored. We developed an encoding-recall paradigm using ambiguous images that generated multiple interpretations. Participants (N=41) underwent fMRI across two sessions. In session-1, on each trial, they viewed an image, generated their own interpretation (SELF), and saw another person's interpretation (OTHER). A week later, in session-2, participants freely viewed each image again, then were cued to recall SELF and OTHER interpretations one at a time (order counterbalanced across trials). Behaviorally, both interpretations were recalled above chance, though SELF was recalled more accurately. SELF and OTHER became more similar in memory, but this merge was asymmetrical: OTHER memories shifted to resemble SELF more than vice versa (p<.001). Neurally, we compared multivariate activity patterns in 100 cortical parcels during SELF-vs.-OTHER-cued viewings. Cueing with different interpretations significantly shaped neural activity across multimodal cortical regions, despite identical sensory input (q<.05). The "asymmetrical merging" was mirrored neurally, with less distinct patterns for the two interpretations in the temporal poles and angular gyrus on trials where OTHER merged more toward SELF. This suggests self-generated interpretations serve as a default "anchor" in memory. Further, neural activity during uncued viewing also resembled SELF-cued more than OTHER-cued patterns. These findings suggest self-generated interpretations dominate subjective recall by anchoring how ambiguous information is remembered.

Topic Area: EMOTION & SOCIAL: Self perception

D111 - Finding the Self in Other's Music: Self and Other Representations in Prefrontal & Parietal Cortices During Music Listening

Nicholas Kathios[1] (kathios.n@northeastern.edu), Kelsie L. Lopez[1], Rebecca Hennessy[1], Quincy Dillard[1], Fahim Ahmed[2], Rishitha Kudaravalli[1], Juliet Y. Davidow[1], Laurel J. Gabard-Durnam[1], Psyche Loui[1]; [1]Northeastern University, [2]Harvard University

Music has a unique ability to foster bonds between listeners. People affiliate with others who have similar musical tastes, suggesting that music listening may engage networks of the brain supporting social cognition and empathy (the ability to understand others' affective states). Listening to self-selected (relative to researcher-selected) music engages areas of the brain which support self-referential processing, e.g., the default mode network. However, these results are confounded by the effect of liking: participants self-select music they like. Here, we disentangle self-selection and liking by asking participants to 1) self-select music they do and do not like, and 2) rate whether the music matches their own taste. Young adults (n=36) listened to self- or researcher-selected musical excerpts while undergoing fMRI. Participants rated each excerpt on liking and how closely it resembled their own music or that of close friends, acquaintances, or strangers (social closeness). More liked musical excerpts (regardless of self- vs. researcher-selection) elicited activation in the ventral striatum and ventral medial prefrontal cortex (vmPFC), but this did not overlap with the effect of listening to self- over researcher-selected music in the the dorsal mPFC (regardless of liking). Furthermore, a parametric contrast on social-closeness ratings showed negative effects in the right supramarginal gyrus, an area implicated in empathy tasks (p<0.05,TFCE-FWE-corrected). Results suggest that music listening, depending on its perceived social closeness, can activate brain networks implicated in self- and other-representations and empathizing independent of liking.

Topic Area: EMOTION & SOCIAL: Self perception

D112 - Beyond Self-Report: Direct Detection of Depressive Symptoms from Neural Activity

Apoorva Vallampati[1] (avalla01@tufts.edu), Victoria Sharpe[1], Arim Choi-Perrachione[1], Julia Klein[1], Maggie Wargo[1], Bethany Bracken[2], Spencer Lynn[2], Gina R. Kuperberg[1,3]; [1]Tufts University, Medford, MA, USA, [2]Charles River Analytics, Cambridge, MA, USA, [3]Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Depression is typically assessed through clinical interviews and self-report questionnaires. These approaches, however, are prone to biases from conscious deliberation and self-presentation. Can symptoms instead be inferred directly from patterns of brain activity produced as individuals read depression-consistent and -inconsistent statements? To address this question, we developed 160 self-relevant vignettes designed to evaluate various domains of depression, including emotional (e.g., mood, guilt), cognitive (e.g., concentration, suicidal ideation), behavioral (e.g., motivation, withdrawal), and physiological (e.g., energy, appetite), as informed by rating scales and the DSM-5. Each vignette was carefully controlled to isolate specific symptoms from the valence of a sentence-final critical word (e.g., "…Lately my mind hasn't been that/has been quite foggy/clear"). We recorded event-related potentials as 39 participants with a range of scores on the Beck Depression Inventory read these vignettes word-by-word. In participants with higher depression scores, depression-consistent (versus inconsistent) critical words elicited a sustained positivity between 300-1000ms. This effect was highly selective: participants with lower depression scores showed no such differences, and neither group exhibited differences in activity when reading the same critical words in a matched set of non-self-relevant vignettes. These findings demonstrate that depressive symptoms can be directly detected from neural activity recorded during natural reading, which reflects the earliest stages of access to meaning (300–500ms) and later evaluative processing (500ms onward). These targeted, self-relevant vignettes provide a promising foundation for developing a measure to objectively evaluate depressive symptomatology directly from neural activity, without the need for explicit behavioral responses.

Topic Area: EMOTION & SOCIAL: Self perception

D113 - Accelerating Sleep Onset with Wireless EEG Biofeedback

James Glazer[1], Ken A. Paller[1]; [1]Northwestern University

Sleep is essential for human brain function. Yet, many people have occasional difficulty falling asleep and 10-15% meet diagnostic criteria for insomnia disorder. Although sleep is well-studied, many unanswered questions remain about why people sometimes struggle to fall asleep. Electroencephalographic (EEG) studies have linked delayed sleep onset with prolonged high-frequency activity (e.g., alpha and beta) and faster sleep onset with rising low-frequency activity (e.g., theta and delta). Given advances in wearable biosensors, we attempted to improve sleep using brain and body biofeedback in the home over multiple nights. Auditory feedback changed based on real-time data from a consumer sleep-monitoring device (Muse-S); slower brainwaves and decreased movement produced reductions in sound intensity. Participants (N=19) slept as usual on one night, followed by 2 days with 20-min biofeedback sessions each day while awake and again at bedtime while falling asleep, and they were generally able to reduce feedback intensity. Furthermore, participants successfully reduced alpha-theta and beta-theta ratios on biofeedback nights relative to the first-night baseline, with lowest ratios on the final night. Both ratio reductions correlated with reduced subjective sleep latency. These findings need to be confirmed using additional control conditions, given the possibility of order effects between the first night and subsequent biofeedback nights. We are also planning more extensive studies. These preliminary results nevertheless suggest that individuals can learn to modulate brain rhythms and accelerate sleep onset after a few biofeedback sessions. At-home biofeedback could provide an easily scalable approach to supplement other strategies for treating mild sleep difficulties.

Topic Area: METHODS: Electrophysiology

D114 - Using EEG to Predict Dementia Risk and Cognitive Resilience in Elderly Patients Undergoing Surgery

Yessica Martínez Serrato[1] (y.martinez-serrato@bham.ac.uk), Thomas Jackson[1], Ali Mazaheri[1]; [1]The University of Birmingham

Introduction: Elective surgeries in older adults often lead to cognitive decline, including delirium and memory issues. Disruptions in attention networks, particularly the alerting network, have been linked to post-surgical cognitive deficits. This study examines task-related EEG changes, specifically alpha modulation during the Attention Network Task (ANT), as predictors of post-operative cognitive resilience. Additionally, we investigate the role of inflammatory markers in cognitive vulnerability after surgery. Methods: Pre-surgical EEG recordings will be collected during the ANT to assess alerting, orienting, and executive control networks. The primary focus is alpha modulation within the alerting network, hypothesizing that its efficiency predicts post-operative cognitive outcomes. Inflammatory markers will be analyzed to explore their relationship with attention network function and cognitive resilience. EEG and inflammatory profiles will be integrated with clinical data to identify key predictors of post-surgical cognitive decline. This study is conducted in collaboration with multidisciplinary teams at the University of Birmingham and NHS Trusts. Results: We hypothesize that stronger alpha modulation in the alerting network will correlate with better cognitive resilience, while disrupted modulation may indicate higher risk for cognitive decline. Additionally, elevated inflammatory markers may correlate with weaker alpha modulation, suggesting an interaction between inflammation and attentional control in predicting cognitive outcomes. Conclusion: This research highlights alpha modulation in the alerting network as a key biomarker for post-surgical cognitive outcomes. By integrating EEG and inflammatory profiles into pre-surgical evaluations, we aim to develop a comprehensive tool to identify at-risk patients, guiding interventions to improve recovery in elderly populations.

Topic Area: METHODS: Electrophysiology

D115 - Screening for amyloid positivity in patients with mild cognitive impairment using an electroencephalography-driven functional network

Hayom Kim[1,2] (happyhy3@gmail.com), Jung Bin Kim[1,2]; [1]Korea University College of Medicine, [2]Korea University Anam Hospital

Introduction While monoclonal antibodies targeting Amyloid-β (Aβ) offer disease-modifying potential, identifying suitable candidates at the mild cognitive impairment (MCI) stage in Alzheimer's disease (AD) remains critical. This study explored whether resting-state electroencephalography (EEG) network indices can discriminate Aβ-positive from Aβ- negative groups in MCI. Methods Participants with cognitive decline were classified into subjective cognitive decline (SCD), MCI, or dementia groups. Aβ-positivity was determined using 18F-flutemetamol PET/CT. Resting-state EEG data were analyzed for functional connectivity (FC) using weighted phase lag index, and global network properties were assessed via graph theoretical analysis. Machine learning algorithms evaluated the discriminative ability of these metrics for Aβ-positivity in MCI. Results Among 100 participants (19 SCD, 55 MCI, 26 dementia), 53 were Aβ-positive. In the MCI subgroup, Aβ-positive individuals (n = 28) exhibited lower strength, global efficiency, local efficiency, clustering coefficient, and transitivity in the delta band compared to Aβ-negative (all $p < 0.05$). Machine learning algorithms using these features achieved an AUC of up to 0.835. Conclusion Resting-state EEG network indices could be a non-invasive, cost-effective tool for screening Aβ-positivity in MCI. These findings suggest the potential of global network measurements as biomarkers for early diagnosis, disease monitoring, and therapeutic evaluation in the era of monoclonal antibody therapies for AD.

Topic Area: METHODS: Electrophysiology

D116 - Examining resting state EEG reliability between laboratory and clinical settings

Erin S.M. Matsuba[1] (erin.matsuba@childrens.harvard.edu), Alex Job Said[1], Margaret Norberg[1], Charles A. Nelson[1], Carol L. Wilkinson[1]; [1]Boston Children's Hospital

Electroencephalography (EEG) is increasingly being used as a tool to aid in early identification efforts for neurodevelopmental disorders. However, less is known regarding how EEG-based biomarkers may generalize from highly standardized laboratory settings into real-world environments. Thus, this study evaluates the reliability of resting state EEG features between laboratory and clinical settings. Resting state EEG recordings were obtained from participants aged 4 months to 34 years (n=16) across two settings: a space adjacent to a primary care waiting room of a large hospital and a dimly lit, electrically isolated, and sound-attenuated laboratory room. Mean absolute error (MAE) and intraclass correlation coefficients (ICC) were used to quantify the magnitude of difference between laboratory and clinic settings for the power spectrum, periodic and aperiodic components. The MAE between laboratory and clinical settings for the power spectrum was 0.12 (SD=0.07), the periodic component was 0.05 (SD=0.03), and the aperiodic component was 0.14 (SD=0.09). Previous studies have described acceptable MAE values for the adequacy of spectral fit between 0.025-0.1 (Ostlund et al., 2022). ICC (2,1) for periodic components was poor for delta (0.47), moderate for gamma (0.72) and high beta (0.75), and good for theta (0.76), low alpha (0.80), high alpha (0.83), and low beta (0.83) frequency bands. ICC (2,1) was good for aperiodic slope (0.81) and excellent for aperiodic offset (0.91). These findings suggest that resting-state EEG features demonstrate respectable reliability across settings. This increases the generalizability and accessibility of EEG as a potential clinical tool to identify neurodevelopmental disorders.

Topic Area: METHODS: Electrophysiology

D117 - Prediction of Critical Speech Sites in Glioma-Infiltrated Cortex using Intraoperative, Resting State Electrophysiologic Biomarkers

Vardhaan Ambati[1], Sanjeev Herr[1], Jasleen Kaur[1], Paul Villalobos[1], Emily Cunningham[2], Youssef Sibih[1], Sena Oten[1], Alexander Aabedi[1], David Brang[2], Shawn Hervey-Jumper[1]; [1]University of California, San Francisco, [2]University of Michigan

Background Diffuse gliomas often invade speech-critical areas, making maximal safe resection difficult. Direct cortical stimulation (DCS) identifies functional (DCS+) vs. nonfunctional (DCS-) cortex but is technically demanding. This study investigates electrophysiologic biomarkers of DCS+ cortex to improve surgical safety and efficiency. Methods Prospectively collected intraoperative local field potentials (Theta [4-8 Hz], Alpha [8-13 Hz], Beta [13-30 Hz], Gamma [30-70 Hz], High Gamma [70-150 Hz]) from subdural arrays in glioma-infiltrated cortex were compared between DCS+ and DCS- sites. Machine learning classifiers (separate for LGG and glioblastoma [GBM]), using stacked logistic regression and XGBoost, were trained (80%) and tested (20%) to predict DCS+ vs. DCS- sites using resting-state power spectral data (frequency x power). Results In total, 1421 cortical sites were studied, with 512 sites aligned to electrodes (49 DCS+) in 91 patients (oligodendroglioma 21, astrocytoma 22, GBM 48). In LGG (oligodendroglioma/astrocytoma), DCS+ cortex exhibited significantly higher Alpha, Beta, Gamma, and High Gamma power (all p<0.05). In contrast, DCS+ sites in GBM (N=20) showed only increased High Gamma power (p<0.05). Classifier accuracy for LGG was 94%, for GBM 92%. Permutation tests confirmed significant classification performance (LGG: p<0.001; GBM: p=0.0001). Conclusion This is the first study to predict DCS status based on resting-state electrophysiologic biomarkers and demonstrates that identification of DCS+ areas based on frequency power may aid in safe glioma resection. Additionally, these results highlight tumor/grade-specific effects on cortical function (LGG vs. GBM DCS+ sites had different spectral power signatures), prompting further investigation into tumor/grade-specific effects on neural circuits.

Topic Area: METHODS: Electrophysiology

D118 - Brain Magnetic Resonance Imaging (MRI) Findings Among Patients Presenting with Neurological Symptoms at a Nigerian Tertiary Health Care Facility

Kenneth Chiedozie Oparaji[1] (chiedozieoparaji@gmail.com), Darlington-Peter C. Ugoji[2], Victor U. Chukwu[2], Miracle N. Okoche[1], Chibuike G. Okereke[1], Henry C. Ibere[1], Victory E. Onyenagbagha[1], Yadirichukwu J. Nwani[1]; [1]Alex Ekwueme Federal University Ndufu-Alike Ikwo (AE-FUNAI), [2]David Umahi Federal University Teaching Hospital (DUFUTH)

CONTEXT AND OBJECTIVE: In Nigeria, the burden of neurological disorders is growing, and this poses significant challenges for our frail health-care systems. This informed the need for the investigation of local (African) brain MRI data to better understand these abnormalities and their pattern of presentation. METHODOLOGY: As a retrospective study, it was designed to review clinical data and MRI reports of 51 patients who presented at a tertiary health facility (DUFUTH) in Uburu, Ebonyi State, Nigeria between January 2023 and June 2024. Demography, image findings, and the relationship between the MRI findings, age, and sex were data obtained and analysed using descriptive and inferential statistics with the degree of significance set at p < 0.05. RESULTS: This study involved 25 females and 26 males, aged 0 to 95 years. About 19 (37.25%) patients had normal brain MRI findings, while 32 (62.75%) were abnormal. The most common pathologies noted were brain tumour (25.49%), followed by hydrocephalus (17.65%), and white matter diseases (13.73%). Age group 0-23 years had the highest number of pathological findings (37%); this was followed by age group 24-63 years (21%). No significant association (P>0.05) was found to exist between gender and the MRI findings. CONCLUSION: The most common brain MRI findings were brain tumours, hydrocephalus, and white matter diseases respectively. The study adds to existing data-sets, and

also highlights common brain pathologies in a local African tertiary hospital setting which will not only offer research-based insights but also, clinical and medical perspectives.

Topic Area: METHODS: Neuroimaging

D119 - Between-movie variability severely limits generalizability of "naturalistic" neuroimaging

Simon Leipold[1], Rajat Ravi Rao[1], Jan-Mathijs Schoffelen[1], Sara Bögels[1], Ivan Toni[1]; [1]Donders Institute for Brain, Cognition, and Behaviour, Radboud University

"Naturalistic imaging" paradigms, where participants watch movies during fMRI, have gained popularity over the past two decades. Many movie-watching studies measure inter-subject correlation (ISC), which refers to the correlation between participants' neural activation time series. Previous research has focused on explaining ISC differences during movie-watching based on individual states and traits, such as social distance, personality, and political orientation. For example, friends show higher ISC than strangers while watching movies. However, movies are not natural categories but cultural artifacts that evoke varying levels of ISC depending on content, directing style, or editing methods. This raises questions about how much trait- or state-like differences in ISC depend on the specific movies chosen, potentially limiting the generalizability of findings across different movies. Here, we used an fMRI dataset of 112 participants watching eight animated movies to (a) quantify between-movie variability in ISC across the brain and (b) assess the implications for the generalizability of trait- or state-like effects on ISC. We found substantial between-movie variability in ISC, with this variability differing across brain regions. Crucially, brain regions with the highest ISC exhibited the greatest variability, indicating that trait- or state-like differences in ISC from one movie may not generalize to others. We conclude that variability between movies limits the generalizability of trait- or state-like ISC differences. Using a specific movie in neuroscience should be treated similarly to using a particular task, requiring a comparable characterization of the constituent cognitive elements. Broad generalizations about "naturalistic imaging" or "movie watching" are not warranted.

Topic Area: METHODS: Neuroimaging

D120 - Functional connectivity changes associated with depression in dementia with Lewy bodies

Manon Querry[1] (m.querry@unistra.fr), Anne Botzung[2], Marion Sourty[1], Elena Chabran[1], Léa Sanna[2], Paulo Loureiro de Sousa[1], Benjamin Cretin[2], Catherine Demuynck[2], Candice Muller[2], Alix Ravier[2], Benoît Schorr[2], Nathalie Philippi[2], Frédéric Blanc[1]; [1]Icube Laboratory (CNRS, UMR 7357), IMIS team, [2]University Hospitals of Strasbourg, Research and Resources Memory Center

Depression is frequent in the early stages of dementia with Lewy bodies (DLB), and more than half of DLB patients would have a history of depression. Our study sought to investigate the functional connectivity (FC) changes associated with depression in prodromal to mild DLB patients compared with controls. MRI data were collected from 66 DLB patients and 18 controls. Depression was evaluated with the Mini International Neuropsychiatric Interview. Resting-state FC (rsFC) was investigated with the CONN toolbox using a ROI-to-ROI approach and both regression and comparison analyses. Correlations were found between the depression scores and the rsFC between fronto-temporal and primary visual areas in DLB patients ($p < 0.05$, FDR corrected). Depressed DLB patients also showed decreased rsFC within the salience network (SN), increased rsFC between the default mode network (DMN) and the language network (LN) and decreased rsFC between the cerebellar network (CN) and the fronto-parietal network (FPN) compared to non-depressed DLB patients ($p < 0.05$, uncorrected). Comparison analyses between treated and non-treated DLB patients highlighted FC changes in treated patients involving the SN, the DMN, the FPN and the dorsal attentional network ($p < 0.05$, uncorrected). Our findings highlighted specific FC changes associated with depressive symptoms in DLB. The SN would especially be a key network for understanding the link between DLB and depression. Furthermore, the rsFC alterations we identified in dDLB patients could contribute to emotional symptoms and cognitive bias related to depression. However, antidepressants might be able to act on brain networks and improve depressive symptomatology.

Topic Area: METHODS: Neuroimaging

D121 - Examining the role of phonological and semantic mechanisms during morphological processing of sentences in seven-year-old children

Marjolein Mues[1] (marjolein.mues@vanderbilt.edu), Avantika Mathur[1], James Booth[1]; [1]Vanderbilt University

Introduction: Morphological skill is a linguistic feature impacting language and literacy outcomes. Its neural underpinnings have mostly been examined at the word-level. We examined if phonological and semantic mechanisms play a role during morphological processing in sentences in seven-year-old children and whether language skills were associated with a greater reliance on either mechanism. Methods: This study was pre-registered. We examined the dorsal pathway (phonology; left posterior STG; IFG opercularis) and the ventral pathway (semantics; left posterior MTG; IFG triangularis). We selected the top 500 voxels associated with phonology and semantics using a novel functional localizer approach that correlated activation with standardized scores for phonology and semantics. We examined activation in these voxels during an in-scanner morphology task that included sentences with and without morphological error. Language skill was characterized behaviorally. Results: Both phonological regions were significantly activated during the morphology task, compared to only one of the semantic regions (IFG triangularis). We did not observe a correlation with language

in our ROIs. Exploratory whole-brain analyses revealed a brain-behavior correlation in the cerebellum showing that greater activation was related to lower language abilities. We also examined morphological processing in five-year-olds, but did not observe significant results, likely due to a small sample (n = 32 while n = 100 for seven-year-olds). Conclusion: Our results suggest that processing morphological structures in sentences relies on phonemic segmentation and those with lower language may compensate for lower phonological skill by engaging the cerebellum to amplify and refine those phonemic representations to aid in segmentation.

Topic Area: METHODS: Neuroimaging

D123 - Improving Infant MRI Success Rates in HBCD Study Visits

Olivia Poolos[1], Emily K. Walsh[1], Vicky Acuna[1], Alberto Martínez-Hernández[1], Michelle Bosquet Enlow, PhD[1], P Ellen Grant, MD, MSc[1], Banu Ahtam, DPhil[1]; [1]Boston Children's Hospital

The HEALthy Brain and Child Development (HBCD) Study is a nationwide, longitudinal study examining neurological, cognitive, physical, and social development in infants and children. One major assessment used is magnetic resonance imaging (MRI), performed at multiple timepoints across infancy and throughout childhood. MRI is a powerful tool in examining brain development in infants. For successful data collection, infants must sleep, unsedated, through the procedure. The Boston Children's Hospital HBCD Study site examined MRI success rates at BCH and observed that newborn scans (N= 66; Mage=1.04 months; SD=0.13) were 16.2% more successful than older infant scans (N = 36; Mage= 6.81 months; SD= 1.53). The objective of the present study was to examine relative success rates for infant MRIs (conducted between 3 and 9 months) in conjunction with the order of other study activities. The goal was to determine the visit schedule that maximizes scan success rates. Infant visit activities include an electroencephalogram (EEG), two behavioral tasks, and an MRI. Infants who completed an EEG and at least one behavioral task before the MRI had an MRI success rate of 74% (N = 19) compared to a 40% success rate for infants who completed no EEG and fewer than two behavioral tasks before the scan (N = 15). Our findings suggest that performing EEG and at least one behavioral test before MRI increases MRI success rates for infants aged 3-9 months. These findings could help inform subsequent studies attempting unsedated MR imaging on infant populations.

Topic Area: METHODS: Neuroimaging

D124 - Detection of language network during free speech using Optically Pumped Magnetometers (OPMs)

Josefina Weinerova[1], Ryan Hill[2], Roni Tibon[1]; [1]School of Psychology, University of Nottingham, [2]Sir Peter Mansfield Imaging Centre (SPMIC), University of Nottingham, United Kingdom

Our memories of events represent a key aspect of our identity. Recently, there has been a shift to using more naturalistic approaches to studying memory, especially memory encoding. Natural retrieval on the other hand is currently poorly understood. This is partly due to methodological challenges. In natural settings memories are often retrieved within a conversation. However, with the sensitivity of most imaging methods to movement artifacts, recording brain activity while participants engage in a conversation can be challenging. This study aims to develop and validate a method to analyse brain signals during continuous speech, using the Optically Pumped Magnetometers (OPMs). OPMs can be used to characterise brain activity on a millisecond timescale and are more resilient to movement artifacts. We will utilise these advantages to investigate whether we can accurately detect brain activity during continuous speech. We will use a rapid visual presentation (RSVP) task where participants will be exposed to 4 conditions: sentences and nonword sequences read overtly or covertly. We expect to detect the well-established language network using the contrast between sentences and nonword sequences. The key addition is the contrast between the overt and covert reading condition which will allow us to develop a specialized pipeline to detect comparable language network for each condition and participant, despite increased movement and muscle artefacts in the overt reading condition. This study has the potential to create a way to study brain function during continuous speech, therefore enabling further research that would significantly improve our understanding of natural memory retrieval.

Topic Area: METHODS: Neuroimaging

D125 - Exploring the impact of pediatric acquired demyelinating syndrome in brain network connectivity and its influence on neurocognitive outcomes

Florencia Ontiveros[1], Whitney I. Mattson[1], Aaron McAllister[2], Kelsey Poisson[3], Camille S. Wilson[4], Eric E. Nelson[1,5]; [1]Center for Biobehavioral Health, Abigail Wexner Research Institute, Nationwide Children's Hospital, Columbus, OH, [2]Department of Radiology, Nationwide Children's Hospital, Columbus, OH, [3]Division of Neurology, Department of Pediatrics, Nationwide Children's Hospital, Columbus, OH, [4]Division of Pediatric Psychology and Neuropsychology, Nationwide Children's Hospital, Columbus, OH, [5]Department of Pediatrics, The Ohio State University College of Medicine, Columbus, OH

Pediatric acquired demyelinating syndromes (PADS) are a group of neuroimmune disorders characterized by acute episodes of myelin injury. Although specific neurocognitive manifestations during episodes have been well characterized, the impact of PADS on systematic brain function is not completely understood. We hypothesized that PADS would negatively impact network connectivity, and adversely affect global cognitive functioning, which may be particularly impactful on brain development. Participants were 14 youth with PADS (Mage=15.93yr; Male=42.85%) and 23 matched healthy controls (HC; Mage=15.34yr; Male=30.44%). Patients with a PADS diagnosis were enrolled during hospitalization for treatment of symptoms and controls were recruited from the community. Participants completed 10 minutes of resting-state fMRI and a neurocognitive battery which included the Wide Range Achievement Test (WRAT-5). Preliminary results indicate a trend toward reduced connectivity within the dorsal attention ($F(1,35)=3.81$, $p=.06$) and fronto-parietal ($F(1,35)=3.02$, $p=.09$) networks among PADS patients. However, no differences were found on neuropsychological tests (ps=.13-.78). We used a regression model to predict performance on the WRAT-5 with group, network connectivity, and their interaction. The interaction term was significant, ($t(32)=-2.61$, $p=.01$), suggesting that higher connectivity of the language network predicted higher performance on the WRAT-5 in the control group but showed no relationship in the PADS group. These preliminary results suggest PADS may impact network connectivity beyond cognitive performance but may also point toward plasticity in neurocognitive outcomes in this group. Larger studies will need to confirm these findings and assess how this manifests across development.

Topic Area: METHODS: Neuroimaging

D126 - Comparative Analysis of Input Devices for a Digitized Trail Making Task

Erin Lynch[1], Isabella* Frenzilli[1], Bailey Utiz[1], Emma Tinney[1], Tarkeshwar Singh[2], Timothy Morris[1], Mathew Yarossi[1]; [1]Northeastern University, [2]Pennsylvania State University*

The Trail-making test (TMT) is a neuropsychological test used by clinicians and researchers to detect changes in cognitive function, motor control, and visual scanning. The TMT is a connect-the-dots task where participants connect circles in numeric (ie. 1-2-3..., TMTA) or alphanumeric (ie. 1-A-2-B..., TMTB) order. The traditional TMT offers limited performance metrics in a single domain, like completion time. Therefore, we have developed a novel digitized trail-making test (dTMT) with integrated eye-tracking to capture quantitative spatial-temporal measures of domain (cognitive, visual, motor) specific performance. Our goal is to refactor this setup by replacing the digitizing tablet with an alternative input device to be used with functional magnetic resonance imaging (fMRI). The purpose of this study is to evaluate the criterion validity of two alternative input devices compared to the tablet version. Data collection was completed from 12 young, healthy individuals (18-28 years, 10 female) following institutionally approved informed consent. Each participant completed the dTMT with eye-tracking using three different devices: a Wacom tablet with a stylus (previously validated), an Xbox controller, and a TrackBall. Spatial and temporal features of the hand path and gaze path were extracted. Pearson's correlations were used to determine associations between the experimental devices (Xbox, Trackball) and the Wacom tablet. Overall, stronger correlations were found between Xbox and Wacom. This is supported by a larger interclass correlation across all features between Xbox and Wacom. Understanding how type of input device affects TMT visuomotor performance measures provides measurement validity for implementing the dTMT in an fMRI environment.

Topic Area: METHODS: Neuroimaging

D127 - Bridging fMRI Segmentation and 3D Printing for Detailed Modeling of Brain Anomalies

Aryan Kodali[1], Jonathan Barta[1]; [1]University of North Carolina at Chapel Hill

Functional neuroimaging techniques, particularly resting state functional MRI (rs-fMRI), have emerged as a powerful tool for mapping and displaying blood oxygen level dependent (BOLD) signals. This study presents a novel integration of fMRI processing, fMRI segmentation and 3D printing to create anatomically accurate brain models, designed to enhance patient and clinician understanding of various brain pathologies. The research involved preprocessing over 1,000 fMRI scans, including skull-stripping, normalization, and reorientation. Advanced medical software was utilized to segment regions of interest (ROIs) and produce 3D models. These models were printed to visually represent disrupted neural pathways, tumors, and other clinical conditions. The resulting models serve as a valuable tool for patient education and clinical planning.

Topic Area: METHODS: Neuroimaging

D128 - Hemispheric biases in automatic atlas-based cortical parcellations exaggerate surface area lateralization

Yinuo Liu[1], Ja Young Choi[2], Tyler K. Perrachione[1]; [1]Boston University, [2]Northwestern University

Anatomical asymmetry is a hallmark of the human brain and may reflect hemispheric differences in its functional organization. Powerful software like FreeSurfer can automate neuroanatomical measurements and facilitate studies of hemispheric asymmetry. However, surface area asymmetry results from FreeSurfer's default processing pipeline are curiously consistent across diverse samples. Here, we demonstrate that systematic biases in these measurements exist when using the default processing pipeline in FreeSurfer. We compared surface area asymmetry measured from reconstructions of natural brains vs. reconstructions of the same scans after flipping their left-right orientation. The default pipeline returned implausible asymmetry patterns across original and flipped brains (i.e., structures that were always left- or right-lateralized). In contrast, manual labelling of key structures yielded expected reversals of left/right lateralization in flipped brains. A linear SVM model trained to classify left vs. right hemispheres based on automatic regional surface area measurements was suspiciously accurate (>98%) for natural brains but mislabeled the vast majority (>80%) of flipped brains, further indicating biases in these measurements that do not reflect the underlying neuroanatomy. Notably, these biases are greatest in key speech and language regions. We determined that these biases result from discrepancies in how regional labels are defined in the default hemisphere-specific atlases. We further demonstrate how these biases can be ameliorated by using the symmetric registration templates and parcellation atlases available from FreeSurfer, but separate from the default pipeline. These results underscore the need for validating bias-free neuroanatomical measurements, particularly when studying regions likely to exhibit hemispheric lateralization.

Topic Area: METHODS: Neuroimaging

D129 - Defining a Photophobia Connectome: Abnormal Visual and Pain Network Activity Associated with Light Sensitivity in a Multimorbid Veteran Sample

Caroline Carrozzini[1,2,3], Madeleine Nowak[2,3,4], Jennifer A. Gustafson[1,2,5,6,7], David H. Salat[2,3,7,8], Catherine B. Fortier[2,7], William P. Milberg[2,7], Francesca C. Fortenbaugh[1,2,3,6,7]; [1]Cognitive & Sensory Systems Laboratory (CASSL), VA Boston Healthcare System, [2]Translational Research Center for Traumatic Brain Injury and Stress Disorders (TRACTS), VA Boston Healthcare System, [3]Neuroimaging Research for Veterans Center (NeRVe), VA Boston Healthcare System, [4]Department of Psychiatry, Boston University Chobanian & Avedisian School of Medicine , [5]Optometry Clinic, VA Boston Healthcare System, [6]New England College of Optometry , [7]Department of Psychiatry, Harvard Medical School, [8]Anthinoula A. Martinos Center for Biomedical Imaging

Photophobia, or abnormal light sensitivity, is a prevalent disorder primarily assessed through subjective self-report measures. It has frequently been linked to chronic pain and neuropsychiatric comorbidities, including PTSD, depression, and anxiety. While animal models have primarily focused on disrupted signal processing in early sensory nuclei (i.e., trigeminal pathways), the association between photophobia and psychiatric disorders suggests that cortical networks may play a critical role in chronic photophobia. This study investigated the relationship between self-reported photosensitivity and resting-state function connectivity (rs-fMRI) to identify distinct neural patterns associated with the condition. Data were analyzed from 204 post-9/11 Veterans in the Translational Research Center for TBI & Stress Disorders longitudinal cohort study. Participants were categorized as having photosensitivity (n=61) or not having photosensitivity (n=143) via self-report on item seven of the Neurobehavioral Symptom Inventory. Demographic, psychiatric, and clinical data were evaluated in conjunction with rs-fMRI scans. A hierarchical feature selection process identified a 7-feature connectome with maximum predictive accuracy for photosensitivity status (accuracy=74.02%, sensitivity=68.85%, specificity=76.22%, $p < 0.001$). Cross-validated discriminant analyses confirmed the specificity of these features to photosensitivity, independent of psychiatric or behavioral comorbidities. This study identified distinct functional connectivity patterns associated with photophobia, revealing a crucial neural link between visual processing and pain pathways. Findings suggest that photophobia is not exclusively a symptom of behavioral or psychiatric disorders but represents a unique neurophysiological process triggered by multiple interacting factors. These results suggest that alternative therapeutic approaches, such as transcranial magnetic stimulation, may be beneficial to effectively target photophobia in some patients.

Topic Area: METHODS: Neuroimaging

D130 - Graph theory reveals electroconvulsive therapy-induced whole-brain network integration and subnetwork changes in major depression and suicidality

K. Tristan Donaldson[1] (ktdonaldson@mgh.harvard.edu), Shane W. Walsh[1], Anirudh Chinthakindi[1], Olivia J. Newman[1], Samadrita R. Chowdhury[1], Kristen K. Ellard[1], Joan A. Camprodon[1]; [1]Massachusetts General Hospital and Harvard Medical School

Electroconvulsive therapy (ECT) effectively treats major depressive disorder (MDD), but its therapeutic mechanisms are unclear. Resting-state functional magnetic resonance imaging (rs-fMRI) and graph theory studies suggest ECT enhances whole-brain functional connectivity (FC) and reorganizes brain networks via generalized therapeutic mechanisms. While these effects may alleviate MDD symptoms, ECT's impact on suicidality—a core MDD dimension—and disruptions in specific subnetworks like the reward circuit remain unexplored. We analyzed a harmonized cohort of 32 subjects (16 males, 16 females; mean age 33 years, SD 12) who underwent pre- and post-ECT scanning on a Siemens Magnetom 3.0T XR MRI system. Subjects were classified into High Suicidality Depressed (HSD) and Low Suicidality Depressed (LSD) groups using suicide-specific responses from the CHRT-SR (14) scale. Resting-state functional connectivity was computed for the whole-brain and a predefined reward network using Pearson correlations. Graph theory metrics—mean degree, clustering coefficient, and global efficiency—were applied to identify potential network-level biomarkers distinguishing suicidal types within MDD. Preliminary findings indicate that whole-brain functional connectivity analysis showed no significant pre- and post-ECT differences. However, graph theory revealed significant increases in mean degree and global efficiency, suggesting enhanced brain network integration and improved inter-regional communication. A decrease in clustering coefficient indicated reduced local connectivity and greater global integration. Preliminary reward network analysis suggests targeted effects on circuits involved in motivation and anhedonia. These results highlight ECT's therapeutic mechanisms at global and circuit-specific levels, offering insights into MDD pathophysiology and suicide-specific risk.

Topic Area: METHODS: Neuroimaging

D131 - New Biomarkers Predict Post-stroke Behavioral Recovery

Emily Long[1] (elong@bu.edu), Rockwell Tang[1], Gülce Küreli[1], Evren Erdener[1,2], Piergiulio Bressan[1], John Jiang[1], Shashwat Shah[1], John Giblin[1], Sreekanth Kura[1], David Boas[1]; [1]Neurophotonics Center, Boston University, Boston, Massachusetts 02215, USA, [2]Institute of Neurological Sciences and Psychiatry, Hacettepe University, Ankara 06230, Türkiye

Motor and cognitive impairments, common consequences of stroke, significantly affect post-stroke functioning and quality of life. Early and accurate prediction of behavioral recovery is crucial for guiding targeted interventions and optimizing rehabilitation, emphasizing the need for reliable prognostic biomarkers. This study longitudinally examined ischemic stroke progression in a mouse model and identified two biological signals with diagnostic value for predicting behavioral recovery and outcomes: vascular oscillations and capillary stalling. Vascular oscillations are low-frequency oscillatory dynamics in the hemodynamic signal, typically observed within the 0.1-0.3 Hz band in mice; Capillary stalling occurs when capillary blood flow is transiently interrupted due to physiological changes including leukocyte-endothelium adhesion. Measurements of vascular oscillations in cerebral blood flow and capillary stalling were gathered using laser speckle contrast imaging (LSCI) and optical coherence tomography (OCT) respectively, while behavioral outcome was evaluated with cylinder tests. Our results revealed that the elevation in stalling events at week 1 post-stroke is correlated with a poorer behavioral recovery at week 2, whereas a higher oscillation power at week 1 predicts a better behavioral outcome at week 2. Mechanistic analysis showed that vascular oscillations enhanced recovery by reducing capillary stalling, indicating an interdependent relationship between these biomarkers. These findings underscore the potential of vascular oscillations and capillary stalling as prognostic biomarkers for stroke recovery and further experiments can be performed to determine the physiological drives for higher vascular oscillation powers and potentially discover new prognostic biomarkers to monitor stroke progression.

Topic Area: METHODS: Neuroimaging

D132 - The Impact of Internal Attention on Learning from Online Lectures

Vishal Easwar[1] (easwarv@bc.edu), Ido Davidesco[1], Jason Geller[1], Sarah Gilmore[2]; [1]Boston College, [2]University of Connecticut

Students often find it challenging to remain engaged during online lectures because attention, by its nature, tends to fluctuate between perceptually guided and self-generated thoughts (external and internal attention, respectively). However, little is known about how internal attention may promote or hinder student learning. This in-progress study explores this question by manipulating the frequency and duration of internal attention ("thinking") periods, inserted into an online lecture. In a large scale online study, undergraduate students (N = 640) are being asked to watch a pre-recorded biology lecture divided into five 5-minute segments. In the experimental condition, thinking periods are inserted between either three or all five of these segments, guiding students to quietly think about a lecture-related prompt for 15, 30, or 60 seconds before typing their answer. In the comparison condition, students press a button to advance to the next lecture segment. To measure student learning, they complete a pre- and post-test. A webcam-based eye-tracking system is used to assess student attention during the lecture. We hypothesize that students learn better with thinking periods, and particularly when they are at intermediate levels of frequency and duration. This study has implications for better designing structured opportunities for students to direct their attention internally to improve learning.

Topic Area: METHODS: Neuroimaging

D133 - Mapping the Neural Basis of Cotard Syndrome: Insights from Lesion Network Analysis

Mengyuan Ding[1,2] (jessy@neurospirituality.io), Morgan Healey[1], Yaser Sánchez Gama[1,2], Michael A. Ferguson[1,2]; [1]Neurospirituality Lab, Center for Brain Circuit Therapeutics, [2]Brigham and Women's Hospital, Harvard Medical School

Background: Cotard syndrome (CS), characterized by nihilistic delusions such as believing one is dead or non-existent, remains poorly understood due to its rarity and subjective presentation. Using lesion network mapping, we sought to identify brain network disruptions underlying CS to advance the understanding of its neuroanatomical basis. Methods: A systematic review identified 19 lesion-induced CS cases. Lesions were mapped onto a standard brain template, and functional connectivity was analyzed using a resting-state fMRI connectome from 1,000 healthy subjects. Sensitivity was tested by overlapping lesion network maps (threshold: $t > 4.7$) to identify regions connected to >70% of CS lesion sites. Specificity was assessed by comparing CS lesion networks to a stroke lesion dataset not associated with CS ($n = 135$). A CS conjunction map was derived from regions meeting both sensitivity and specificity criteria. Results: A CS-specific functional network was identified, with key nodes in the right inferior frontal lobe, anterior temporal pole, anterior insula, and temporoparietal junction. These regions are implicated in neuroimaging tests of CS cases, highlighting structural and metabolic disruptions in the right frontal, temporal, and parietal lobes. Their roles in self-awareness, emotional regulation, and bodily perception align with the symptoms of CS, providing a cohesive neural explanation for its characteristic delusions. Conclusions: This study identifies a functional network underlying Cotard syndrome, implicating disrupted connectivity in self-perception and body ownership. These results provide a framework for understanding CS and suggest potential targets for neuromodulation, paving the way for future research into this enigmatic condition.

Topic Area: METHODS: Neuroimaging

D134 - Assessing the Reliability of MRS Estimates of GABA and Glx

Silvia Abbasi[1] (silviaa@umich.edu), Esther Kim[1], Bingjie Liu[1], Noah Reardon[1], Kayla Wyatt[1], Thad A. Polk[1]; [1]University of Michigan

Magnetic resonance spectroscopy (MRS) is increasingly used to estimate levels of the inhibitory neurotransmitter gamma-aminobutyric acid (GABA) in the human brain non-invasively. This is challenging because GABA concentrations are relatively low and its signal overlaps with other metabolites'. A common approach uses a MEGA-PRESS sequence, alternating between GABA-selective excitation pulses and non-selective pulses to compute a difference spectrum isolating GABA. GABA estimates derived this way are often corrected for the brain region's tissue composition (tissue correction) and the proportion of GABA expected in gray versus white matter (alpha tissue correction). A similar approach estimates levels of glutamate and glutamine in a combined signal called Glx. This study examines the test-retest reliability of MRS estimates of GABA and Glx in a longitudinal sample of 59 older adults (mean age at initial session = 70.02, second session = 74.20, average interval = 4.21 years) using intraclass correlation coefficients. All participants completed an MRS scan at 3T using MEGA-PRESS, and data were analyzed with Gannet. We placed six 3cm^3 voxels bilaterally in auditory, sensorimotor, and ventrovisual cortices. Uncorrected estimates relative to water and creatine were analyzed, as were tissue-corrected and alpha tissue-corrected estimates. Paired t-tests revealed that average GABA uncorrected, tissue-corrected, and alpha tissue-corrected estimates, as well as estimates relative to creatine, were significantly more reliable than their Glx counterparts. Likewise, average GABA uncorrected estimates were significantly more reliable than GABA tissue-corrected and alpha tissue-corrected estimates, and average GABA estimates relative to water were more reliable than GABA estimates relative to creatine.

Topic Area: METHODS: Neuroimaging

D135 - The salience and frontoparietal networks in dementia with Lewy bodies: functional connectivity changes through disease progression

Vincent Gabriel[1] (vincent.gabriel125@gmail.com), Elena Chabran[1], Marion Sourty[1], Paulo Loureiro de Sousa[1], Anne Botzung[2], Olivier Bousiges[1], Frédéric Blanc[2]; [1]University of Strasbourg and CNRS, ICube Laboratory UMR-7357, IMIS Team, Strasbourg, France, [2]University Hospital of Strasbourg, CM2R, Geriatric Day Hospital and Neuropsychological Unit, Strasbourg, France

Context: Previous resting-state fMRI studies in dementia with Lewy bodies (DLB) have described functional connectivity modifications in key brain networks related to cognition, attention, psychiatric and motor functions. However, little is known about the evolution of these changes as the disease progresses towards dementia. This study compares the functional connectivity of key neurodegenerative brain networks in DLB patients at different disease stages with healthy older controls (HC) and Alzheimer's disease (AD) patients. Methods: Seventy-seven DLB patients, including 55 DLB patients with mild cognitive impairment (MCI-DLB) and 22 DLB patients with dementia (d-DLB), along with 13 AD patients and 34 HC underwent a detailed clinical and neuropsychological evaluation and resting-state fMRI. ROI-to-ROI analyses were performed to assess within- and between-network functional connectivity differences across groups, using the CONN toolbox. Results: The DLB group showed significantly lower functional connectivity within the salience network (SN) compared with HC group, but did not significantly differ from the AD group. While no significant changes were found in the MCI-DLB subgroup, the DLB-d subgroup showed reduced functional connectivity within the SN and the FPN compared to both the HCS and AD groups. The DLB-d subgroup showed significantly lower functional connectivity within the FPN compared to the MCI-DLB subgroup. Conclusion: We identified intra-network changes involving the SN and the FPN in DLB patients, which appeared as trends at the prodromal stage and became significant at the dementia stage. These networks may play a key role in disease progression in DLB.

Topic Area: METHODS: Neuroimaging

D136 - BrainEffeX: A web app for exploring fMRI effect sizes

Hallee Shearer[1] (h.shearer@northeastern.edu), Matt Rosenblatt[2], Jean Ye[2], Rongtao Jiang[2], Link Tejavibulya[2], Qinghao Liang[2], Javid Dadashkarimi[3,6], Margaret Westwater[2], Iris Cheng[2], Alexandra Fischbach[1], Ashley Humphries[4], Aneesh Kumar[1], Max Rolison[2], Hannah Peterson[2], Brendan Adkinson[2], Saloni Mehta[2], Chris Camp[2], Thomas Nichols[5], Joshua Curtiss[1], Dustin Scheinost[2], Stephanie Noble[1]; [1]Northeastern University, [2]Yale University, [3]Massachusetts General Hospital, [4]University of Nebraska-Lincoln, [5]University of Oxford, [6]Harvard Medical School

Estimating effect size is a critical step in power analyses, and can help inform experimental design. However, effect size estimation is particularly difficult for fMRI data due to the complexity of both the data and the analysis techniques. Further, it is difficult to obtain estimates from the literature, and small sample sizes of pilot studies may not provide precise enough estimates. When similar studies can be found in the literature, effect sizes are often not reported across the whole brain, limiting utility for study design. To facilitate the estimation and exploration of effect sizes for fMRI, we estimated effects for "typical" study designs with large (n>500) datasets (ABCD, HCP, HBN, PNC, UKB). We conducted brain-behavior correlations, task vs. rest contrasts, and between-group analyses with both functional connectivity and task-based activation maps. The analyses leverage fMRI data from rest and commonly used tasks, and behavioral data reflecting various phenotypes. In light of recent research supporting the promise of broader-level methods, we included network-level and multivariate versions of all analyses. We repeated analyses with four motion deconfounding strategies: statistical control, full residualization, thresholding, and no correction. We transformed results to Cohen's d and R-squared estimates of effect size and calculated simultaneous confidence intervals. Finally, we created an interactive web application (BrainEffeX) for comprehensively exploring and visualizing these results. BrainEffeX is the first step in an effort to address the need for facilitated power calculations in fMRI by providing a growing resource enabling researchers to estimate and summarize effect sizes for fMRI studies.

Topic Area: METHODS: Neuroimaging

D137 - A Naturalistic Movie Functional Localizer is Equivalent to a Task Localizer of the Fusiform Face Area in Adolescents with and without Autism

Clara J Steeby[1] (clara.steeby@childrens.harvard.edu), Gillian N Miller[1], Alexander L Cohen[1,2]; [1]Boston Children's Hospital, [2]Harvard Medical School

To study face perception with neuroimaging, an additional independent task is typically used to functionally localize the fusiform face area (FFA) in each participant; this can be dull and may negatively impact data quality, especially in clinical or pediatric populations. Here, we explore whether an engaging Pixar short movie can functionally localize the FFA as well as a 'traditional' face versus house passive viewing task in adolescents with and without autism (n=48). We obtained the peak activated voxel for each participant, e.g. the 'best estimate peak' of the FFA, using statistical maps of face selectivity derived from four runs of a traditional FFA localizer task, masked with the Neurosynth 'face' meta-analytic result. We then calculated the Euclidean distance from this best estimate FFA to the peak activated voxel from either a single run of the traditional localizer task or the Pixar movie and compared with a paired t-test.The location of the movie peak voxel was highly consistent with that of the traditional localizer task, in both the left (pairwise m=2.82mm, sd=11.20mm; $t(47) = -1.61$, $p=0.11$) and right (pairwise m=1.09mm, sd=11.78mm; $t(47) = -0.59$, $p=0.56$) hemisphere, with more consistency in the right hemisphere. Our findings suggest that a short movie may be a reasonable replacement to traditional functional localizers, and depending on the movie, may allow localization of multiple regions simultaneously. Further analyses will explore if participant characteristics impact this alternative localizer's utility.

Topic Area: METHODS: Neuroimaging

D138 - Targeting Region-Specific Cerebrospinal Fluid Noise to Enhance Subcortical Neural Estimates in fMRI

Alexandra Fischbach[1] (fischbach.a@northeastern.edu), Hallee Shearer[1], Ajay Satpute[1], Karen Quigley[1], Jordan Theriault[1], Lisa Feldman Barrett[1], Stephanie Noble[1]; [1]Northeastern University

Distinguishing neural signals from noise is a major challenge in neuroimaging, with physiological noise being a dominant contributor. Subcortical structures are disproportionately affected by physiological noise due to low signal-to-noise ratio, small size, and proximity to cerebrospinal fluid (CSF). Traditional CSF correction methods, pool signals from all CSF compartments into a single regressor which is applied to all regions of interest (ROIs). However, these methods may fail to account for the spatial heterogeneity of CSF-noise, potentially allowing residual noise to persist in the data. To investigate this, resting-state data (N=83) were analyzed to compute voxel-wise spatial correlations between CSF time-series and a weighted CSF average. The analysis revealed distinct spatial patterns across the inferior-superior axis, with correlations increasing towards the superior (top)regions of the brain, emphasizing the anatomical and functional heterogeneity of CSF distribution. We then explored whether a localized correction approach could better account for region-specific noise. To examine this, we developed a method to model CSF signals adjacent to each subcortical ROI. We evaluated its impact on resting-state functional connectivity (FC) estimates in comparison to standard global correction methods. Global correction introduced more negative correlations compared to local correction. A paired two-tailed t-test (FDR, $\alpha < 0.05$, $p < 0.05$), revealed significant differences in edge strength for 85% of connections, with 80% demonstrating stronger FC following local CSF correction. Our results indicate that targeting region-specific CSF-noise increases sensitivity to subcortical neural estimates, highlighting the critical role of spatially-informed noise correction in preserving neural signals while reducing unwanted variance.

Topic Area: METHODS: Neuroimaging

D139 - flatsurfer: A flexible, open-source package for generating limbic-centered flat maps of the cerebral cortex

Joshua Paul Rodriguez[1] (rodriguezjoshuapaul@gmail.com), Chan H. Hong[1], Lisa Feldman Barrett[1,2], Karen S. Quigley[1], Bradford C. Dickerson[2,3], David C. Van Essen[4], Jordan E. Theriault[1,2], Yuta Katsumi[2,3*]; [1]Northeastern University, Boston, MA, USA, [2]Massachusetts General Hospital, Boston, MA, USA, [3]Harvard Medical School, Boston, MA, USA, [4]Washinton University in St. Louis, St. Louis, MO, USA*

Surface-based visualization of neuroimaging data in relation to major anatomical or functional features of the cerebral cortex makes quality control easier and enhances the spatial interpretation of analysis results. Flattened representations of cortical surfaces ("flat maps") can reveal some spatial associations that would not be obvious in three-dimensional space. Flat maps also distort some spatial relationships to preserve others, however, and the existing flat maps implemented in several software packages make relaxation cuts through the medial surface to preserve the lateral convexity. This distorts the cortical limbic areas near these cuts, and projects neighboring limbic vertices to different, sometimes opposite, peripheries of the flat map, making it difficult to visualize meaningful patterns on medial cortical surfaces. Here, we introduce limbic-centered flat maps of the cerebral cortex, a novel approach to cortical surface visualization that centers on limbic cortices and uses an azimuthal equal-area projection to optimize spatial representation of different cortical structures. We have developed flatsurfer, an open-source python package designed to make it easy for users to generate limbic-centered fla maps from any input neuroimaging data in common formats (e.g., .nii.gz, .mgz) with minimal coding experience. flatsurfer is also highly configurable, as it allows users to flexibly customize features of flat maps (e.g., underlay/overlay colors, parcellation borders/labels) and enables tailored visualizations in diverse experimental contexts. This package provides a powerful tool for exploring and interpreting neuroimaging data for investigators at all levels of expertise.

Topic Area: METHODS: Neuroimaging

D140 - Functional neurobiological effects of electroconvulsive therapy versus transcranial magnetic stimulation in treatment resistant depression

Pedro Silva[1] (phdasilva@mgh.harvard.edu), Asif Jamil[1], Maia Gersten[1], Samadrita Chowdhury[1], Shane Walsh[1], Guillermo Garibay[1], Tracy Barbour[1], Joan Camprodon[1]; [1]Harvard Medical School and Massachusetts General Hospital

Right unilateral electroconvulsive therapy (RUL-ECT) and high-frequency repetitive transcranial magnetic stimulation (rTMS) are established antidepressant treatments with similar efficacy, though their mechanisms of action remain unclear. This study compared brain functional changes, measured by the amplitude of low-frequency fluctuations (ALFF) and fractional ALFF (fALFF), in patients with treatment-resistant depression (TRD) treated with RUL ECT versus left dorsolateral prefrontal cortex (lDLPFC) 10 Hz rTMS. The study also explored the relationship between brain functional changes induced by ECT or rTMS and clinical response. Forty TRD patients were recruited from Massachusetts General Hospital, with 18 undergoing ECT and 22 receiving rTMS. Depression severity was assessed using the Hamilton Depression Rating Scale (HAMD-17). FMRI data were preprocessed with fMRIprep (v. 24.1.1). ALFF and fALFF analyses were performed using in-house scripts. A flexible factorial design was used at the group level to examine ALFF and fALFF changes across time points and treatment groups. Multiple regression analyses investigated the relationship between ALFF/fALFF changes and clinical improvements. Multiple comparisons were corrected using the Threshold Free Cluster Enhancement (TFCE) method. Linear mixed model analysis did not show a significant interaction between treatment group and time. After rTMS, ALFF and fALFF increased in the middle cingulate and superior medial frontal gyrus. However, no significant association was found between ALFF or fALFF changes related to any treatment and HAMD-17 score changes. In summary, the results indicate that although clinical outcomes may be comparable, only rTMS is linked to functional changes, underscoring the idea that there are different antidepressant therapeutic strategies.

Topic Area: METHODS: Neuroimaging

D141 - Unveiling the cognitive relevance of functional connectivity through deconfounding

Michael Cole[1] (mwcole@mwcole.net), Kirsten Peterson, Lakshman Chakravarthula, Ravi Mill, Ruben Sanchez-Romero; [1]Rutgers University

Functional connectivity is typically defined as the statistical similarity between neural time series, yet this defines the measures used rather than what brain properties are being measured. We propose that the proper theoretical target of functional connectivity is the routes of neural activity flow – the propagation pathways of activity between neural populations. Activity flows generate neurocognitive functionality, such that measured functional connections are relevant to cognition (and cognitive disorders) to the extent that they accurately describe activity flow routes. This perspective reveals a strong need to remove the confounding of functional connectivity estimates introduced by the field-standard bivariate Pearson correlation approach. Confounded connections can arise due to a third region (or artifact) creating a falsely inferred connection among two or more other regions (e.g., A<--B-->C creating a false A–C connection). We recently reported that regularized partial correlation substantially reduces confounding from motion artifacts and neural confounding in resting-state fMRI data. Here, we tested whether regularized partial correlation also reduces confounding from task stimuli, as is common when estimating task-state functional connectivity with bivariate correlation. We used neural mass modeling and empirical fMRI to test the effectiveness of regularized partial correlation (graphical lasso) for removing task stimuli confounds. Regularized partial correlation performed better than expected, removing 99.8% of the task stimuli confounds while reducing false negatives. Further, this approach was more effective than best practices for regressing out task timing. These results demonstrate the efficacy of regularized partial correlation for removing stimulus-driven confounds for task-state functional connectivity estimation.

Topic Area: METHODS: Neuroimaging

D142 - Towards Common Dynamic Connectivity Modes in Schizophrenia and Healthy Controls

David Blair[1] (dblair@gsu.edu), Krishna Pusuluri[1], Vince Calhoun[1]; [1]Georgia State University

Data analysis has become more time- and resource-intensive than data collection in neuroimaging research. Public datasets allow labs to specialize in analysis, but the lack of methods that address time and spatial dependencies is a major bottleneck. Disposing of temporal information sacrifices detection power for mathematical convenience. We applied independent component analysis constrained by the NeuroMark template [1] (cICA) to the FBIRN Phase III dataset [2], [3], [4] to identify functionally distinct spatial networks. We then computed windowed functional network connectivity (wFNC) and searched for recurring, time-dependent patterns between these networks using dynamic mode decomposition (DMD) [5], [6], [7], [8]. DMD estimates the eigendecomposition of the linear map between consecutive samples, thus accounting for temporal dependencies and providing insights into spatial pattern dynamics, oscillation frequency, and power. All six examined modes showed significant reductions in mean power and variance in schizophrenia. The network-based statistic [9], [10] reveals substantial group-level connectivity changes in all but one mode, with changes concentrating between functional domains. NeuroMark gICA and DMD effectively isolate inter-domain alterations in spatial and temporal structure between groups. The reduced power in the six most dominant modes in patients suggests a flattening of the power distribution or an overall power reduction. Connectivity alterations imply issues with inter-domain integration, supporting the dysconnectivity hypothesis [11]. Both groups display substantial intra-group heterogeneity, indicating possible transdiagnostic subgroups. Future studies should search for such subgroups, perhaps via generative embedding [12] or functional connectivity dynamics-specific tests [13], [14].

Topic Area: METHODS: Neuroimaging

D143 - Topological Data Analysis of Pre- and Post-ECT Participant Data

Connor M. Harris[1,2], Shane W. Walsh[1,2], Samadrita Chowdhury[1,2], Joan A. Camprodon[1,2]; [1]Massachusetts General Hospital, [2]Harvard Medical School

Topological Data Analysis (TDA) offers a novel way to analyze high-dimensional datasets by capturing topological features. In this study, TDA is applied to electroconvulsive therapy (ECT) datasets to investigate brain connectivity changes before and after treatment. ECT, a therapy for major depressive disorder (MDD), likely alleviates symptoms by altering brain connectivity, though its mechanisms remain unclear. While graph theory focuses on pairwise relationships in brain networks, it may miss higher-order interactions and topological structure, which TDA could better capture. Analyses were conducted on data from 32 participants (16 male, 16 female; age 33 ± 12) with treatment-resistant MDD who underwent ECT and pre- and post-treatment MRI scans. Resting-state functional MRI data were preprocessed using fmriprep (v.24.1.0) and correlation-based adjacency matrices were created. These matrices were harmonized using NeuroComBat (0.2.12) for consistency between studies. The Python-based MULTINET TDA library generated simplicial complexes via a Vietoris-Rips filtration of each participant's pre- and post-ECT connectivity matrices, capturing topological features like persistence barcodes and Betti numbers. Statistical tests quantified differences between pre- and post-treatment groups. To the best of our knowledge, this study represents the first application of TDA to ECT data. Although no conclusive results are available at this stage, exploratory statistical analyses are being conducted to identify potential topological differences. It is important to note that these analyses are preliminary, and further work will be required to validate any findings and determine whether the observed differences can serve as consistent and replicable biomarkers of ECT-related changes in neural connectivity and functional reorganization.

Topic Area: METHODS: Neuroimaging

D144 - Precision Networks Exhibit High Temporal Stability over Longitudinal Periods

Hyejin J. Lee[1], Ally Dworetsky[2], Alexis Porter[3], Sihan Fei[3], Benjamin A. Seitzman[2], Babatunde Adeyemo[2], Jessica R. Cohen[4], Mark D'Esposito[5], Maital Neta[6], Steven E. Petersen[2], Caterina Gratton[1]; [1]University of Illinois Urbana-Champaign, [2]Washington University in Saint Louis, [3]Northwestern University, [4]University of North Carolina at Chapel Hill, [5]University of California Berkeley, [6]University of Nebraska-Lincoln

Measuring the system-level ‘network’ organization of the human brain can be useful for characterizing individual brain function and linking this function to phenotypic behavioral traits. A prerequisite for these applications is to understand how stable these measures are over time within individuals. Providing sufficient evidence that network features maintain high stability over significant periods could establish them as reliable tools for tracking individuals and detecting changes associated with psychiatric or neurodegenerative disorders. To address this need, we examined the temporal stability of brain networks in three participants over periods ranging from 6 to 13 years. We were able to reliably assess these measures for each individual using highly sampled precision resting-state fMRI data (>58 minutes per participant per time point, post-processed). The results showed stable network patterns, with consistent individual differences in the patterns even over a decade. We further conducted a systematic analysis of temporal stability by assessing functional connectivity, network assignments, and idiosyncratic network features in ten participants over 1-3 years. These measures demonstrated high consistency, underscoring the preservation of unique brain network features over time that define individual characteristics. Our findings support the use of brain network measures—provided sufficient participant data are collected—for phenotypic prediction and biomarker research.

Topic Area: METHODS: Neuroimaging

D145 - Predicting brain responses from short movies: challenges and opportunities

Avery Van De Water[1] (avery-vandewater@uiowa.edu), Lisa Byrge[2], Dan Kennedy[3], Dorit Kliemann[1], James Traer[1]; [1]The University of Iowa, [2]University of North Florida, [3]Indiana University

The human brain must flexibly integrate complex, dynamic information describable by high-dimensional features. Passive movie-viewing paradigms (moviefMRI) have been shown to reliably engage dynamic information processing across brain networks and predict individual differences. Encoding models have shown promise in revealing distributed feature organization within high-dimensional feature spaces. Combining encoding models and moviefMRI to understand dynamic brain function offers particular promise for characterizing atypical information integration in psychiatric conditions. However, the robustness of this approach in short(er) research protocols (<30 minutes) remains unclear. We applied cross-validated encoding models (ridge, banded ridge regressions) to moviefMRI data (typically developed adults, n=79; mean age 26.8; six 5-23 minute movies) using cortical parcellations derived from multimodal or resting-state data. Extracting feature spaces (visual, auditory, abstract representations e.g., socio-emotional) from the movie stimuli, we assessed model prediction accuracy, quantified feature contributions via variance decomposition, and introduced novel null models. Results showed robust signal predictions, for a sparse set of parcels within sensory and multimodal networks, driven by a sparse set of auditory and abstract features. Model performance was sensitive to hyperparameter selection. With increasing numbers of stimulus features, null models performed increasingly well, approaching standard feature model levels (r~0.3 across most of the brain), limiting visual features' utility (the largest feature space). In summary, future work using shorter paradigms (e.g., for clinical populations) must carefully address overfitting beyond standard cross-validation. Restricting encoding models to smaller, carefully selected feature sets may yield more robust results.

Topic Area: METHODS: Neuroimaging

D146 - Greater amyloid accumulation in cognitive networks in Preclinical Alzheimer's Disease

Sara Nolin[1], Stephanie Aghamoosa[1], Averi Jones[1], Andreana Benitez[1]; [1]MUSC

Introduction: Preclinical Alzheimer's disease (pAD) is defined by elevated brain amyloid-beta prior to the onset of symptoms. We investigated whether amyloid accumulation in pAD differs across cognitive and non-cognitive functional brain networks and relates to cognitive performance. Methods: 157 cognitively unimpaired participants aged 45–84 underwent neuropsychological testing, brain MRI, and amyloid PET (18F-florbetapir) at baseline and 2-year follow-up (M=2.06, SD=.25 years; n=138). At baseline, 28 were amyloid positive (AB+) based on neuroradiological read. We calculated amyloid burden as the mean standard uptake value ratio (mSUVr) within cognitive networks (default mode, fronto-parietal, ventral attention, dorsal attention, limbic) and non-cognitive networks (visual, somato-motor). Linear mixed models tested the 1) main effects and interaction of network type (cognitive, non-cognitive) and age and 2) main effects and interaction of group (AB+, AB-) and network type, covarying age. We correlated mSUVr within cognitive networks with baseline and change in composite cognitive scores. Results: mSUVr was greater in cognitive than non-cognitive networks, and this difference increased with age. There was a group-by-network interaction, whereby the effect of higher mSUVr in cognitive vs. non-cognitive networks was greater in the AB+ than AB- group. Cognitive network mSUVr was not correlated with baseline or change in cognition. Conclusion: Amyloid preferentially accumulates in cognitive functional networks in pAD, and this discrepancy increases with age. Amyloid burden in cognitive networks was not related to cognitive performance in this unimpaired sample. These findings highlight the importance of targeting cognitive networks in early detection and intervention.

Topic Area: METHODS: Neuroimaging

D147 - Using a machine learning classifier to estimate neural distinctiveness in EEG data

Noah Reardon[1], Erin Knape[1], Poortata Lalwani[2], David Brang[1], Molly Simmonite[1], Thad Polk[1]; [1]University of Michigan, [2]University of California, Irvine

Patterns of neural responses to different stimuli, such as faces vs. buildings, become less distinctive and more confusable with advancing age. This so-called neural dedifferentiation is hypothesized to contribute to age-related declines in cognitive and sensory abilities. The distinctiveness of neural activity patterns is most commonly measured using functional magnetic resonance imaging (fMRI). However, fMRI is an indirect measure of neural activity and has relatively poor temporal resolution. Electroencephalography (EEG) complements these limitations by measuring neural activity more directly with excellent temporal resolution. Here, we test whether a machine learning classifier (support vector machines, SVM) can reliably distinguish EEG responses to faces vs. buildings. EEG data was recorded from 27 healthy older adults aged 65+ as they completed a task in which they viewed images of faces and buildings. To ensure participants were alert and paying attention, they were asked to respond whenever they saw famous faces or buildings. EEG recordings were preprocessed and 600ms epochs beginning at stimulus onset were extracted from all 64 electrodes. The data were then randomly divided into training and testing datasets and SVM classifiers were trained on the training data using 20-fold cross-validation. The most accurate model across the folds for each participant was then used to classify the independent testing data. The SVM classifiers demonstrated robust above chance discrimination of house and face trials in the testing dataset. This result highlights the potential of using SVM classifiers to examine neural distinctiveness in EEG data.

Topic Area: METHODS: Neuroimaging

D148 - Relationship between Polygenetic Risk Score of BrainAge and plasma biomarkers in the A4/eLearn Study.

Jorge Garcia Condado[1,2,3], Colin Birkenbihl[3], Jesus M Cortes[1,4], Ibai Diez[1,4,5,6], Rachel F Buckley[3,7]; [1]Computational Neuroimaging Lab, Biobizkaia Health Research Institute, [2]Universidad del Pais Vasco (UPV/EHU), [3]Massachusetts General Hospital, Department of Neurology, [4]IKERBASQUE, [5]Gordon Center for Medical Imaging, Department of Radiology, [6]Athinoula A. Martinos Center for Biomedical Imaging, [7]Melbourne School of Psychological Sciences, University of Melbourne

Tools such as Brain Age Gap, which measures the discrepancy between chronological and predicted brain age based on neuroimaging, and Polygenic Risk Scores (PRS), which quantify genetic predisposition to specific traits like accelerated brain aging, are proving valuable in elucidating the genetic underpinnings of neurodegeneration. In this study, we analyzed genetic information and plasma biomarkers from the A4/ELearn study on 3014 cognitively normal subjects (71.4 +- 4.6 age; 40.3% male). PRS of BrainAge models were calculated for each subject using the summary GWAS statistics of Wen et. al, Nature Communications 2024 for three types of BrainAge models: Grey Matter (GM), White Matter (WM) and Functional Connectivity (FC). We focused on 6 plasma biomarkers from the study: pTau217, FP42/FP40, plasma APOE4 prtoein levels, GFAP, Neuro Filament Light Chain and pTauC2. We used a general linear model to study the association between the biomarkers with PRS and with the interaction between age and PRS for each BrainAge model. We found that the interaction between age and GM PRS, was positively associated with pTAU217 (p-value=0.0073) and pTauC2 (p-value=0.040). The GM PRS alone was also associated with pTauC2 after adjusting for age and the interaction (p-value=0.042). Moreover, the interaction between age and WM PRS was associated positively with FP42/40 (p-value=0.020) and pTauC2 (p-value=0.043). This study highlights the significance of genetic factors contributing to accelerated brain aging and its association with neurodegenerative biomarkers. It's noteworthy that the effects of these genetic predispositions often become apparent only when combined with aging.

Topic Area: METHODS: Neuroimaging

D149 - Variability in suprathreshold electric field simulations for transcranial magnetic stimulation treatments

Megan E. Chang[1] (mec4024@med.cornell.edu), Nicola Manfredi[1], Maximilian Lueckel[1], Megan Johnson[1], Jolin Chou[1], Claire A. Ho[1], Indira Summerville[1], Immanuel G. Elbau[1], Charles J. Lynch[1], Conor Liston[1]; [1]Weill Cornell Medicine

Transcranial magnetic stimulation (TMS) is a non-invasive neuromodulation technique used in cognitive neuroscience to establish causality between brain activity and cognitive functions or behaviors (Sandrini et al., 2011). Coil placement and stimulation intensity are crucial for determining whether TMS effectively alters neural activity in targeted brain areas or functional networks. Treatment dosage is typically inferred from motor evoked potentials (MEP), the minimum intensity required to elicit a muscle twitch, and is sometimes adjusted linearly (Stokes et el., 2007). However, this approach assumes uniform responses across individuals, prompting this investigation into whether MEP-based heuristics accurately estimate intensity for effective stimulation. Electric field (E-field) modeling can estimate TMS spatial distribution, considering the distance to cortex, coil type, and brain tissue conductivity derived from cortical segmentation (Thielscher et al., 2015). In this study, we masked motor thresholding E-field simulations utilizing a probabilistic group map of the primary motor cortex (M1) and individual network topologies obtained from precision functional mapping (PFM). The maximum E-field strength within the constrained region established thresholds in treatment E-field simulations, identifying areas of suprathreshold engagement for each subject (n=66). Preliminary results revealed a median suprathreshold stimulated area of 201.87 mm2 (std=875.36 mm2), spanning a range from 0 to 5867.90 mm2. These findings indicate considerable interindividual variability in suprathreshold stimulation, highlighting the limitations of conventional dose calculations which may not adequately capture the complexity of individual brain anatomy and functional connectivity. These findings suggest that E-field-based thresholding approaches for personalized TMS could optimize stimulation accuracy and enhance therapeutic outcomes.

Topic Area: METHODS: Neuroimaging

D150 - Age and sex-related blood-brain barrier function differences in treatment-resistant depression and obsessive-compulsive disorder

Indira Summerville[1] (ins4004@med.cornell.edu), Claire Ho[1], Jolin Chou[1], Megan E. Chang[1], Megan Johnson[1], Nicola Manfredi[1], Hayley Seltzberg[1], Lindsay Victoria[1], Conor Liston[1], Eric Goldwaser[1]; [1]Weill Cornell Medicine

The blood-brain barrier (BBB) is a critical aspect of the cerebrovascular system and has been implicated in psychiatric disorders. Previous studies show that neurovascular BBB water exchange rates (kw) decline with age and is accelerated in males compared to females of an otherwise healthy cohort. Further, this decline has been shown to predict impairments in working memory and other executive function tasks related to Alzheimer’s disease. Preclinical evidence suggests that BBB dysfunction may drive pathophysiologic mechanisms of serious mental illnesses. Here we investigate age and sex-related trajectories in BBB kw among participants with treatment-resistant depression (TRD) and/or obsessive-compulsive disorder (OCD). Diffusion-prepared arterial spin label (DP-ASL) MRI was used to measure BBB function (kw) in subjects with depression and OCD (n=91; 18-75 years old). We specifically investigated kw differences in three age groups: 18-35 (n=34), 36-55 (n=44), and 56-75 (n=13). Results showed lower kw among males overall (t=-1.99, p=0.05). Within the 18-35 age group, males exhibited lower average whole-brain kw compared to females (male kw=120.3; female kw=130.5; t=-2.15; p=0.04). However, these differences were not found in the 36-55 age group (t=-1.44, p=0.16), or 56-75 age group (t=0.44, p=0.67). Preliminary results showed that with increasing age, there were trending decreases in kw among males and females. These results support the hypothesis that age- and sex-differences in BBB function trajectory exist in our cohort of depression and OCD. Future work will examine how these differences in cerebrovascular function contribute to symptom trajectory and may predict clinical and cognitive impairment across the lifespan.

Topic Area: METHODS: Neuroimaging

D151 - Exploring Amygdalar Activity in Response to Symptom-Relevant Memories in Social Anxiety: A Neuroimaging Study

Sarab Anand[1] (sarab.anand@tufts.edu), Emma Laurent[2], Sophia Vranos[2], Abigail Beech[1], Jamie Greer[2], Emily Stekl[2], Abigail Sullivan[1], Megan Paterson[1], Nur Apkolat[1], Ramina Bebezova[1], Maria Perdomo[1], Connor Gibson[2], KemKem Ogbuefi[2], Gaston Aime[2], Jenn Segawa[2], Elizabeth Phelps[2], M. Alexandra Kredlow[1]; [1]Tufts University, [2]Harvard University

Research in social anxiety (SA) shows amygdala hyperactivity in response to emotional compared to neutral stimuli, with activation levels correlated with symptom severity (Bruehl et al., 2014). However, the stimuli used in these studies are not personally-relevant, thus lacking ecological validity. Studies in healthy controls have shown greater amygdala activation during recall of negative personally-relevant autobiographical memories relative to neutral memories (Sharot et al., 2007); however, it remains to be determined whether this pattern holds for individuals with SA. Participants with SA generate titles and narratives for two neutral and two SA-related memories. In the fMRI scanner, participants are shown their neutral titles followed by SA-related titles. After each title, participants vividly recall their memory for 30s and then rate memory-related feelings. We hypothesize that SA individuals will show greater amygdalar activation for SA memory recall relative to neutral, and that the degree of activation will correlate with memory-related feelings. Mass univariate analysis will be used to determine differences in neural activity between both task types focusing on the amygdala. At the individual level, statistical tests will be performed to identify voxels with significant differences in activation between task types. Second-level analysis will assess whether task-dependent brain activation is consistent and significant across participants. We will examine associations between amygdala activity, memory-related feelings, and SA severity. This project will examine whether neural patterns during symptom-relevant autobiographical memory retrieval in SA align with results from studies using non-personally relevant stimuli. These findings will provide insight into possible maintenance factors of SA.

Topic Area: METHODS: Neuroimaging

D152 - Altered spatiotemporal connectivity patterns and diminished higher-order information exchange in Parkinson's patients with hyposmia

Sneha Ray[1] (sneha.ray@ucsf.edu), Navkiran Kalsi[2], Henning Boecker[3], Neeraj Upadhyay[3], Rajanikant Panda[1]; [1]University of California San Francisco, [2]O.P. Jindal Global University, [3]University of Bonn

Background and aim: Hyposmia is one of the common non-motor symptoms related to loss of olfaction in Parkinson's disease (PD) and olfactory dysfunction is associated with perturbation of higher order cognitive functioning. While structural and functional brain changes in PD patients with hyposmia are well-documented, exploring the dynamic nature of brain states could enhance understanding of abnormalities in cognitive information exchange. Methods: Structural and functional MRI of PD patients 15 with severe-hyposmia (PD-SH), 15 with cognitive normal ability (PD-CN) and 15 healthy controls (HC) were selected from an open-source study database. We assessed the dynamic brain state (spatiotemporal connectivity pattern), which characterizes brain's spontaneous spatiotemporal network alterations, and synergy & redundancy which capture brain's capacity for higher-order information exchange. Results: A dynamic brain state that consists of complex, long-range-global connections was significantly decreased in PD-SH and PD-CN only when compared to HC. However, another brain state, which has prominent modular-local clusters consisting of sensorimotor and frontal areas, has an increased probability of occurrences in the patient's group PD-SH compared to PD-CN. Furthermore, the higher-order information flow was reduced significantly in the bilateral superior-temporal and parahippocampus areas in the PD patients (both PD-CN and PD-SH) compared to HC. Though no significant differences were found, however, PD-SH showed a larger reduction in higher-order information flow in the bilateral frontal, insula and left sensory-motor areas then PD-CN. Conclusion: PD patients with hyposmia showed disruption of spatiotemporal functional connectivity and reduced higher-order information exchange, which could potentially discriminate PD with hyposmia to cognitively-normal PD.

Topic Area: METHODS: Neuroimaging

D153 - Scaling Laws in Functional Region of Interest (fROI) Analyses

Ruimin Gao[1] (rgao76@gatech.edu), Anna Ivanova[1]; [1]Georgia Institute of Technology

Functional region-of-interest (fROI) analyses of task fMRI offer enhanced sensitivity and spatial resolution over traditional group-based analyses, but their replicability depends on sample size and parameter choices. We introduce funROI, a new Python toolbox for fROI analyses, and investigate the impact of sample size (N=10 to 500) on three key outputs: (1) group probabilistic maps of significant activation during the localizer task, (2) group-level parcels that serve as anatomical boundaries for subsequent fROI definitions in individual subjects, and (3) effect size estimates of fROI responses to task conditions. Using independent samples from four Human Connectome Project tasks—working memory, social cognition, motor tasks, and language—we show that the correlation between the probabilistic maps generated from different samples is highly consistent at larger sample sizes, with most task contrasts reaching a correlation of 0.9 starting at N=250. The parcel overlap between different samples increases from ~0.6 at N=10 to ~0.9 at N=500, primarily driven by large parcels with significant participant overlap. Parameter choices, such as intersubject overlap at the voxel level and smoothing, substantially influence parcel generation, with different domains (e.g., language vs. vision) benefiting from different parameter combinations. For effect size estimation, even small sample sizes suffice. With the effect size of N=500 as the ground truth, over 90% of N=10 and

N=20 samples capture the ground truth within their 95% confidence intervals, improving to >95% with N=50. Overall, this work provides both a computational tool and an analytical framework for robust and replicable fROI analyses.

Topic Area: METHODS: Neuroimaging

D154 - Community Detection in Adults and Neonates

Nilanjan Chakraborty[1] (chakrabortyn@mst.edu), Ayoushman Bhattacharya[2], Jiaxin Tu[2], Donna Dierker[2], Soumen Lahiri[2], Adam Eggebrecht[2], Muriah Wheelock[2]; [1]Missouri University of Science and Technology, [2]Washington University in Saint Louis

This poster aims at using the Weighted Stochastic Block Model algorithm to determine the optimal number of brain communities in neonates and compare the findings and benchmark the findings against other popular community detection algorithms. The findings and preliminary figures are included in the poster where we have obtained 15 communities in neonates. We used fMRI data from the Baby Connectome Project (BCP), which included an average of 16.9 minutes of MRI images from 301 full-term infants (8-30 weeks) acquired using a Siemens 3T Prisma scanner. The Weighted Stochastic Block Model (WSBM) algorithm was applied to identify communities. We bootstrapped the log-likelihood differences 2000 times to determine the optimal community number based on the 95% confidence interval and via a consensus algorithm. We applied WSBM, on the Baby Connectome Project (BCP) dataset and obtained K = 15 as the optimal number of communities using bootstrap Bayes factor intervals and identified community structure in the infant brain. Comparisons with Infomap on BCP dataset (Tu et al. 2024) showed moderately high Normalized Mutual Information values. Our preliminary results suggest that the number of communities in the infant brain is 15 and the community structure in the infant brains are not fully assortative. This is consistent with prior work using Infomap (Tu et al. 2024; Kardan et al. 2020; Eggebrecht et al. 2017) demonstrating higher order association networks are not fully formed in infancy.

Topic Area: METHODS: Neuroimaging

D155 - Individualized models connect nontrivial whole-brain dynamics across rest and task conditions

Ruiqi Chen[1] (chen.ruiqi@wustl.edu), Matthew Singh[2], Todd Braver[1], ShiNung Ching[1]; [1]Washington University in St. Louis, [2]University of Illinois Urbana-Champaign

It remains debated whether whole brain dynamics reflect distinct brain “states” or noisy sampling of a monolithic state. Resting state fMRI (rfMRI) is often characterized as switching between multiple discrete states. In the N-back working memory task, single-trial neural responses were also found to be best described by multiple states. However, the mechanistic underpinnings and behavioral relevance of these nontrivial brain states remain elusive. We fit Mesoscopic Individualized NeuroDynamic (MINDy) models for rfMRI and N-back task fMRI (tfMRI) recordings in the Human Connectome Project. MINDy models consist of interconnected neural masses representing brain parcels and task-related inputs. We analyzed the “resting” and “task state” dynamics of fitted models through numerical simulations. MINDy models fit rfMRI and tfMRI data significantly better than linear null models and recapitulated key features such as functional connectivity. The models revealed nontrivial (e.g., multistable) dynamics in both resting and task states. When projected into anatomical space, the dynamical attractors mapped onto a limited set of canonical functional brain networks. We found that participants that showed a “bifurcation” between resting and task state (e.g., multistable in rest, monostable in task) performed significantly better in task. Next, we will analyze single-trial neural responses according to different attractors and associate them to trial-by-trial behavioral fluctuations. Ongoing brain dynamics contain nontrivial attractors embedded in functional brain networks, which might account for trial-by-trial variations in neural responses. The ability to modulate brain dynamics towards cognitive demand might be beneficial to cognitive performance.

Topic Area: METHODS: Neuroimaging

D156 - Nicotine Usage and Changes in Dopamine Physiology Explored Using fMRI Temporal Dynamics

Bhakti Patwardhan[1] (bhaktippat@gmail.com), Ian Ballard, Ioannis Pappas, Ann M. Kring, Ingrid R. Olson, Barbara A. Cohn, Piera M. Cirillo, Nickilou Y. Krigbaum, Thomas M. Olino, Mark D'Esposito, Raana A. Mohyee, Ashby B. Cogan, Lauren Weittenhiller, Lauren M. Ellman; [1]UCSF, [2]UC Riverside, [3]University of Southern California, [4]UC Berkeley, [5]Temple University, [6]Child Health and Development Studies, [7]Child Health and Development Studies, [8]Child Health and Development Studies, [9]Temple University, [10]UC Berkeley, [11]Temple University, [12]UC Berkeley, [13]UCLA, [14]Temple University

Use of nicotine products has significant health risks, but quitting nicotine is challenging and associated with high rates of remission. Nicotine causes changes in the brain’s dopamine system that may persist after cessation of nicotine. We examined whether a history of nicotine use was associated with alterations in brain physiology linked to dopamine function. Recent results from our lab have shown that the timing of the hemodynamic response – hemodynamic latency – provides information about dopamine physiology in the striatum. In prior work, we found that individuals with cocaine use disorder have increased hemodynamic latencies in the striatum, and the degree of altered hemodynamic latencies was associated with individuals’ daily nicotine use. We hypothesized that this profile of altered physiology would persist in former nicotine users. We calculated hemodynamic latency maps from resting state fMRI data from a sample of middle-aged adults (n = 102, mean age: 58.70) who have taken part in a lifelong longitudinal study with data extending back to when individuals were in utero. Participant’s self-report of current nicotine use and whether they had ever used nicotine was collected. Unlike the earlier study, previous nicotine users exhibited increased hemodynamic latency in the striatum relative to individuals who never used nicotine. This difference could reflect physiological adaptations that differ between current nicotine use, such as internalization of dopamine receptors, and nicotine cessation. Planned analyses will examine the relationship between hemodynamic latency and measures of reward processing— Anticipatory Social Pleasure, Temporal Experience of Pleasure Scale, Motivation, and Pleasure Scale.

Topic Area: METHODS: Neuroimaging

D157 - Correlating the effect of the size and location of TBI induced lesions on the likelihood of developing epilepsy through functional connectivity mapping

Shivek Narang[1] (shivekn@sas.upenn.edu), James Gugger[2]; [1]University of Pennsylvania, [2]University of Rochester

Traumatic brain injury (TBI) is a leading cause of epilepsy, with approximately 1 in 10 patients developing post-traumatic epilepsy (PTE). Initial seizures often occur within weeks of the injury, persisting for months in some cases. Identifying pathways linked to increased PTE risk is essential for targeted therapies, prevention strategies, and improved patient care. While biomarkers for PTE remain limited, neuroimaging shortly after TBI may hold predictive potential. However, the relationship between post-traumatic lesions, remote neural networks, and epileptogenesis remains unclear. This study leverages Magnetic Resonance Imaging (MRI) and functional MRI (fMRI) to assess lesion characteristics and their effects on brain connectivity. Using data from phase one of the Transforming Research and Clinical Knowledge in TBI (TRACK-TBI) study, we manually segmented lesions on two-week post-injury MRIs of participants. Lesion cores and edema were identified using coregistered T1 and FLAIR sequences. These lesion maps were normalized to standard space and used as seeds for connectivity analyses, incorporating normative connectomes from the Human Connectome Project. Comparisons were made between lesion network maps of participants who developed seizures and those who did not. Preliminary results from 100 participants with at least one contusion revealed an average lesion core volume of 2.2 mL and edema volume of 128 mL. Group analysis, conducted using the generalized linear model and threshold-free cluster enhancement in FSL, aims to uncover connectivity patterns predictive of seizure development. These findings will enhance understanding of TBI-related epileptogenesis and inform future clinical interventions and therapeutic strategies worldwide.

Topic Area: METHODS: Neuroimaging

D158 - Behavioral and neural signatures of transient arousal from sleep during bilateral central lateral thalamic stimulation in humans

Taruna Yadav[1] (taruna.yadav@yale.edu), Zheng Zhang[1], Vaclav Kremen[2], Kristine Dacosta[1], Maxime Oriol[1], Devon Cormier[1], Christopher Benjamin[1], Kate Christison-Lagay[1], Eyiyemisi Damisah[1], Allyson Derry[1], Abhijeet Gummadavelli[1], Tyler Hamilton[1], Lawrence Hirsch[1], Patrice Lauture[1], Bogdan Patedakis Litvinov[1], Dennis Spencer[1], Kim Bailey[2], Karla Crockett[2], Starr Guzman[2], Vladimir Sladky[2], Delana Weis[2], Jennifer Hong[3], Krzystof Bujarski[3], Charlotte Jeffreys[3], Anastasia Kanishcheva[3], Grant G. Moncrief[3], Robert M. Roth[3], George P. Thomas[3], Jonathan Baker[4], Eun Young Choi[5], Jaimie Henderson[5], Matthew Hook[6], Irina Korytov[6], Kyle O'Sullivan[7], Brian Rutt[5], Joseph Giacino[8], Benjamin H. Brinkman[2], George Culler[3], Nicholas Gregg[2], Brian Lundstrom[2], Xi Chen[9], Jermaine Robertson[9], Charles Mikell[9], Sima Mofakham[9], Imran H. Quraishi[1], Joshua P. Aronson[3], Jason Gerrard[1], Jamie Van Gompel[2], Christopher R. Butson[6], Nicholas Schiff[4], Barbara Jobst[3], Gregory Worrell[2], Hal Blumenfeld[1]; [1]Yale School of Medicine, [2]Mayo Clinic, [3]Dartmouth-Hitchcock Medical Center, [4]Weill Cornell Medical School, [5]Stanford University Medical Center, [6]University of Florida, [7]University of Utah, [8]Harvard Medical School, [9]Stony Brook University

The role of the thalamic intralaminar region in arousal and sleep is well studied in animal models but little investigated in humans. Our aim is to examine the effects of bilateral stimulation of human central lateral thalamus (CL) during natural sleep. As part of an ongoing clinical trial, Stimulation of the Thalamus for Arousal Restoral in Temporal lobe epilepsy (START), an investigational neurostimulator (RC+STM) was implanted in five patients with medically refractory temporal lobe epilepsy. An overnight sleep study was conducted in patients admitted for video-scalp EEG recordings. Simultaneous neural recordings were obtained from the implanted device (bilateral hippocampi and bilateral CL). Patient's maximum tolerated CL stimulation current with no reported side-effects was determined during the awake state. Clinicians tracked patient's sleep state on scalp EEG and remotely delivered electrical stimulation once patient was in N2 or N3 sleep. The CL stimulation was delivered for 5 minutes and repeated over multiple epochs varying in stimulation current, frequency (40 or 125 Hz) and pulse width (90 or 120 µs). Arousal from sleep was quantified as changes in EEG band power, beta- to-delta ratio and behavior (movement and respiration) relative to 5-minute pre-stimulation baseline. All patients exhibited decreases in delta and theta power and increases in beta-delta ratio, respiration and body movement during stimulation, consistent with arousal from sleep. These findings demonstrate a key role of CL in human arousal and can serve as a potential target for therapeutic stimulation in seizures with impaired awareness and other disorders of arousal and attention.

Topic Area: METHODS: Neuroimaging

D159 - "Action Understanding and Mu Suppression Between Athletes and Non-Athletes"

Nathan Vandegrift[1] (nathansv@usca.edu), Lucille Burns[1], Vincent Bush[1], Laura Jelsone-Swain[1]; [1]University of South Carolina-Aiken

Action understanding is the ability to predict and interpret other individuals' actions and understand the action's intentions, goals, and plans. Action understanding is a key concept to theory of mind, which is the cognitive ability to recognize the mental states, beliefs, desires, and wants of others that differ from the self. Athletes participate in extensive observation and prediction of actions during competition and practice, which may suggest an advantage in action understanding. This may also manifest in neural activity differences, specifically enhanced mu suppression over somatosensory regions during observation of motor actions. To test this, we recruited athletes and non-athletes based on standardized criteria to compare understanding of actions and mu power using EEG. Using a fast Fourier transform, mu power suppression between 8 - 12 hz was examined over electrodes Cz, C3, and C4. No significant differences were found between athletes and non-athletes for mu power suppression. Similarly, no differences in accuracy or reaction time were found for identification of actions. Weekly exercise levels were included as a covariate in these models to control for level of physical activity between groups, which did significantly relate to the accuracy of action understanding. There was also a medium effect size between exercise and midline mu suppression at Cz, albeit not statistically significant. Collectively, athlete status may not play a specific role in neuroplastic differences related to action understanding compared to non-athletes. Rather, it appears exercise more generally is involved, which suggests that exercise may support social interactions related to theory-of-mind.

Topic Area: PERCEPTION & ACTION: Multisensory

D160 - Task-Dependent Changes in Aperiodic Neural Activity Reveal Glioma Subtype and Cognitive Error Profiles

Youssef Sibih[1] (youssef.sibih@ucsf.edu), Niels Olshausen[1], Jasleen Kaur[1], Emily Cunningham[2], Sanjeev Herr[1], Vardhaan Ambati[1], Saritha Krishna[1], Alex Aabedi[1], Andy Daniel[1], David Brang[2], Shawn Hervey-Jumper[1]; [1]University of California, San Francisco, Department of Neurological Surgery, [2]University of Michigan, Department of Psychology

Electrophysiological signals exhibit both periodic and aperiodic properties. Periodic oscillations are associated with numerous physiological and cognitive processes. Emerging evidence demonstrates the aperiodic component 1/f slope represents putative physiological interpretations, including excitation-inhibition (E/I) balance. Our study analyzes the power spectral density's aperiodic component (1/f slope) of glioma-infiltrated cortex to evaluate E/I imbalance across glioma subtypes in resting state and cognitive tasks. Electrocorticography data were analyzed from glioma patients. The 1/f slope was computed in the upper beta and high-gamma range (30-50Hz; 70-150Hz) for each electrode. Electrodes were classified as tumor-infiltrative or normal-appearing using MRI T2-FLAIR. Linear mixed-effects models examined differences in 1/f slopes across glioma subtypes, tissue types, and cognitive conditions (correct vs. incorrect trials in Picture-Naming and Auditory-Naming tasks). Single nucleus RNA sequencing of glioma tissues validated electrophysiological findings. Tumor-infiltrative electrodes exhibited lower 1/f slopes compared to normal-appearing electrodes ($p<0.001$), indicating excitation dominance. Glioblastoma had significantly lower 1/f slopes in tumor-infiltrative regions compared to astrocytoma and oligodendroglioma ($p<0.001$). During task-based analyses, incorrect trials in tumor-infiltrative regions showed lower 1/f slopes compared to correct trials (Picture-Naming: $p=0.028$; Auditory-Naming: $p=0.0032$), highlighting task-specific shifts toward excitation dominance. No significant differences were observed between trial response in normal-appearing tissue. Glioblastomas exhibited the most pronounced task-related E/I imbalances. RNA sequencing confirmed an excitatory transcriptomic profile in tumor-infiltrated cortical regions. Glioblastomas are associated with excitation-dominant cortical states and heightened task-related E/I imbalances, particularly during cognitive errors. The 1/f slope serves as a physiologically relevant measure for glioma-associated cortical dysfunction, linking electrophysiological changes to cognitive performance.

Topic Area: PERCEPTION & ACTION: Multisensory

Poster Session E

Monday, March 31, 2025, 2:30 – 4:30 pm, Back Bay Ballroom/Republic Ballroom

E1 - Crossmodal task and modality representations in the auditory cortex of deaf and hearing individuals

Velia Cardin[1] (velia.cardin@ucl.ac.uk), Konstantin Grin[1], Martin Eimer[2], Samuel Evans[3], Luigi Tamè[4], Bencie Woll[1], Rita Bertani[1], Dilay Ercelik[1], Lucy Core[1], Yueming Gao[1], Matthew Longo[2], Valeria Vinogradova[1,5], Barbara Manini[1,6]; [1]University College London, [2]Birkbeck, University of London, [3]King's College London, [4]University of Kent, [5]HSE University, [6]University of Derby

We studied how sensory experience shapes cognitive processing in the brain, and the function of cortical 'sensory' regions. Specifically, we investigated whether brain regions typically considered 'sensory' can implement higher-order cognitive functions when their main input is absent or significantly reduced. Previous fMRI research has suggested a specialisation for executive processing in the auditory cortex of deaf individuals (Cardin et al., 2018; Ding et al., 2015; Manini et al., 2022; Zimmermann et al., 2021). It is unknown whether increased activations during executive function tasks in deaf individuals reflect: i) a sensory processing function, such as extracting information about relevant sensory features, or ii) processing of task-specific information, such as coding task rules or modulating attentional states. To distinguish between these hypotheses, we conducted an fMRI delay-to-match experiment in either the visual or somatosensory modality in deaf (N=13) and hearing (N=18) individuals. Representational Similarity Analysis

(RSA) showed that the auditory cortex of deaf individuals contains information about higher-level processes such as task and sensory modality. We also found significant representations of somatosensory frequency. Critically, task and modality representations were also found in the auditory cortex of hearing individuals, suggesting that plasticity effects rely on the enhancement of representations that are present in hearing individuals, rather than through the implementation of novel ones. Overall, we show that sensory experience shapes cognitive processing and the function of sensory regions in the brain, and that the “functional destiny” of cortical regions can be shaped by early sensory experience.

Topic Area: EXECUTIVE PROCESSES: Other

E2 - Differentiating ADHD Diagnosis and Executive Function Contributions to White Matter Microstructure in Dyslexia

A. Takahesu Tabori[1] (atakahesutabori@mghihp.edu), A. Azor[1], R. Marks[2], A. Cardinaux[3], A. Kaminsky[1], K. Wade[3], R. Norton[1], A. Doyle[4,5], E. Braaten[4,5], J. D. E. Gabrieli[3], J. A. Christodoulou[1]; [1]MGH Institute of Health Professions, [2]Purdue University, [3]Massachusetts Institute of Technology, [4]Harvard Medical School, [5]Massachusetts General Hospital

Executive Function (EF) challenges are often identified in children with Dyslexia (DD) and ADHD, disorders that frequently co-occur. Our prior work found that EF weaknesses, rather than ADHD diagnosis, predict reading ability and related brain function among children with DD (Al Dahhan et al., 2022), pointing to EF as a shared mechanism for ADHD and DD. Here, we test the hypothesis that EF ability rather than ADHD diagnosis predicts differences in the brain’s white matter (WM) microstructure in children with DD. Diffusion data and standardized test scores were analyzed for 59 3rd-6th graders with DD (28 ADHD). Diffusion MRI data were preprocessed using QSIPrep (V.0.18.1). The auto-track feature of DSI Studio was employed to streamline the reconstruction of WM tracts, and quantitative scalar measures were computed at each voxel. We examined if there were group differences in WM tracts related to reading and EF as a function of diagnostic group (DD only vs DD +ADHD) and by EF ability (EF-low vs EF-high). ‘EF low’ was operationalized as 1.5 SD below the mean of controls of the same age group on the behavioral EF measures. Linear regressions were fitted predicting microstructure values in WM tracts of interest. There were no differences in WM microstructure as a function of ADHD diagnosis, but there were differences in some EF-related WM tracts as a function of EF. Results suggest (1) low EF scores serve as a risk factor for co-occurring ADHD and DD, and (2) ADHD and EF have little overlap in WM microstructure.

Topic Area: EXECUTIVE PROCESSES: Other

E3 - Investigating structural differences between children with Developmental Language Disorder, Dyslexia, and controls

Olivia Baldi[1], Ted Turesky[1], Nadine Gaab[1]; [1]Harvard Graduate School of Education

Developmental Language Disorder (DLD) is a neurodevelopmental disability characterized by difficulties comprehending and producing language and can lead to adverse social-emotional, academic, and vocational outcomes. A considerable number of children with DLD subsequently develop developmental dyslexia (DD), suggesting shared brain differences between DLD and DD. The DLD-DD Quadrant Model hypothesizes how individual differences in word recognition, affected in DD, and language comprehension, affected in DLD, contribute to reading comprehension deficits (RC). While this has been studied behaviorally, there are no current studies examining the underlying brain mechanisms of the model. To explore the neural underpinnings of the Quadrant Model, we acquired structural magnetic resonance imaging (MRI) data in children with DLD, DD, and typically developing children (TD). In a preliminary analysis, 5-6-year-old children were categorized as either DLD (n=18) or TD (n=21) based on measures of language comprehension, expressive language, receptive language, and syntactic processing. To identify differences in gray matter volume and cortical thickness between groups, a preliminary whole-brain analysis was conducted using FreeSurfer. The TD, compared to the DLD group, showed significantly greater gray matter volume in the inferior temporal cortex in the right hemisphere (vertex-wise threshold $p < 0.005$; cluster-wise threshold $p < 0.05$). This preliminary finding suggests structural differences between children with DLD and TD; however, future analyses will include a DD group and employ RC outcome measures to disentangle how deficits in word reading and/or language skills influence RC. Furthermore, implications will be discussed based on hypotheses within the Quadrant Model.

Topic Area: LANGUAGE: Development & aging

E4 - Cognitive Profile of Chinese Children with Developmental Dyslexia

Suei Cheng Wong[1] (scrystal.wong@polyu.edu.hk), Allen Ming Yan Cheong[1], Henry Ho-Lung Chan[1], Duo Liu[2], Tsz Wing Leung[1]; [1]School of Optometry, The Hong Kong Polytechnic University, Hong Kong, [2]Department of Special Education and Counselling, The Education University of Hong Kong

Developmental dyslexia (DD) has been more extensively studied in alphabetic languages, but less is understood in Chinese – a logographic writing system. This study aims to characterize the cognitive profile of Chinese children with DD. We hypothesized that Chinese-speaking children with DD would exhibit deficits in working memory and the M-D pathway, impacting visual attention and motion perception.Forty-nine children with DD (9.02±1.76 years) and 50 age-matched typically developing (TD) controls (9.15±1.80 years) were recruited. Working memory was assessed with the reverse digit span test. Visual attention span (VAS) was evaluated under cue-first and retro-cue conditions. Coherent motion perception was assessed using a random dot kinematogram. Group differences were analyzed using ANCOVA with age as a covariate. Children with DD exhibit significant deficits in working memory by 28.5% ($p < 0.001$) and retro-cue VAS by 6.2% ($p < 0.001$) compared to TD controls. Age significantly affected performance on both tasks ($p<0.001$), but there were no significant group-by-age interactions ($p>0.20$). No significant group differences ($p=0.23$) or group-by-age interactions ($p=0.29$) were observed for coherent motion perception, although age had a significant effect ($p=0.02$). Chinese DD is characterized by impairments in working memory and visual attention. While no significant coherent motion deficit was observed, suggesting the M-D pathway may not be primarily impaired, the observed working memory and visual attention deficits warrant further investigation into the interplay between these cognitive functions and the M-D pathway. These findings have implications for developing targeted interventions for Chinese-speaking children with DD.

Topic Area: LANGUAGE: Development & aging

E5 - The role of dorsal and ventral white matter tracts in phonological and semantic specialization in beginning readers – a combined fMRI and DTI study.

Avantika Mathur[1] (avantika.mathur@vanderbilt.edu), Sriya Kondapavuluru[1], Marjolein Mues[1], Christiana Werner[1], James R Booth[1]; [1]Vanderbilt University

The Interactive Specialization (IS) theory proposes that cortical regions become specialized through activity-dependent interactions during development. This pre-registered study examines IS hypothesis that specialization of cortical regions is determined by their connectivity patterns. Functional specialization is measured by comparing activation during phonological versus semantic tasks in temporal and frontal regions, and structural connectivity is measured with fractional anisotropy (FA) of white matter tracts connecting these cortical regions. Specifically, we explore whether (1) phonological specialization within posterior superior temporal gyrus (pSTG) and dorsal inferior frontal gyrus (dIFG) is associated with structural connectivity in the left arcuate fasciculus (AF), and (2) if semantic specialization within posterior middle temporal gyrus (pMTG) and ventral inferior frontal gyrus (vIFG) is associated with structural connectivity in the left inferior fronto-occipital fasciculus (IFOF). 102 participants (7.39 ± 0.31 years) DTI and fMRI data on auditory rhyming and meaning judgment tasks is analyzed. Phonological and semantic specialization are indexed using average beta estimates from top-250-voxels within anatomical masks. Automatic-Fiber-Quantification is performed on DTI scans to map and segment white matter tracts. Partial correlation analyses are conducted to assess the relationship between functional specialization and the tract-integrity (FA) of tracts at node-level. Results revealed that tract-integrity of (1) AF show positive-correlation with phonological specialization within dIFG (nodes-69-75) and (2) IFOF show negative-correlation with semantic specialization within pMTG (nodes-44-50). Conclusively, the positive-correlation for phonology suggests that specialization is still developing for the dorsal pathway and the negative-correlation for semantics suggests that specialization is relatively mature for the ventral pathway.

Topic Area: LANGUAGE: Development & aging

E6 - Cognitive mechanisms and white matter pathways supporting reading acquisition in Spanish speakers.

Moramay Ramos-Flores[1] (morarf35@gmail.com), M. Florencia Assaneo[1], Luis Concha; [1]Institute of Neurobiology, National Autonomous University of Mexico

Reading is one of the most intricate abilities developed during childhood, relying on the dynamic interplay of cognitive skills and neuroanatomical structures. Despite substantial research, much of our understanding of reading acquisition derives from studies of English-speaking populations, limiting the generalizability of these findings to other languages. In this study, we assessed 61 monolingual Mexican-Spanish-speaking children aged 6 to 8 years, including 41 early readers and 20 non-readers. Participants completed seven tasks from a cognitive battery tailored for Latin America, assessing verbal and metalinguistic skills. Additionally, in early readers, fluency was measured by having them read aloud a short, child-friendly story. Diffusion-weighted magnetic resonance imaging (DW-MRI) data were collected for all participants, and mean diffusion kurtosis imaging fractional anisotropy (dkiFA) values were computed for five bilateral reading-related white matter tracts7: the arcuate, fronto-occipital, inferior longitudinal, superior longitudinal, and uncinate fasciculi. Results revealed that early readers exhibited higher dkiFA values in a composite measure of bilateral ventral tracts compared to non-readers, a difference fully mediated by metalinguistic skills. Among early readers, higher dkiFA values in the right arcuate and right superior longitudinal fasciculi were positively correlated with reading fluency, independent of (i.e., not mediated by) the assessed cognitive skills. Our findings highlight the essential role of metalinguistic skills and bilateral ventral pathway in early reading acquisition among Spanish-speaking children. As reading develops, different brain structures become relevant. Notably, the right dorsal pathway supports fluency in early Spanish readers, challenging typical left-hemisphere dominance models.

Topic Area: LANGUAGE: Development & aging

E7 - Gesture-based instruction enhances neural synchrony and predicts children's mathematical learning

Marine Yumeng Wang[1] (marinewang@uchicago.edu), Marc Berman[1], Susan Goldin-Meadow[1], Yuan Chang Leong[1]; [1]University of Chicago

Teachers' hand movements during lessons influence how children learn mathematics, yet not all movements are equally effective. For instance, in solving 4+2+5=_+5, gesture-based instruction, where a teacher forms a V-shaped hand under the 4 and 2 and points to the blank (the "grouping strategy"), promotes learning more than action-based instruction, where magnetic numbers are physically manipulated. We use fNIRS to measure neural activity as participants watch the same videotaped lesson that either contains gestures or actions. Eighty children (aged 8–10) participated in a math lesson while undergoing fNIRS. They were randomly assigned to the gesture (n=40) or action condition (n=40). In the gesture condition, participants watched videos where the instructor gestured the grouping strategy. In the action condition, the instructor moved magnetic number tiles instead of gesturing. Before and after the lesson, participants completed tests on mathematical equivalence. Inter-subject correlation analysis (ISC) was used to identify neural synchrony differences between the conditions and examine their relationship to learning outcomes. ISC was significantly higher in the gesture condition than in the action condition in the right temporoparietal junction (rTPJ) ($r = 0.17$, $p < 0.001$), right angular gyrus ($r = 0.19$, $p = 0.001$), and right motor area ($r = 0.13$, $p < 0.001$). Furthermore, ISC in the rTPJ during gesture videos correlated with improvement ($r = 0.44$, $p = 0.003$), but not during action videos. The rTPJ, implicated in theory of mind, may reflect children's recognition of gestures as communicative acts, helping them interpret the instructor's intent and enhance learning.

Topic Area: LANGUAGE: Development & aging

E8 - Decay makes all the difference: Facilitation and interference from thematic relations in younger and older adults

Katarina Antolovic[1] (katarina.antolovic@gmail.com), Jessica Marutani[2], Yan H. Yu[3], Mira Goral[1,4], Valerie L. Shafer[1]; [1]The Graduate Center, City University of New York, [2]Hunter College, City University of New York, [3]St. John's University, [4]Lehman College, City University of New York

Thematic relations are context-dependent word associations (e.g., "shell" is an exemplar of the thematic category "beach"). Competing theories propose that co-activation of thematically related words may aid (e.g., Oppenheim & Nozari, 2021) or interfere with (e.g., Abdel Rahman & Melinger, 2019) lexical retrieval. Previous work suggests older adults are less susceptible to context effects due to age-related decrements in contextual processing. This study compared these theories and assessed age-related differences in retrieval. Twenty-four younger ($M = 28.5$) and 23 older ($M = 70.35$) adults completed a modified Blocked Cyclic Naming Paradigm. Participants listened to a narrative establishing a thematic context (e.g., day at the beach) and named related or unrelated images in two block configurations: related items followed by unrelated items (related-first blocks), and vice-versa. We examined responses during initial picture naming and across five repetitions. Participants experienced facilitation from related items in related-first blocks, but interference in unrelated-first blocks. Younger adults experienced greater interference from related items than older adults, but only during initial naming. Electrophysiological N2 amplitudes were more negative for both related items in related-first blocks and unrelated items in unrelated-first blocks. Overall, thematic relations facilitate naming initially but produce interference as conceptual priming decays. The electrophysiological data suggest that the mechanisms underlying retrieval are sensitive to context; both groups exhibited more negative N2 amplitudes for words appearing immediately following the narrative regardless of condition. These results suggest a dynamic relationship between thematic relations, decay in working memory, and aging that current theories do not account for.

Topic Area: LANGUAGE: Development & aging

E10 - Infants at familial risk for DLD, ADHD, or ASD show enhanced rapid auditory processing as a function of interactive acoustic experiences.

Naseem Choudhury[1,2] (nchoudhu@ramapo.edu), Teresa Realpe-Bonilla[2], Cynthia Roesler[2], Laura Milovic[2], April Benasich[2]; [1]Ramapo College of New Jersey, Mahwah, NJ, [2]Center for Molecular and Behavioral Neuroscience, Rutgers University- Newark, NJ

Infants' ability to discriminate between auditory stimuli presented in rapid succession and differing in fundamental frequency (Rapid Auditory Processing [RAP] abilities) has been shown to be impaired in infants at familial risk for Developmental Language Disorders (DLD) as well as infants with a family history of autism spectrum disorder (ASD). We have previously demonstrated that early interactive acoustic experience (IAE), starting at 4-months-of-age, with spectro-temporally modulated non-speech, significantly enhances processing of key pre-linguistic acoustic cues, generalizes to novel non-speech stimuli, and promotes fine tuning of early acoustic mapping in typically developing infants. In this study, 27 typically developing infants (AFH-) and 25 infants with a familial history of DLD, ADHD or ASD (AFH+) received non-speech IAE once a week for 6 weeks from 4.5-6 months of age. At 7-month post-test, dEEG/ERP was recorded while infants listened to 70-ms-long complex tones using an oddball paradigm and a blocked design; interstimulus intervals (ISIs) were 70 or 300ms. Age-matched naive controls (NC), (N=22) were also tested at 7 months. Compared to NC, both AFH+ and AFH- groups showed more efficient processing of these stimuli as indicated by latency and amplitude of waveforms. Surprisingly, in group comparisons, the AFH+ group achieved the fastest latencies as compared to the other groups. Moreover, the N2* ERP component, an early marker for later language outcomes, was significantly enhanced for both active groups as compared to naïve controls. These results suggest that early IAE both accelerates and enhances the maturational trajectory of RAP processing critical for early language.

Topic Area: LANGUAGE: Development & aging

E11 - Examining associations between white matter microstructure in infancy and subsequent reading comprehension skills: A longitudinal investigation

Megan Loh[1], Ted Turesky[1], Olivia Baldi[1], Emily Hu[1], Nadine Gaab[1]; [1]Harvard Graduate School of Education

Reading comprehension (RC) is a complex skill essential for functioning in modern society. Early reading models posit that RC requires word recognition (WR) and language comprehension (LC) skills but also emphasize reading fluency (RF) as a key factor for developing RC. The left-hemispheric arcuate fasciculus (AF) and inferior longitudinal fasciculus (ILF) are important white matter tracts linked with WR and RC in school-age children. Furthermore, fractional anisotropy (FA) of the left AF in infants has been linked to oral language skills in preschool, suggesting the emergence of a scaffold for reading development as early as infancy. We investigated whether FA in the AF and ILF in infancy is also related to subsequent RF and RC skills. Diffusion tensor imaging data were acquired in 31 infants, who had reading skills assessed nine years later at school-age. Whole-brain tractography was performed with MRtrix3 and fibers were segmented into canonical tracts, each 100 nodes, using pyBabyAFQ. Results showed that FA in infancy is positively associated with subsequent higher-order reading skills, specifically between; the left AF and RC, as well as between the left ILF and RF and RC. These results remained significant when controlling for age at time of scan, biological sex, and home literacy environments. These results highlight the role of the left AF and ILF in supporting the long-term development of RF and RC starting as early as infancy. Further analyses are necessary to understand the specific WR and LC mechanisms that connect early white matter organization and higher-order reading skills.

Topic Area: LANGUAGE: Development & aging

E12 - What makes Metaphors hard(er)? An exploration of behavioral responses as a step towards neuroimaging analysis using fNIRS

Anna Schwartz[1], Erin Meier[1]; [1]Northeastern University

Metaphors are phrases frequently used in daily conversation but the neural underpinnings of metaphor remain relatively unknown, with debate revolving around the extent to which additional brain regions (such as regions in the multiple demand network or regions in the right hemisphere) are recruited to support processing of metaphors. We have previously analyzed the neural correlates (via functional near infrared spectroscopy) of novel and familiar metaphors as compared to paired literal phrases with the same base word (e.g., "The only noise was a flush; His memoirs were a toilet flush") but we have yet to explore how other features of the stimuli contribute to processing difficulty. In this work we seek feedback for extending analyses of neuroimaging to other features that contribute to metaphor difficulty. We analyzed behavioral responses to three additional linguistic features of the phrases (1) sensory modalities, 2) syntactic structure, and 3) semantic diversity of the base term, along with three variables of individual differences (2) executive function and (1) vocabulary knowledge. Twenty-eight healthy individuals (n = 14 female; M age = 23.1 ± 3.1 years) participated. In a multi-step linear regression, individual differences were consistently predictive of reaction time and metacognitive awareness, but vocabulary knowledge and syntactic structures were only predictive of slower reaction times, not metacognitive awareness, where sensory modality made no difference to either metacognitive judgments or reaction times. Our findings suggest that a number of features contribute to metaphor difficulty and may recruit different regions of the brain during processing.

Topic Area: LANGUAGE: Development & aging

E13 - Development of Language Processing and Attention in Adolescence: A Longitudinal fMRI Study

Nea Rinne[1] (nea.rinne@helsinki.fi), Patrik Wikman[1], Sofia Lindholm[1], Juha Salmi[2,3], Kimmo Alho[1,4]; [1]University of Helsinki, [2]University of Oulu, [3]Aalto University, [4]Advanced Magnetic Imaging Centre, Aalto University

Language is a fundamental component of human cognition and communication, yet the development of language processing during adolescence remains poorly understood. While much research of language processing has focused on childhood or comparisons between children and adults, adolescence—a period of significant brain and cognitive maturation—has been largely overlooked. We used longitudinal functional magnetic resonance imaging (fMRI) to explore the neural basis of semantic processing during adolescence. Data were collected at three timepoints from 27 participants at approximately two-year intervals, at the ages of 13, 16, and under 18. During the fMRI measurements, participants were presented with written or spoken sentences, with distractor sentences in the other modality either present or absent. Half of the sentences were semantically congruent, and the other half semantically incongruent (e.g., "This morning I had coffee with milk/socks"). Participants attended to the written or spoken sentences and reported whether the attended sentence was congruent or incongruent. The fMRI data was analysed using Multivariate Repeated Measures (MRM) tool. Participants performed better at older ages in both reading and listening tasks, with performance measured as the percentage of correct responses. We observed increased brain activity in the left temporal and frontal regions during incongruent sentences and in frontal regions during distracted conditions. While whole-brain analyses did not reveal significant longitudinal effects, region-of-interest analyses showed age-related neural changes in the inferior frontal gyrus, middle temporal gyrus, and superior temporal gyrus. These findings indicate that neural processes underlying semantic processing continue to develop through adolescence.

Topic Area: LANGUAGE: Development & aging

E15 - I can hear clearly now the strain is gone: Hyper-articulated speech reduces the impacts of listening effort on speech processing in older adults

Jack Silcox[1] (jack.silcox@utah.edu), Sarah Woods[1], Karen Bennett[1], Sarah Ferguson[1], Brennan Payne[1]; [1]University of Utah

The presence of background noise can lead to higher levels of listening effort when trying to process and remember speech. These increases in effort can lead to reduced and delayed brain responses, decreased word recognition and poorer subsequent memory for speech. In the current study, we investigated whether hyper-articulated (or clear) speech would help listeners overcome the negative impact of listening effort. To do this, we presented participants with highly constraining sentences that were accompanied by background noise to induce listening effort. Half of the sentences were presented with hyper-articulated speech and half with conversational speech (i.e., speech that is spoken in an everyday conversational manner). Sentences ended with an expected word, an unexpected word or a syntactic violation. Participants were older adults with a wide range of hearing acuity levels. Results showed that clearly articulated speech led to higher accuracy rates on a grammaticality judgment task, a larger N400 response to unexpected words, a large prediction-related frontal response to unexpected words and a robust, prediction-related N400 response to syntactic violations. Interestingly, the P600, an electrophysiological marker of integration effort was largely unaffected by clear speech. These results suggest that clearly articulated speech is a potential strategy that speakers can use to reduce listening effort effects on semantic processing in older listeners.

Topic Area: LANGUAGE: Development & aging

E16 - To “B” or Not to “B”: Exploring Letter Statistical Learning in the Language Network of Autistic Children

Katherine Trice[1] (trice.k@northeastern.edu), Anna Ciriello[1], Brynn Siles[1], Zhenghan Qi[1]; [1]Northeastern University, Boston, MA, USA

Autistic (ASD) children exhibit variable language and reading skills, and research has found an association between spoken-language and statistical learning (SL) (Boucher, 2011; Davidson & Weismer, 2013; Hu et al., 2023; Aslin & Newport, 2014; Erickson & Thiessen, 2015). The connection between syllable and letter SL found in typically-developing (TD) children does not exist in ASD (Hu et al., 2023). In this fMRI study, we ask whether letters and their embedded patterns are processed by the language network in autistic school-aged children. Using a visual-letter SL task, we examined brain activation in language regions while children viewed structured letter (embedded statistical patterns) vs random letter sequences (ASD: N=16, 3 girls, Mage=7.87 years, SDage=0.99. TD: N=22, 12 girls, Mage=8.78 years, SDage=2.04) (Schneider et al., 2020). In TD, LpSTG, LMFG, and LIFG showed sensitivity to letters, regardless of sequence (ps<0.001), but not ASD. No sensitivity to images in either group, regardless of sequence, were seen in these regions. TD demonstrated structured over random letter sequence sensitivity in LIFG and LaSTG (ps<0.05), but not ASD. This wasn’t a case of lateralization effects – none of the right hemisphere language regions or homologues showed sensitivity to letters or letter-sequence contrasts. Unlike TD, letter SL in ASD did not engage language-related regions of the brain, nor did letters regardless of sequence type. This suggests that autistic children may not treat letters in their phonological forms during SL, which could contribute to learning difficulty for letter-embedded patterns that might lead to downstream reading difficulties in autism.

Topic Area: LANGUAGE: Development & aging

E17 - Statistical Learning with Inner Speech Suppression – Behavioral and ERP Evidence from an Artificial Grammar Learning Task in Children

Ziyi Cao[1] (zcao@mghihp.edu), Asiya Gul[1], Lauren Baron[1], Shivani Patel[1], Annika Schafer[1], Kelsey Black[1], Yael Arbel[1]; [1]MGH Institute of Health Professions

Statistical learning is characterized as an implicit, automatic, and unconscious process. However, there are arguments that explicit processing may not be entirely excluded and might play a supplementary or distractive role in commonly-used statistical learning tasks. This study aimed to evaluate implicit learning in school-age children (8:0 – 12:0) by employing two strategies to suppress explicit processing in a visual Artificial Grammar Learning (AGL) task. First, stimuli were replaced with non-namable, abstract shapes to minimize verbalization that could aid memorization. Second, participants were randomly assigned to an inner-speech-suppression group (S) or a non-suppression group (NS) for comparison. The suppression group was required to repeatedly vocalize an irrelevant word (e.g., "tea") during the learning phase to suppress inner speech and working memory. During the learning phase, participants were exposed to sequential patterns governed by an underlying finite structure. In the subsequent testing phase, they judged whether new patterns were grammatical. A follow-up test one week later assessed knowledge consolidation. Preliminary behavioral results revealed that S and NS groups performed with similar accuracy, significantly above chance ($p < .05$). Accuracy levels were maintained across the one-week interval, with the S group showing a trend of improvement. ERP analyses, time-locked to both pattern completion and violation points, showed a P600 effect in response to grammatical violations at completion points in both groups, but at violation points only in the S group . Additionally, the S group exhibited an FN400 effect at both time points, which was absent in the NS group.

Topic Area: LANGUAGE: Development & aging

E18 - Children’s reading fluency is predicted by cortical delay: Processing latencies estimated from steady-state visual evoked potentials

Fang Wang[1] (fangwang@stanford.edu), Quynh Trang Nguyen[1], Blair Kaneshiro[1], Anthony Norcia[2,3], Bruce McCandliss[1]; [1]Graduate School of Education, Stanford University, [2]Department of Psychology, Stanford University, [3]Wu Tsai Neurosciences Institute, Stanford

EEG studies using Event-Related Potential (ERP) paradigms often investigate the neural temporal dynamics of word recognition through latency measurements. However, these studies typically focus on group-level component peak latencies, leaving a gap in methods that reliably estimate individual differences in neural temporal precision and their relationship to reading fluency. In this study, we utilized the Steady-State Visual Evoked Potential (SSVEP) paradigm, where a sequence of stimuli are presented at a predefined frequency rate. This approach not only assesses latencies but also has the potential to provide reliable single-subject latency estimates. Visual word form stimuli (five-character strings) were presented at 3 Hz, and EEG-SSVEP data were collected from 68 middle school students aged 8 to 15 years. Processing latencies at both group and individual levels were estimated from spatially optimized EEG data, calculated as the change in phase as a function of frequency across multiple harmonics of the stimulation frequency. We discovered highly reliable latency estimates ranging 150~250 ms. Linear correlations revealed that students with higher reading proficiency exhibited shorter latencies, even after controlling for age. Additionally, older students demonstrated shorter latencies after accounting for reading ability. These findings suggest that the neural temporal dynamics of visual word processing may serve as a good predictor of reading abilities and potentially reading difficulties. The study provides a foundation for future translational and clinical applications, particularly in supporting children with developmental dyslexia.

Topic Area: LANGUAGE: Development & aging

E19 - Exploring the Neural Mechanisms of Phonological Awareness in Chinese Children with Potential Reading Disabilities

Yueh-Lin Li[1], Hsin-Chin Chen[2], Li-Ying Fan[3], Shiou-Yuan Chen[4], Tai-Li Chou[1]; [1]Department of Psychology, National Taiwan University, Taiwan, [2]Department of Psychology, National Chung Cheng University, Taiwan, [3]Department of Education, National Taipei University of Education, Taiwan, [4]Department of Early Childhood Education, University of Taipei, Taiwan

Chinese reading comprehension relies on multiple factors, with morphological awareness and reading fluency being particularly critical, especially for children with dyslexia. Phonological awareness also plays a key role in reading comprehension; however, its specific contribution to Chinese-speaking children with dyslexia remains a subject of debate. This study investigates the differential roles of phonological awareness in children with potential reading disabilities and their typically developing peers when learning Chinese. We utilized functional near-infrared spectroscopy (fNIRS) to examine key differences in the neural mechanisms underlying phonological awareness between two groups. Thirty Chinese-speaking children participated, including eighteen typically developing children (mean age = 9.97 years; average Chinese character recognition percentile = 90.42) and twelve children with potential reading disabilities (mean age = 8.47 years; average Chinese character recognition percentile = 60.00). Neural activation patterns during a Chinese phonological awareness task were compared between these two groups. The findings revealed that typically developing children tended to engage more right-hemispheric brain regions during Chinese phonological awareness tasks, including the right superior temporal gyrus (STG) and dorsal inferior frontal gyrus. In contrast, children with potential reading disabilities showed a greater reliance on left-hemispheric brain regions, such as the left STG and inferior parietal lobe. Moreover, typically developing children were more inclined to activate right-hemispheric regions relative to their counterparts in Chinese. These findings reveal distinct roles of phonological awareness in children with different reading abilities and highlight the significant association between right-hemispheric activation and phonological awareness in Chinese during early-stage language development.

Topic Area: LANGUAGE: Development & aging

E20 - Maturation of the T-complex to lexical tone in bilingual Mandarin-English children

YAN YU[1] (yanhyu@gmail.com), Rigel Baron[1], Anita Hyseni[1], Victoria Billack[2], Angela Cheng[1], Valerie Shafer[3]; [1]St. John's University, New York, [2]Saddle Brook Middle/High School, New Jersey, [3]The Graduate Center, City University of New York

Individuals with various developmental disorders, including auditory processing disorders, frequently exhibit abnormalities in their cortical auditory evoked potentials (CAEPs) at temporal sites. Temporal CAEPs, or T-complex, have been studied in monolingual and bilingual children with non-tonal language backgrounds. However, the developmental trajectories of the T-complex in bilingual children with tonal language backgrounds, such as those with a Mandarin-English background, is mostly unknown. This study aims to investigate the neurodevelopmental changes in Mandarin lexical tone processing, as reflected by the T-complex, in Mandarin-English bilinguals. We employed a multiple oddball paradigm and recorded event-related potentials using 65 sensors from bilingual adults and children aged 5 to 10. Tone 1 (high level tone) and tone 2 (low rising tone) served as the deviant tones, while tone 3 (low dipping tone) was the standard. The analysis included data from 17 adults and 35 children, comprising 18 children aged 5-7 years and 17 children aged 8-10 years. We observed that the three sub-components of the T-complex (Na, Ta, and Tb) are less well-formed in children compared to adults, with both groups of children showing significantly larger Ta amplitudes than the adult group. The largest Ta amplitudes were seen in children aged 8 to 10. These results indicate that the T-complex involved in lexical tone processing is not fully developed in bilingual children before the age of 10.

Topic Area: LANGUAGE: Development & aging

E21 - Insights into acquired reading disability: White matter correlates of reading after childhood hemispherectomy

Amy Maguire[1,2,5] (amaguire1@mgb.org), Adriana Azor[2,5], Rebecca Marks[3], Steven Meisler[4], John Gabrieli[5], Joanna Christodoulou[2,5]; [1]Massachusetts General Hospital, [2]MGH Institute of Health Professions, [3]Purdue University, [4]University of Pennsylvania, [5]Massachusetts Institute of Technology

Developmental reading disabilities (e.g., dyslexia) have been well-studied, but acquired reading disabilities (A-RD) have received less attention, leaving students with A-RD underserved. Individuals post-hemispherectomy comprise a unique population for studying A-RD because surgery forces reliance on a single hemisphere for all cognitive functions, even when the remaining hemisphere is not typically associated with language dominance. This study aimed to characterize reading-related white matter structures (arcuate fasciculus (AF); inferior longitudinal fasciculus (ILF)) and their relation to reading measures in children and young adults post-hemispherectomy. We predicted significant correlations between decoding skills and AF microstructure and between sight word skills and ILF microstructure. We measured neurostructural and reading characteristics for N=16 individuals (7-23yrs; 11 right-hemispherectomy, 5 left-hemispherectomy), representing the largest sample to date of post-hemispherectomy patients analyzed using diffusion tensor imaging (DTI) and standardized reading measures. A significant positive correlation was found between the remaining AF's fractional anisotropy (FA) and elision ($r=0.72$, $p<.05$), a decoding subskill that enables "sounding out" unfamiliar words. Moderate positive correlations ($r > 0.54$) were found between arcuate FA and word reading (real and pseudoword) scores . There were no significant correlations between ILF and reading scores. There were significant negative correlations between time since surgery and: AF-MD ($r=-0.75$, $p<.05$), ILF-MD ($r=-0.81$, $p<.01$), and ILF radial diffusivity ($r=-0.83$, $p<.01$). Our findings suggest that microstructural properties of the AF are related to word reading skill development post-hemispherectomy; ILF may support reading development post-hemispherectomy differently than in children with two hemispheres.

Topic Area: LANGUAGE: Development & aging

E22 - Neural Maturation of T-complex responses to vowels in Spanish-English bilingual infants and toddlers

Valerie L Shafer[1] (vshafer@gc.cuny.edu), Katarina Antolovic[1], Kennedy Stomberg[1], Yan H Yu[2]; [1]The Graduate Center, CUNY, [2]St. John's University

The aim of this study was to examine the maturation of the T-complex electrophysiological responses in infants exposed to both Spanish and English from birth. Several previous studies of bilingual four- to six-year old children have shown more negative T-complex measures for bilingual than monolingual children over the left and right temporal electrode sites (T7 and T8). These differences were attributed to bilingual children needing more exposure to their two languages before neural committment to the phonological systems of their languages. The current study hypothesized that differences in experience might occur in even younger children. In this study, the amplitudes of the T-complex elicited to the vowel in "bed" were compared between 89 monolingual (English only) and 81 bilingual infants and toddlers between three months and 46 months of age in a paradigm where infants ignored the speech sounds and watched a muted video while auditory evoked potentials (AEPs) were recorded from 65 scalp electrodes. The results reveal similar latencies and amplitudes of the T-complex AEPs for the youngest age groups. The older monolingual children (28 months to 46 months), however, showed significantly greater negativity at the right site (T8) than bilingual children, with no difference at the left site ($P< .05$). More specifically, the monolinguals showed asymmetry, with left more positive than right sites, whereas the bilingual toddlers showed more symmetrical T-complex responses. We discuss these findings in relation to the maturation patterns observed in other language pairs.

Topic Area: LANGUAGE: Development & aging

E24 - Emotional cues in L2 vocabulary learning: How expressive facial contexts enhance initial learning and long-term vocabulary retention

Chunlin Liu[1] (liu.chunlin.b8@tohoku.ac.jp), Takumi Uchihara[1,2], Motoaki Sugiura[1,3,4], Ping Li[5], Hyeonjeong Jeong[1,2,3]; [1]Cognitive Neuroscience Application Center, Tohoku University, Sendai, Japan, [2]Graduate School of International Cultural Studies, Tohoku University, Sendai, Japan, [3]Institute of Development, Aging and Cancer, Tohoku University, Sendai, Japan, [4]International Research Institute for Disaster Science, Tohoku University, Sendai, Japan, [5]Faculty of Humanities, the Hong Kong Polytechnic University, Hong Kong, China

How do emotional contexts influence both initial learning and long-term retention in second language (L2) vocabulary learning? This study examines how emotional contexts, particularly expressive facial expressions, enhance the acquisition and retention of L2 emotional vocabulary, focusing on both initial and delayed memory performance. Thirty-four native Japanese speakers with no prior knowledge of Chinese learned Chinese positive and negative vocabulary over three days. They watched videos of either emotional (videos with expressive faces) or neutral contexts (videos with neutral faces). On the fourth day, participants completed memory tasks, including a lexical decision task during MRI scanning and a translation task. One month later, delayed translation task was conducted to assess long-term retention. Results revealed a significant emotional context effect in both initial and delayed translation accuracy, with words learned in emotional contexts outperforming those learned in neutral contexts. Additionally, words learned in emotional contexts activated emotional memory regions, such as the amygdala and hippocampus, more strongly than vocabulary learned in neutral contexts. Neural data also showed a significant negative correlation between hippocampal activation and delayed translation accuracy for positive words learned in emotional contexts, while positive words learned in neutral contexts exhibited a marginally positive correlation. These distinct patterns suggest that emotionally enriched learning contexts facilitate more efficient processing of L2 positive words, requiring fewer cognitive resources. These findings highlight the critical role of emotional contexts in enhancing both the formation and retention of L2 vocabulary, offering new insights into the role of affective processing in language learning.

Topic Area: LANGUAGE: Lexicon

E25 - Like… Immersion Matters: Learning English-Specific Discourse Marker Use in Mandarin-English Bilinguals from China

Chenke Wei[1] (ckwei@ucdavis.edu), Katie Sendek, Tamara Swaab; [1]Cognitive Neuroscience of Language Lab

This study investigates how immersion in an English-speaking environment influences the use of English-specific discourse markers (DMs)—words like "well," "you know," and "like" that connect ideas and manage social interactions—by Mandarin-English bilinguals. These markers play distinct roles in English, often lacking direct equivalents in Mandarin, presenting unique challenges for bilingual speakers to master both their grammatical and pragmatic functions. Mandarin-English bilingual students at UC Davis were divided into two groups: those recently immersed in English (fewer than 12 months) and those with over two years of immersion. Speech samples were collected through interviews and storytelling tasks and analyzed for DM usage, grammatical accuracy, and cohesive structure. Using AI-based transcription tools and statistical analyses, including ANOVAs and Principal Component Analysis (PCA), the study revealed that longer immersion significantly increased DM usage. However, this improvement did not correspond to reductions in grammatical errors, suggesting that these require more extended exposure to nuanced social and linguistic contexts. To deepen these insights, follow-up experiments will employ Event-Related Potentials (ERPs) to explore the neural processes underlying the use of English DMs. The N400 (semantic processing) and P600 (reanalysis) will be measured to examine how bilinguals process and adapt to DMs in English versus Mandarin contexts. By investigating how neural responses change with immersion duration, this study aims to elucidate how bilinguals' brains navigate language-specific pragmatic challenges, contributing to our understanding of second-language learning and bilingual adaptation.

Topic Area: LANGUAGE: Lexicon

E26 - Robust Predictive Mechanisms in Aging: Insights from Behavioral and Neuroimaging Research

Sandra Martin[1] (martin@cbs.mpg.de), Merle Schuckart[2,3], Jonas Obleser[2,3], Gesa Hartwigsen[1,4]; [1]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany, [2]Department of Psychology, University of Lübeck, Germany, [3]Center of Brain, Behavior and Metabolism, University of Lübeck, Germany, [4]Wilhelm Wundt Institute for Psychology, Leipzig University, Germany

Language prediction is crucial for understanding and facilitating everyday communication. For instance, when navigating through heavy traffic while following navigation instructions, it acts as a catalyst that enhances processing efficiency. However, there is ongoing debate how much language prediction taxes executive resources. Cognitive aging provides an intriguing context to explore this interaction due to age-related sensory and executive decline. We present data from two large studies: a behavioral study (n=175) and a neuroimaging study (n=90), using a dual-task paradigm that combines text reading with an n-back task of varying cognitive demands. Language predictability is measured by word surprisal, derived from GPT-2. Behavioral study results, using linear and non-linear mixed-effects regression, show that limiting executive resources reduces the benefits of language predictability on reading times across the adult lifespan (20-84 years). Interestingly, even under high cognitive demand, older adults exhibit the strongest language predictability effects, with faster reading times for low surprisal words. These findings have significant implications. They highlight the resource-dependent nature of predictive mechanisms in language comprehension, suggesting that linguistic predictions rely on executive resources. The age-dependent effects underscore the susceptibility to increased processing costs with age, while also demonstrating robust predictive mechanisms in older age. This skill may serve as a compensatory mechanism for executive decline with age. Initial neuroimaging results indicate that predictability processing occurs in a left-lateralized fronto-temporal network. Analyses targeting changes associated with advancing age will further emphasize the age-dependent modulation of this network, offering insights into the neural basis of language prediction in aging.

Topic Area: LANGUAGE: Lexicon

E27 - Beta Bursting During Naturalistic Speech Processing

Lindsey Power[1] (lindsey.power@mail.mcgill.ca), Sylvain Baillet[1]; [1]McGill University

Cortical oscillations in the beta (15-30 Hz) frequency range are increasingly studied for their role in top-down control of neural circuit functions. Beta oscillations manifest as brief bursts with distinct timing and frequency properties. However, associations between these properties and cognitive processes beyond the motor domain remain to be resolved. The present work investigates the hypothesized involvement of beta bursting in predictive processes participating in naturalistic speech processing. MEG data was obtained from 11 healthy participants listening to TED talk recordings. We trained an artificial neural network to predict upcoming speech tokens, and outputs were used to derive proxy measures of the contextual uncertainty and lexical surprisal surrounding each phoneme and word in the audio recordings. We mapped the cortical sources of MEG data and detected ongoing beta bursts in 200 regions of interest. We found that beta bursting was strongly modulated by contextual and lexical speech features. Specifically, beta bursting decreased during speech segments with high uncertainty and surprise. This effect mapped bilaterally over the auditory cortex and broadly over left frontal and temporal regions typically associated with language. Moreover, duration, magnitude, and peak frequency of the beta bursts correlated with contextual metrics over a subset of these language-related regions. Together, these findings suggest broad involvement of beta bursting in predictive speech processes across the language network. Further research on the functional relevance of burst characteristics in relation to speech variables will provide more insight into the nature of naturalistic speech processing by the human brain.

Topic Area: LANGUAGE: Lexicon

E28 - The Influence of Memory Reactivation During Sleep on Vocabulary and Grammar Learning

Stacey Reyes[1] (staceydomagasreyes@gmail.com), Aaron Gibbings[1], Elizabeth Laplante[1], Laura J Batterink[1]; [1]Western University

Two essential components of language learning include vocabulary (item-specific) learning, and rule generalization – the ability to extract regularities from input and apply them to novel instances. During sleep, information is reactivated, leading to the consolidation and strengthening of both item-specific and abstract memory representations. However, it is unclear whether sleep-based memory consolidation influences both vocabulary and regularity-based knowledge to a similar degree, or whether one type of knowledge is preferentially consolidated over the other. In the current project, we test how externally-induced memory reactivation, known as targeted memory reactivation (TMR), influences both vocabulary and grammar knowledge. Participants learned an artificial language comprised of individual vocabulary items along with a hidden suffix rule, followed by a 90-minute nap, during which a subset of the words were covertly presented during stage 3 sleep. This TMR group was compared to two control groups – one that napped without cues (sleep controls) and one that watched a short film (wake controls). Vocabulary knowledge and grammar rule generalization were assessed upon awakening, and after an overnight delay. Results showed that knowledge of the trained words declined over the delay, and this decline was not modulated by sleep or TMR cuing. However, preliminary analyses suggest that only cued participants showed enhanced overall sensitivity to the suffix rule following overnight consolidation. These findings provide initial evidence that, within a language learning context, TMR preferentially impacts general rule-based knowledge over specific item-based vocabulary representations. Ongoing analyses will focus on how sleep physiology relates to these learning effects.

Topic Area: LANGUAGE: Lexicon

E29 - Periodic statistical events trigger downstream when and what predictions

Lorenzo Titone[1] (titone@cbs.mpg.de), Lars Meyer[1,2]; [1]MPI for Human Cognitive and Brain Sciences, [2]University Hospital Münster

Neural synchronization to periodic sequences facilitates downstream processing of subsequent targets that temporally align with the sequence—a mechanism termed entrainment. It is debated whether entrainment drives predictions of both when (timing) and what (identity), and whether the two types of predictions are mediated by distinct or interdependent mechanisms. We recorded the electroencephalogram of 36 participants who listened to periodic streams of syllables. Triplets of syllables formed pseudowords, which could be segmented and learnt from periodic patterns of low transitional probabilities. Streams were followed by a delayed pseudoword target that either matched or violated the time point (when) or identity (what) that could be expected from the prior sequence. Learning was assessed through a recognition task. Participants accurately recognized pseudowords (d’ = 2.46). Frequency-domain analyses revealed phase synchronization at the pseudoword rate (1.1 Hz) during the entrainment phase and the delay, suggesting pseudoword segmentation and sustained synchronization. This temporal-statistical context modulated downstream evoked responses to when violations, with increased P200 amplitude over central electrodes, and to what violations, with decreased N400 amplitude over central-posterior electrodes for pseudowords vs. deviants. Lastly, we found an interaction effect over frontal electrodes with increased P1 amplitude for targets that either matched or violated both types of predictions compared to either one alone. These results suggest that neural synchronization to periodic statistical events induces sustained when and what predictions: Form-based recognition (what) is modulated by temporal (when) predictions at early latencies, but the two types of predictions affect target processing distinctly at later timescales.

Topic Area: LANGUAGE: Lexicon

E31 - The Effects of Bilingual Experience on Neural Flexibility and Prediction During Language Comprehension

Jaime Chou[1], Katherine Sendek[2], Tamara Y. Swaab[3]; [1]UC Davis

Heritage and sequential bilinguals differ in their language experiences, particularly with respect to language switching. This experience promotes their ability to flexibly adapt to environmental demands (Kroll & Mendoza, 2022); however, it is unclear whether it also affects flexible adaptation of predictive processing during language comprehension. Prior research indicates that the facilitative effects of prediction, reflected in N400 modulation, correspond to shifts in lower and higher frequency oscillatory activity in the brain before the onset of critical words (Dave, Brothers & Swaab, 2019). Increased power in lower frequencies, associated with top-down predictive processes, combined with reduced power in higher frequencies, related to bottom-up sensory processing, predicts greater facilitation for anticipated words. This balance can be quantified by measuring the aperiodic slope of broadband EEG activity (0-30Hz), with a steeper slope indicating greater activity in slower oscillatory frequencies. We examine 30 Mandarin/English heritage and 30 Mandarin/English sequential bilinguals as they read sentences with predictable or unpredictable endings. By measuring the slope of aperiodic EEG activity prior to critical word onset and the N400 predictability effect, we hypothesize that heritage bilinguals, with more frequent language switching and longer dual-language exposure, will show a steeper slope and a greater N400 prediction effect. General cognitive flexibility will be assessed using the AxCPT task to determine whether predictive flexibility is mediated by domain-general mechanisms. This study will advance our understanding of how bilingual language experience shapes predictive processing and the extent to which general cognitive flexibility supports adaptation in bilingual language use.

Topic Area: LANGUAGE: Other

E32 - Mirror Speech Entrainment: A novel technique for entraining speech production in aphasia

Celine Davis[1] (celinedavis@usf.edu), Gerald C. Imaezue[1]; [1]University of South Florida

Nonfluent aphasia, often caused by stroke, is characterized by effortful, fragmented speech. Speech entrainment, which uses auditory (voice-speech) or audiovisual stimuli (facial mouth movements plus speech), has shown promise in entraining and improving speech fluency in persons with nonfluent aphasia (PWNA). Traditional speech entrainment relies on external stimuli; however, research suggests individuals focus more on their voice (self-voice attention) or face (self-face attention) than on external sources. Building on this, we introduce Mirror Speech Entrainment (MSE), a novel approach leveraging AI-generated personalized stimuli—voice and video clones of participants—to entrain PWNA's speech using their own voice (audio) and voice paired with facial movements (video). Three feasibility studies, each employing a single-arm (within-subjects) controlled design, will test MSE. In Study 1, four English-speaking PWA (>6 months poststroke) sequentially receive MSE-audio and MSE-video treatments, counterbalanced across participants. Speech rate and accuracy are assessed at baseline (T1), post-treatment one (T2), and post-treatment two (T3). Study 2 evaluates four additional PWA using MSE-video versus traditional audiovisual entrainment, with counterbalanced treatment orders and identical assessment timepoints. Study 3 compares MSE-audio with traditional audio entrainment using the same protocol. All treatments are delivered via mobile apps that automate both MSE and traditional entrainment procedures. Pre- and post-treatment assessments will evaluate gains in speech rate and accuracy in PWNA. Findings aim to determine the feasibility of MSE as an innovative tool for improving speech production in PWNA.

Topic Area: LANGUAGE: Other

E33 - The perceptual span in reading: is there a difference between dyslexic students and their peers?

Antonin Rossier-Bisaillon[1,2,3,4] (antonin.rossier-bisaillon@umontreal.ca), Julie Robidoux[1,2,3,4], Brigitte Stanké[1,2,3], Boutheina Jemel[1,2,3,4]; [1]Université de Montréal, [2]Centre de recherche interdisciplinaire en réadaptation du Montréal métropolitain (CRIR), [3]Institut universitaire sur la réadaptation en déficience physique de Montréal (IURDPM), [4]Centre de recherche du CIUSSS du Nord-de-l'Île-de-Montréal (CIUSSS NÎM)

Introduction: Studies of eye movements in reading show that information located outside the central fixation point – parafoveal information – facilitates preprocessing of subsequent letters and words. For instance, adult readers preview up to 15 characters to the right of the fixation point when reading. This is known as the perceptual span. However, no study has documented the perceptual span in children with a reading disorder such as dyslexia. Considering theoretical models of dyslexia, one might expect a reduction in the extent of the perceptual span for these readers. Methods: 12 dyslexic children aged 9 to 12 years old and 24 age-matched controls were recruited. Children read aloud sentences in which a precise number of characters were revealed to both sides of the fixation point, according to the gaze-contingent window paradigm used in eye-tracking (3, 5, 7, 10 characters and a baseline condition). By masking part of the letters in parafovea and measuring the effect on reading fluency, this experiment indicates the extent of the perceptual span. Results: Restrictions on parafoveal information access progressively reduce reading fluency in control participants, indicating a perceptual span of 5 to 7 characters during reading. In contrast, dyslexics are less affected by the gaze-contingent windows and present a reduced perceptual span of 3 to 5 characters. Conclusion: A better understanding of the perceptual span in dyslexia will be useful to theoretical models of the disorder, but may also inform adaptative tools for screening and addressing reading difficulties.

Topic Area: LANGUAGE: Other

E34 - The sound of silence: Intracranial recordings of covert and overt speech

Taisha Donnelly[1] (taisha.donnelly@univ-grenoble-alpes.fr), Ioana Mîndruță[2,3], Andrei Barborica[4], Andrei-Alexandru Vasiliu[4], Jean-Baptiste Eichenlaub[1], Irina Oane[2,3], Monica Baciu[1], Hélène Lœvenbruck[1]; [1]Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, LPNC, Grenoble, France, [2]Emergency University Hospital Bucharest, Bucharest, Romania, [3]Carol Davila University of Medicine and Pharmacy Bucharest, Bucharest, Romania, [4]University of Bucharest, Bucharest, Romania

Inner speech, or verbal thought, is commonly used for planning, reasoning, and self-regulation. It can be considered a form of motor simulation, wherein multisensory predictions from speech motor plans generate the sensory content of an inner voice. The same mechanisms may support motor control in overt speech through internal monitoring prior to motor execution. To investigate shared recruitment of motor planning and sensory prediction processes across overt and covert speech modes, we compared the neural dynamics of picture naming across each mode, evaluating the high-gamma responses (80-150Hz) using intracranial EEG. Our final dataset included seven patients, who participated in this study while explored with stereo-EEG during presurgical evaluations for focal drug-resistant epilepsy. Group-level analyses revealed peaks in speech motor planning regions around 300-

500ms post-stimulus for both modes, with an additional primary motor cortex peak (~1000ms) exclusive to overt speech, indicating motor execution. Somatosensory regions showed activity around 500ms in both conditions, with a second peak after 1000ms in overt speech. Late auditory activity (>1000ms) occurred only in overt speech. However, early auditory responses (~500ms) were observed in overt speech for two patients and in covert speech for one patient, which may reflect the subjective experience of an inner voice. Overall, the neural dynamics of covert and overt speech support the predictive control hypothesis, highlighting common recruitment of speech motor planning regions and some evidence for sensory predictions before motor execution. This research lays the foundation for advancing speech neuroprosthetics and treating inner speech dysfunctions, such as auditory verbal hallucinations.

Topic Area: LANGUAGE: Other

E35 - Representational Similarity Analysis of the Neural Codes in Word Reading

Deanne Wah[1] (dwah@uwo.ca), Marc Joanisse[1,2]; [1]The University of Western Ontario, [2]Haskins Laboratories

Contemporary models of word reading suggest that reading occurs using two distinct pathways, a dorsal-route decoding pathway (orthography to phonology to semantics; O-P-S) and a ventral-route direct whole word pathway (orthography to semantics; O-S). Rather than forming distinct processes, the two pathways are suggested to interact via a division of labour, with individual readers perhaps differing in their degree of reliance on one or the other. Classical univariate neuroimaging studies are unable to capture graded representations and interdependence of representational units (such as orthography, phonology, semantics, and the intermediate processes). Thus, the present study aimed to investigate how these neural codes are represented in the reading brain using representational similarity analysis (RSA) and whether individual differences in the strength of representations within pathways predict reading ability. Healthy adult monolingual English readers (N = 50) silently read words during fMRI scanning. An RSA searchlight approach was used to identify different reading sub-processes, as instantiated within a computational model of reading. Individual differences were then identified by correlating RSA results with scores on reading and cognitive tests completed outside of the scanner. We found that O-S processing follows a ventral sight recognition pathway, and semantic representations are distributed across the reading network. Additionally, stronger semantic and O-S representations in ventral stream brain regions were related to individuals' greater sensitivity to O-S information. The results support the theory that differences in reading skill ensue from the relative engagement of whole-word processes during visual word processing.

Topic Area: LANGUAGE: Other

E36 - Characterizing frontal-eye-field connectivity in reading and attention

Shaylyn Kress[1,2,3], Josh Neudorf[4], Chelsea Ekstrand[1], Ron Borowsky[3]; [1]University of Lethbridge, [2]Western University, [3]University of Saskatchewan, [4]Simon Fraser University

Background. There is increasing evidence that reading and attention are overlapping and interactive processes. The frontal-eye-fields (FEFs) may be relevant to the theories of shared reading-attention processes, given the involvement of the FEFs in oculomotor control. The goal of this study was to localize interactive reading x attention activation in the FEFs, and examine the structural connectivity profile of the FEFs. Methods. We examined fMRI results from 30 participants who completed a hybrid reading-attention task to identify whether any portion of the FEFs displayed interactive reading x attention activation. We used this subregion as the ROI for a structural connectivity analysis of the open Human Connectome Project (HCP) data. For this analysis, we chose communicability as our measure of structural connectivity, to reflect the strength of indirect connections between regions. Results. In our fMRI dataset, we observed a reading x attention interaction in BOLD intensity in a subregion of the left FEF. In the HCP data, we then observed high communicability between the right hemisphere homologue of this FEF subregion and the basal ganglia (involved in syllabic rhythm processing). These connections appear to support tracts to the cerebellar Crus I/II (involved in eye movements and semantics), and superior parietal lobule (involved in attentional orienting and phonetic decoding). Conclusion. The results of this study support theories of overlapping and interactive reading and attention processes, and highlight a network of regions that should be examined in future studies of functional and structural connectivity.

Topic Area: LANGUAGE: Other

E37 - The role of the Speech-Motor Network in implicit linguistic learning, an fMRI study

Anna Ciriello[1] (ciriello.a@northeastern.edu), Amanda O'Brien[2,3], Zhenghan Qi[1], John Gabrieli[2]; [1]Northeastern University, [2]Massachusetts Institute of Technology, [3]Harvard University

Recently in language learning literature, there has been an interest in the interactions between auditory language learning networks and speech-motor networks. Assaneo et al. (2018) designed the spontaneous synchronization to speech task (SSS) and found an intrinsic speech-motor rhythm that is related to implicit learning of embedded speech patterns. However, we still do not know how the speech production network is involved during different stages of language learning Thus, in the current fMRI study, we ask whether areas active during our speech production task are engaged during learning across synchronization profiles (e.g., high vs. low). Neurotypical adults' (N=48) completed a novel speech production task and an implicit linguistic learning task in an fMRI scanner. We will first examine how the speech production network, defined individually, responds to the embedded linguistic patterns in speech in real time during the learning task. To do this, we will determine the regions of interest (ROIs) for each participant and examine learning-induced brain activation in these regions. Secondly, a subset of participants completed a web-based SSS task (N = 18), where we identified 11 high-synchronizers and 7 low-synchronizers. In an exploratory analysis, we will compare the magnitude of activation in the speech motor network between high and low synchronizers. Our findings will suggest that speech production networks, and their synchrony, play a specific and critical role in auditory statistical learning.

Topic Area: LANGUAGE: Other

E38 - How does the environment wire the brain for literacy? Modeling the relationship between SES, white matter, oral language, and reading

Martina Villa[1,2] (martina.villa@uconn.edu), Nabin Koirala[2,3], Meaghan Perdue[4,5], Lee Branum-Martin[6], Nicole Landi[1,2]; [1]Department of Psychological Sciences, University of Connecticut, USA, [2]Child Study Center, Yale University, USA, [3]Brain Imaging Research Core, University of Connecticut, USA, [4]University of Calgary, Department of Radiology, Canada, [5]Alberta Children's Hospital Research Institute, Canada, [6]Department of Psychology, Georgia State University, USA

Reading is pivotal for educational and occupational success in modern society, therefore, understanding the factors that contribute to variation in reading skill is a major educational objective. Although cognitive and neurobiological contributions to reading are well documented, the contribution of environmental factors remains understudied. One well-described environmental influence on reading is socioeconomic status (SES), which has also been linked to neural development. A small body of literature has shown that SES predicts reading and the integrity of reading-related white matter tracts; however, these studies have not attempted to parcel out the direct and indirect contributions of SES to reading via white matter integrity. Similarly, while many studies link SES and reading to oral language, only one has tested for mediation. The current study uses SEM in a large sample of children from the Healthy Brain Network biobank to test the direct and indirect paths by which SES influences reading through white matter integrity and oral language. Nine white matter tracts (bilateral ILF, SLF, and IFOF; left AF and UF; right CST) and two measures of oral language (phonological awareness (PA) and vocabulary) were selected based on previous literature. Modeling results revealed an effect of SES on reading that was indirectly affected by PA and vocabulary, but not by white matter integrity. Although we did not observe and indirect effect of white matter integrity, it was weakly associated with SES, reading, PA, and vocabulary. Findings will be discussed in the context of existing models of neurobiological and environmental influences on reading.

Topic Area: LANGUAGE: Other

E39 - EEG and cognitive markers of dyslexia and ADHD

Hailey Suttorp[1], Marc Joanisse[1]; [1]University of Western Ontario

ADHD and reading difficulties (RD) are frequently comorbid in children. What underlies this comorbidity is unclear, but a shared underlying deficit that increases the likelihood of either disorder has been suggested. A range of domain-general cognitive skills have been implicated, commonly processing speed and working memory. In this study, we aimed to address this uncertainty, drawing on children and adolescents from the HBN biobank with RD (N=101), ADHD (N=533), both ADHD and RD (N=80), and 404 typically developing controls. Groups were evaluated on processing speed, working memory, naming speed, and executive functions, as well as resting-state alpha power measured with eyes-open and eyes-closed EEG. Individuals with RD showed greater impairment on all 10 cognitive assessments, with comorbid ADHD and RD children showing significantly greater impairment on processing speed and executive functioning measures. Within-group comparisons revealed significantly greater relative alpha power in posterior, compared to anterior electrode sites for ADHD, RD, and comorbid groups in eyes-closed trials. This difference was not observed in RD and comorbid groups in eyes-open trials, however it remained for the ADHD group, as well as became significant for controls. These results indicate that relative alpha power is primarily distributed in posterior electrode sites in attention and reading impaired children especially for eyes-closed resting state trials. Additionally, while RD, and not ADHD, contributes to greater impairment in domain-general cognitive skills, impaired processing speed and executive functioning are candidates for an underlying shared deficit in comorbid ADHD and RD.

Topic Area: LANGUAGE: Other

E40 - Understanding sarcasm requires theory of mind after acute stroke

Somya Mittal[1] (sm174@rice.edu), Margaret Blake[2], Tatiana Schnur[1]; [1]University of Texas Health Sciences Center at Houston, [2]University of Houston

Right hemisphere (RH) stroke often leads to communication deficits, particularly in the comprehension of non-literal language such as sarcasm, which requires understanding a speaker's intended meaning when it is in opposition to what was said. Previous research suggests that difficulties with non-literal language may stem from impairments in understanding another person's perspective, known as Theory of Mind (ToM; Winner et al., 1998). However, the aspects of ToM, such as the ability to spontaneously use ToM (Other ToM) or manage conflict between self and other perspectives (Self ToM), and the ability to interpret nonverbal cues during emotion recognition have not been assessed in the same context. We addressed these gaps to investigate whether sarcasm comprehension deficits were associated with ToM impairments in patients before functional reorganization after brain injury occurred, during the acute phase of RH stroke. We administered a battery of tasks assessing ToM (Other and Self; Biervoye et al., 2018) and abilities to interpret sarcasm and nonverbal cues (McDonald et al., 2017) in 53 participants with acute RH stroke and 17 age- and education-matched controls. Hierarchical regression analyses demonstrated that deficits in sarcasm comprehension following acute RH stroke were significantly linked to difficulties in understanding others' perspectives (Other ToM, p=0.03) independent of contributions from Self ToM, non-verbal cue processing, input processing, and age and education. These results demonstrate that ToM plays a critical role in non-literal language processing, contributing to a deeper understanding of social cognitive mechanisms that may help us understand other pragmatic language deficits in RH stroke.

Topic Area: LANGUAGE: Other

E41 - From a Large Language Model to Three-Dimensional Sentiment

Patrick Clarke[1], Carly Leininger[1], Cristiana Principato[1], Patrick Staples[1], Guy Goodwin[1], Gregory Ryslik[1], Robert Dougherty[1]; [1]Compass Pathways

Understanding sentiment in language with subtlety and precision offers insight into the psychological state of a speaker. Quantitative sentiment applied to therapy transcripts has already proved itself valuable in forecasting outcomes. We present a novel automated model of sentiment analysis that assigns three key emotional dimensions—valence, arousal, and confidence (VAC)—to any arbitrary text. Grounded in the three-dimensional framework of emotion by Mehrabian and Russell, this model offers a nuanced and versatile tool for measuring sentiment in text. Our model utilizes a convex combination of points in a three-dimensional emotion cube, with weights derived from the publicly available BART large language model (LLM), fine-tuned on the Multi-Genre Natural Language Inference (MNLI) dataset. The model demonstrates strong correlations with human ratings for individual words and arguably surpasses human raters in the dimension of confidence. Leveraging the capabilities of LLMs, our model can process text of any size, handle idiomatic expressions, adapt to evolving language trends, and deliver robust sentiment analysis for sentence-length inputs. To highlight its real-world relevance, we apply the model to assess emotional content in sentences spoken during psychological therapy sessions. Additionally, we introduce a new, cleaned version of the EmoBank dataset on which we evaluate the model, thus providing a performance measure on a now high-quality dataset whose text samples resemble the intended real-world application of the model.

Topic Area: LANGUAGE: Other

E42 - Quantifying the involvement of subcortical structures in reading using intracranial electroencephalography

Addison Cavender[1] (addison.c.cavender@vanderbilt.edu), Ghassan S. Makhoul[1], Derek J. Doss[1], Emily Liao[2], Bruno Hidalgo Monroy Lerma[1], Anas Reda[1], Graham Johnson[3], Christos Constantinidis[1], Shawniqua Williams Roberson[2], Shilpa B. Reddy[4], Robert P. Naftel[4], Sarah K. Bick[1,2], Victoria L. Morgan[1,2], Laurie E. Cutting[1], Dario J. Englot*[1,2]; [1]Vanderbilt University, [2]Vanderbilt University Medical Center, [3]Mayo Clinic, Rochester, MN, [4]Vanderbilt Children's Hospital*

Reading ability is a strong predictor of mental health outcomes and later academic achievement and is closely related to socioeconomic status. Previous functional magnetic resonance imaging (fMRI) research has demonstrated that neural processes of reading engage a left-lateralized cortical network of regions including ventral occipito-temporal, temporo-parietal, and inferior frontal language areas. However, these well-studied brain areas are all cortical. Despite recurring evidence of subcortical activation during fMRI reading tasks, few studies specifically investigate the role of subcortical structures in reading. Lesion studies show evidence that damage to one subcortical structure, the thalamus, often disrupts language abilities. Although the thalamus is considered to play an important role in language processing, its role in reading remains unclear. Intracranial EEG (iEEG) recordings from patients undergoing surgical treatment for drug-resistant epilepsy provide an unparalleled view into the spatiotemporal dynamics of cognitive processing and allow researchers to directly measure and probe specific regions in question. While fMRI is an indirect measure of neural activity, iEEG directly measures neural activity with high temporal resolution. Our medical center has recently begun to implant electrodes within the thalamus in these patients, allowing for direct investigation of thalamic activity during presentation of cognitive tasks. Thus, our study aims to investigate high-frequency broadband gamma activation (70-150 Hz) of the thalamus during administration of a passage-reading task to patients undergoing intracranial recording. This study will provide critical insight into thalamic involvement in neural reading processes and may encourage further examination of the influence of subcortical structures in the neural reading network.

Topic Area: LANGUAGE: Other

E43 - Precise numeracy, but not approximation, associated with language across targeted regions of interest

Erin Duricy[1] (etd17@pitt.edu), Corrine Durisko[1], Julie A. Fiez[1]; [1]University of Pittsburgh

Numeracy, a critical skill at the foundation of mathematical processing, can be divided into two subcategories of numerical processing ability: approximate (quantity estimation) and precise numeracy (exact quantity). Loss of numeracy is commonly comorbid with aphasia following stroke, yet little is known about the neural basis of the relationship. Here, we used a targeted region-of-interest (ROI) analysis to investigate the relationship between approximate and precise numeracy with language ability at three ROIs: left intraparietal sulcus (IPS), angular gyrus (AG), and inferior frontal gyrus (IFG). We predicted that damage to left IPS would impact performance on both approximate and precise measures independent of language abilities, while damage to the left AG and IFG would selectively impact performance on precise numeracy measures and co-vary with aphasia severity. In a sample of N=104 left hemisphere chronic stroke survivors (59M/45F, mean age 61.59 ± 12), we performed multiple regression analyses for approximate and precise numeracy performance as a function of percent ROI overlap for each ROI, with aphasia severity as a covariate. Our results support the link between precise numeracy and aphasia severity specifically, with a significant prediction effect for aphasia quotient across all precise numeracy models ($p < .0001$) and no significant association with approximate numeracy (p's > .05). However, we did not find significant association of ROI overlap and numeracy performance for any region (p's > .05). Overall, these findings support distinct relationships between language and precise versus approximate numeracy but highlight the need for a future whole-brain investigation beyond traditional ROIs.

Topic Area: LANGUAGE: Other

E44 - The cerebellar components of the human language network

Colton Casto[1,2] (ccasto@mit.edu), Benjamin Lipkin[2], Hannah Small[3], Moshe Poliak[2], Greta Tuckute[2], Anila D'Mello[4,5], Evelina Fedorenko[1,2]; [1]Harvard University, [2]MIT, [3]Johns Hopkins University, [4]University of Texas Southwestern, [5]University of Texas at Dallas

The cerebellum's capacity for neural computation is arguably unmatched. Yet despite ample evidence of cerebellar contributions to cognition, including language, its precise role in linguistic processing remains debated. One reason for this is that most prior studies have had to choose between cross-domain breadth—sampling a wide range inputs/tasks across domains to inform specificity—and domain-specific depth—sampling specific, theoretically-motivated tasks within a singular domain to inform function. Here, we undertake a large-scale evaluation of cerebellar language-responsive areas using precision fMRI that is both broad and deep with respect to the inputs/tasks that we consider. We identify four cerebellar regions that respond robustly during language processing across both auditory and written modalities (Experiments 1a-b, n=754). However, only one of these areas—spanning Crus I/II/lobule VIIb—appears to be selective for language relative to diverse motor, perceptual, and cognitive nonlinguistic tasks (Experiments 2a-e, n=776). Similar to the cortical language system, Crus I/II/VIIb supports semantic processing, in both comprehension and production, but it does not support word access or phrase structure building (Experiments 3a-b, n=111). Crus I/II/VIIb is also modulated by some, but not all, of the same sentence-level features that modulate cortical language regions (e.g., grammaticality and frequency; Experiment 3c, n=5). Finally, of the cerebellar language-responsive areas, Crus I/II/VIIb is the most functionally integrated with the cortical language system (Experiment 4, n=85), suggesting that it may receive information from the cortical language network for further semantic processing.

Topic Area: LANGUAGE: Other

E45 - Enhanced responses to non-interpretable speech-like stimuli in speech and language brain areas of psychosis patients with auditory hallucinations

Tamar Regev[1] (tamaregev@gmail.com), Melissa Hwang[2], Hee So Kim[1], Evelina Fedorenko[1], Ann Shinn[2,3]; [1]MIT, [2]McLean Hospital, [3]Harvard Medical School

The neural basis of auditory hallucinations (AH) in schizophrenia and related disorders remains debated. We recorded fMRI responses to auditory stimuli in individuals with schizophrenia or psychotic bipolar disorder with (n=42) vs. without (n=37) a lifetime history of AH, alongside healthy control participants (n=35). Auditory stimuli were presented in three conditions in a block design: (1) real sentences, (2) nonword sentences matched for phonological properties, and (3) non-speech auditory stimuli matched to speech acoustics ('speech textures'). In each participant, we identified primary auditory areas anatomically, as well as speech and language areas using validated functional localizers. Results revealed: (i) robust responses across all groups to all conditions in the primary auditory areas, (ii) robust responses across all groups to real sentences in speech and language areas, but critically, (iii) enhanced responses to nonword sentences and speech textures in the speech and language areas in patients with AH, as well as in individuals diagnosed with schizophrenia more generally, relative to controls. These results suggest that in patients with AH, non-interpretable speech-like stimuli propagate further along the auditory pathway, eliciting greater activation in areas downstream of the primary auditory cortex, compared to patients without AH or controls. While this study examined responses to external auditory stimuli, it is plausible that, in the absence of external input, a similar process is endogenously generated, leading to salient verbal percepts; this feature of the auditory-speech-language pathway deserves further investigation as a possible mechanism underlying auditory hallucinations.

Topic Area: LANGUAGE: Other

E46 - Phoneme encoding during spoken language comprehension is enhanced by linguistic structure and by statistical experience

Filiz Tezcan[1,2] (tezcanfiliz@gmail.com), Fan Bai[1], Noémie te Rietmolen[1], Sanne Ten Oever[1,2,3], Andrea E. Martin[1,2]; [1]Max Planck Institute for Psycholinguistics, Netherlands, [2]Donders Centre for Cognitive Neuroimaging, Radboud University, Netherlands, [3]Maastricht University, The Netherlands

The brain uses its knowledge of language (viz., linguistic units and structures, distributional statistics about them) to turn the physical expressions of speech and sign into meaning. However, how these two types of information come together in neural representations of language is an open question that deeply touches on how the information underlying human behavior can be encoded in the brain. Utilizing MEG data from native and non-native speakers listening to Dutch, Chinese, and Turkish speech stimuli, we examined phonemic and acoustic feature encoding during and in the absence of language comprehension. Phoneme features were more robustly encoded in sentences than in word lists, and within words compared to streams of random syllables. Furthermore, for the nonnative speakers, we found statistical experience with an uncomprehended language (i.e. a language speakers were familiar with) to enhance phoneme feature encoding to the same level as in a native language, while acoustic edge tracking was stronger than in the native language, possibly due to lack of suppression by higher-level representations. Our findings suggest that the phase alignment of neural signals with acoustic and phoneme features of speech undergoes dynamic modulation during comprehension based on linguistic structure and statistical experience. This study highlights the interplay between linguistic structure and statistical learning in neural speech processing, with implications for understanding how the brain integrates smaller linguistic units into more abstract structures.

Topic Area: LANGUAGE: Other

E47 - The source of costs in language switching: evidence from ERP and behavioral measures

Kalinka Timmer[1] (k.timmer@uw.edu.pl), Agata Wolna[2], Hanna Cwynar[1], Zofia Wodniecka[3]; [1]University of Warsaw (Poland), [2]Massachusetts Institute of Technology (MIT), [3]Jagiellonian University (Poland)

Bilinguals incur a cost when switching between languages in the traditional language switching paradigm. However, bilinguals effortlessly switch languages during everyday conversations. To investigate the source of language-switch costs, in Experiment-1, 69 Polish-English bilinguals named pictures in their L1 and L2 based on auditory arbitrary (low vs. high tones) and question cues ('Co?' vs. 'What?'). The switch cost (language switch − repeat trials) was reduced in question (52ms) compared to arbitrary cues (91ms). ERPs revealed the source of easier switching following questions: reduced selective attention to cue-processing (N1: tone > L2 > L1 cues), no cue-updating for language-switch costs that is present for tone cues (N2: repeat > switch), and earlier reconfiguration of the cue-to-language-reponse mapping (LPC: question < tones). Thus, question cues show more efficient cue-processing (N1) and language-switching (N2 and LPC). Next, we investigated (1) to what extent the switch cost reflects cue-switch costs (cue-switch-but-language-repeat − full repeat trials) and (2) whether question cues trigger both the language to use and the communicative goal. In Experiment-2 and Experiment-3, bilinguals (67 and 52) named pictures based on auditory question cues ('What's this?'/'And this?' in Polish vs. English) and auditory arbitrary cues (Experiment-2: low/high tones played by piano vs. violin; Experiment-3: 'Tuesday'/'Thursday' in Polish vs. English). Cue-switch costs were smallest for question cues (Exp-2: 31ms; Exp-3: 31ms) than language cues (72ms) than tone cues (188ms). Thus, language-switch costs may partially reflect cue-processing, with question (vs. tone) cues activating the corresponding language and (vs. language) cues activating the goal of speaking.

Topic Area: LANGUAGE: Other

E48 - Investigating the Neural and Behavioural Consequences of Rhythmic Auditory Priming on Statistical Learning

Émilie Rae Hoeppner[1] (ehoeppne@uwo.ca), Laura Batterink[1], Karli Nave[1]; [1]Western University

Statistical learning is the process of becoming sensitive to patterns in the environment simply through exposure. During this process, neural activity aligns with the detected patterns, a phenomenon known as neural entrainment. A central question is whether neural entrainment functionally contributes to statistical learning or whether it merely reflects downstream aspects of the learning process. The current study will address this question using an auditory rhythmic priming approach, which has been previously shown to modulate neural entrainment and enhance aspects of language processing. Participants will listen to musical rhythms, which will be followed immediately by artificial language streams containing repeating trisyllabic words. Critically, the underlying beat of the rhythms will either align with the word presentation frequency (congruent condition), or conflict with the word frequency (incongruent condition). Participants' EEG will be recorded throughout the exposure period to measure neural entrainment to the repeating patterns. Following exposure, participants' learning will be assessed behaviourally using both explicit memory tests and an implicit, reaction-time based target detection task. We hypothesize that participants in the congruent condition will demonstrate increased neural entrainment at the word frequency as well as enhanced statistical learning outcomes relative to participants in the incongruent condition. Our findings will offer insight into whether neural entrainment functionally contributes to statistical learning.

Topic Area: LANGUAGE: Other

E49 - The Influence of Language Congruency on Narrative Recall in Bilingual Individuals

Veronica Foureaux-Lee[1] (l.veronica@wustl.edu), Angelique I. Delarazan[1], Zachariah M. Reagh[1]; [1]Washington University in St. Louis

For multilingual individuals, the language used to encode and remember information provides an important source of context. However, research on the influence of language on memory is limited. Given that most of the world's population is multilingual, understanding these effects has important implications for language access in legal, clinical, and educational settings. This study investigated how recalling a narrative in the same versus a different language from encoding impacts the accuracy and detail with which the narrative is recalled. We additionally examined language-dependent effects on narrative recall both immediately and after a 24-hour delay. Native bilingual (Spanish-English) participants listened to eight stories divided into two equivalent blocks, with each block containing two stories in English and two in Spanish. Participants (N=21) then verbally recalled the stories either in the same or a different language, at an interval of 24 hours or immediately post-encoding. Findings demonstrated a greater vulnerability to memory changes for Spanish recall than English recall, with main effects of both retention interval and language condition. An effect of language condition was also observed for immediate recall in English. Additional exploratory analyses compared recall across individuals, and showed that participants' recall was more semantically similar to each other than to the originally encoded story itself, suggesting a "shared narrative" phenomenon both within and across languages. These findings highlight a complex interplay between language and memory and demonstrate that language may impact memory differently depending on the retention interval.

Topic Area: LANGUAGE: Other

E50 - Regional Brain Age Patterns Predict Aphasia Outcomes

Ansley Martin[1] (ansleymm@email.sc.edu), Leonardo Bonilha[2], Chris Rorden[1], Julius Fridriksson[1], Nicholas Riccardi[1]; [1]University of South Carolina - Columbia, [2]University of South Carolina School of Medicine

Background: Language is a cornerstone of cognition, aiding communication and complex thought. Aphasia is a language impairment commonly caused by stroke, severely affecting quality of life. Emerging evidence suggests that health of surviving brain tissue is important for post-stroke language-related outcomes. Brain age is a novel in vivo neuroimaging biomarker of brain health, but its potential for understanding clinical outcomes in aphasia is largely unexplored. Methods: T1-weighted MR images were analyzed with VolBrain's BrainStructureAges to estimate brain ages for 66 regions. Regional brain age gaps (regiBAG) were calculated as the difference between estimated and chronological ages. An exploratory factor analysis was conducted on the regiBAG correlation matrices from the unlesioned right hemisphere. The 4 identified regiBAG factors, reflecting various brain-aging patterns, were used in a stepwise linear regression model to predict Western Aphasia Battery (WAB) and Philidelphia Naming Task (PNT) scores at baseline and 6-months. Neuroimaging and behavioral data were available for 188 people. All stepwise models included lesion volume, days post-stroke, sex, and age. Results: A model including lesion volume, age, and Factors 1 & 3 significantly predicted WAB scores ($F(4,183)=35.24$, $p<.001$, adj. $R2=.423$). Baseline PNT was significantly predicted by lesion volume, age, and Factors 1 & 3 ($F(4,139)=14.924$, $p<.001$, adj. $R2=.280$) and 6-month PNT by days post-stroke and Factor 4 ($F(2,123)=6.761$, $p=.002$, adj. $R2=.084$). Conclusion: Regional brain age patterns are easily attainable and effectively aid in the prediction of aphasia outcomes, making it a promising tool for evaluation of post-stroke brain health.

Topic Area: LANGUAGE: Other

E51 - Is language-based statistical learning a stable individual trait?

Amiya Aggarwal[1] (aaggar7@uwo.ca), Laura Batterink[1]; [1]University of Western Ontario

Over the past 30 years, statistical learning has been established as a learning mechanism that seems to be universal across development. However, previous research shows that individual statistical learning performance does not reliably correlate across tasks, modalities or even domains within the same modality (e.g. syllables versus nonlinguistic tones). An important question yet to be fully addressed is whether statistical learning within a single domain is a reliable individual trait. Some studies have shown domain-specific individual differences, though primarily using explicit measures of learning. Given that explicit memory abilities are generally stable at the individual level, results from these prior studies may reflect differences in explicit memory performance, rather than sensitivity to patterns in input. To further understand whether statistical learning is a stable trait that reliably differs among individuals, we will test participants' ability to segment words from two distinct artificial language streams at two time-points separated by a two-week delay, using multiple measures of learning. Both testing sessions will include exposure to a unique artificial language composed of repeating trisyllabic words. Subsequently, learning will be assessed with two explicit measures (a familiarity rating task and a 2-alternative forced choice test) as well as an implicit, reaction-time based target detection task. If statistical learning is a stable individual trait, we expect performance on the implicit target detection task to correlate across sessions, independently of explicit memory abilities. Such a result will encourage further investigations targeted at understanding whether implicit statistical learning performance predicts individual differences in real-world language learning.

Topic Area: LANGUAGE: Other

E52 - Examining the impact of ADHD subtype on reading ability and brain function in school-aged children with Dyslexia

Alexander J. Kaminsky[1] (ajkaminsky@mghihp.edu), Rebecca A. Marks[1,2], Hanna K. Thesken[2], Annie L. Cardinaux[2], Karolina Wade[2], Rachel T. Norton[1], Adriana M. Azor[1], Alysa E. Doyle[3], Ellen B. Braaten[3], John D. E. Gabrieli[2], Joanna A. Christodoulou[1,2]; [1]Massachusetts General Hospital Institute of Health Professions, [2]Massachusetts Institute of Technology, [3]Massachusetts General Hospital

Background: In youth with co-occurring neurodevelopmental challenges, understanding the complex interplay of diagnoses is essential for tailoring effective interventions and improving outcomes. Dyslexia and ADHD, two of the most common childhood disorders, commonly co-occur. Prior work shows that reading scores and reading brain systems do not differ for children with dyslexia alone versus those who also have ADHD. To further this idea, we examine whether ADHD subtype may differentially impact reading scores and/or reading brain systems in dyslexia. Methods: Participants were 76 children (grades 2–5) with dyslexia, 42 of whom also had ADHD (20 Inattentive; 22 Combined). Participants completed 30 clinical standardized tests across domains including reading, math, and cognition. Functional MRI during visual word rhyming was conducted. ANCOVAs (correcting for age) compared Dyslexia only, Dyslexia + ADHD-IN, and Dyslexia + ADHD-C groups, with FDR correction for multiple comparisons. Results: The three groups demonstrated no significant differences across the 30 measures, including reading, math, executive function, and non-verbal IQ. Functional MRI during visual word rhyming revealed no significant differences in activation patterns between the Dyslexia only, Dyslexia + ADHD-IN, and Dyslexia + ADHD-C groups. Conclusions: Although ADHD and Dyslexia commonly co-occur, reading performance does not appear to be affected when children are impacted by both challenges; this finding persists across the Inattentive and Combined subtypes of ADHD.

Topic Area: LANGUAGE: Other

E53 - Second and Foreign Language Learning in Autistic Adults

Catherine Caldwell-Harris[1] (charris@bu.edu); [1]Boston University

Introduction. Little is known about autistic adults' experiences of second and foreign language learning (called, additional language learning). In our team's prior qualitative study, autistic adults reported learning via grammar books and self-study and being interested in language history and structure, reminiscent of what has been reported for polyglots. Method. A survey assessed methods of learning, self-reported ratings and 'can do' scales (e.g., order at a restaurant, read a newspaper). Autism and systemizing traits were measured. Phonological pattern recognition was assessed via Sound it out' and sound symbolism tasks. Sensitivity to grammatical structure was measured with a part of speech determination. A surprise memory test was based on previously seen nonsense words. Completed surveys were obtained from 114 self-identified autistic adults and 112 Neurotypical adults, who were recruited online. Respondents reported a wide variety of native languages and ranged in age from 18 to 59. Results. Autistic participants reported studying on average 2.7 foreign languages compared to 1.4 reported by neurotypical learners, but learned their languages less well. Autism Quotient scores correlated positively with Parts of Speech and Sound it Out tests. Many autistic learners reported learning via self-taught methods and online media, whereas neurotypicals were more likely to learn via a classroom, social interaction and immersion. Autistic respondents more often answered affirmatively to the open-ended question, Has learning an additional language improved communication in your first language? Conclusion. Foreign language learning could be an intervention to improve social functioning, for at least some persons with autism.

Topic Area: LANGUAGE: Other

E54 - How individual differences influence code-switched sentence comprehension: An ERP study

Ingrid Chuang[1], Janet G. van Hell[1]; [1]The Pennsylvania State University

Bilinguals regularly use two languages within a single utterance. This code-switching provides a valuable testbed for examining cross-language interaction and cognitive control in bilingual comprehension. Using auditory ERPs, Fernandez et al. (2019) found that dominant-to-weaker language switches elicited N400 (associated with semantic access) and LPC (associated with sentence-level reanalysis) effects, whereas weaker-to-dominant switches elicited only an N400 effect. While these and related findings highlight different neural responses for the two code-switching directions at the group level (for review, see Van Hell, 2022), the role of individual variability remains underexplored. This study investigates how individual differences in cognitive and linguistic skills influence ERP responses associated with auditory code-switching comprehension. Native Spanish speakers proficient in English (about half had become English-dominant at the time of testing) listened to sentences in four conditions: entirely in English, English-to-Spanish switches, entirely in Spanish, and Spanish-to-English switches. Measures of language proficiency, cognitive control, and familial sinistrality were collected. The ERP results replicated Fernandez et al. (2019)'s findings, with dominant-to-weaker language switches eliciting both N400 and LPC effects, and weaker-to-dominant switches eliciting only an N400 effect. Importantly, higher L1 (Spanish) proficiency was associated with reduced N400 effects during weaker-to-dominant switches, whereas higher L2 (English) proficiency was associated with reduced LPC effects in dominant-to-weaker switches. Cognitive control abilities did not impact code-switch related ERP effects. These findings will be explained in terms of the importance of individual differences in shaping bilingual language processing, offering new insights into the cognitive and neural mechanisms underlying code-switching comprehension.

Topic Area: LANGUAGE: Other

E55 - Not so fast! Top-down predictions do not affect the earliest stages of visual word processing

Trevor Brothers[1], Tamara Swaab[2,3], Matthew Traxler[2,3]; [1]North Carolina A&T State University, [2]Univeristy of California, Davis, [3]C Davis Center for Mind and Brain

Prior electrophysiological studies have suggested that linguistic prediction can influence the earliest stages of visual word processing, within 200ms of word onset. However, the timing and polarity of these prediction effects have varied widely across studies, leading some researchers to question the validity of these findings (Nieuwland, 2019). Here, we investigated ERP effects of linguistic prediction in four reading comprehension experiments (N = 155) and an active prediction task (N = 51). In all experiments, predictable and unpredictable words triggered robust visual responses over occipito-temporal sites (P1, N1), but the amplitude of these components did not differ as a function of predictability. Furthermore, mass univariate analyses revealed no significant predictability effects in early windows (0-200ms), despite the considerable statistical power of the current experiments. Instead, the neural effects of word predictability emerged at a slightly later time point (200-300ms), likely reflecting the benefits of contextual predictions on lexico-semantic access. Our findings suggest that earlier stages of visual decoding are impermeable to linguistic context, which places important constraints on predictive coding accounts of visual word recognition.

Topic Area: LANGUAGE: Other

E56 - Brain functional connectivity organization underlying movie watching

Xuehu Wei[1,2], Laura Rigolo[1], Colin P. Galvin[1], Alexandra J. Golby[1], Einat Liebenthal[2], Yanmei Tie[1]; [1]Department of Neurosurgery, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, USA, [2]McLean Imaging Center, McLean Hospital, Harvard Medical School, Belmont, Massachusetts, USA

Introduction: Movie-watching condition can elicit highly synchronized activity in large-scale brain areas across individuals. Beside activity in brain areas, cognitive processing relies on interactions within a complex network of brain regions. In this study, we aim to understand the functional organization of brain networks underlying movie watching. Methods: Twenty-two healthy, right-handed native English speakers (11 males, mean age = 26.3 years) underwent fMRI while watching a 7-minute family movie clip. Using intersubject functional correlation (ISFC) analysis, we investigated the functional network organization across 360 cortical and 16 subcortical regions. We then identified a "rich club" of highly connected hubs of brain network topology. We also performed inter-subject correlation (ISC) analysis and graph theoretical analysis to assess the synchrony and global network properties of brain activation. Results: Our study identified a "rich club" ($p < 0.001$, permutation testing), consisting of 42 regions with a degree $k \geq 68$ located in bilateral superior temporal and parietal cortex gyri, visual cortex, and parahippocampus. ISC analysis showed higher synchrony ($p < 0.005$, FDR corrected) in all rich-club regions. Centrality analysis revealed a high level of betweenness centrality for rich-club regions: over 71% of the shortest paths in the brain networks passed through at least one rich-club region, and 31% passed through at least one rich-club connection. Conclusion: "Brain hubs" - high-degree regions - in the temporal-parietal language system, visual cortex, dorsal attention network, and emotion system exhibit strong interconnectivity, forming a central rich club essential for facilitating whole-brain communication during movie watching.

Topic Area: LANGUAGE: Other

E57 - Inferencing During Visual and Verbal Narrative Comprehension in Autism: An EEG Study

Emily Coderre[1] (emily.coderre@med.uvm.edu), Devon Kearns[1], Olivia Ciocca[1], Holly Chappell[2], Caitlyn Soong[2], Nicole Sperrazza[2], Emily Zane[2], Neil Cohn[3]; [1]University of Vermont, [2]James Madison University, [3]Tilburg University

Autistic individuals sometimes struggle with understanding stories told verbally (i.e., through written/spoken language) and visually (e.g., comics). Inferencing abilities help comprehenders interpret implicit information by filling in the gaps between explicit events in both visual and verbal modalities. Autistic individuals sometimes show difficulties with inferencing, which could contribute to comprehension difficulties in autism that should extend to both verbal and visual narrative comprehension. However, no studies have directly compared inferencing in autistic individuals across modalities. We collected EEG data from 52 participants (mean age=25, range=18-65) with a range of autistic traits (measured by the Autism Quotient: M=21, range=4-44) during two inferencing tasks. In the visual domain, participants viewed 6-panel comic strips (normal condition) or 5-panel strips in which the panel depicting the narrative climax was removed (inference condition). In the verbal domain, participants read 5-sentence stories (normal) or 4-sentence stories in which the climactic sentence was dropped (inference). Participants also completed measures of visual language fluency and reading comprehension. In the visual modality, fluency interacted with autistic traits in late time windows (900-1000 ms). With high visual language fluency, the level of autistic traits did not impact inferencing abilities; when fluency was low, greater autistic traits were associated with larger positivities. In the verbal modality, higher autistic traits were associated with larger early negativities (200-300 ms) regardless of reading comprehension scores, possibly indicating an earlier onset of inferencing processes. Overall, these results suggest that autistic traits influence inferencing processes during narrative comprehension, albeit in different ways across modalities.

Topic Area: LANGUAGE: Other

E58 - Evaluating the impact of channel density on Representational Similarity Analysis of prediction-related effects in language

Aya Gomaa[1] (gomaa2@illinois.edu), Ryan J. Hubbard[1,2], Kara D. Federmeier[1,3,4]; [1]University of Illinois at Urbana-Champaign, USA, [2]State University of New York at Albany, USA, [3]Beckman Institute for Advanced Science and Technology, University of Illinois Urbana-Champaign, USA, [4]Program in Neuroscience, University of Illinois Urbana-Champaign, USA

Predictive processing plays a key role in many aspects of human cognition, including language comprehension. However, to directly capture pre-activation, neural activity must be measured preceding the anticipated stimulus. Representational Similarity Analysis (RSA) combined with EEG offers a promising approach by correlating neural representations across the scalp to identify similarities between stimuli, allowing for the detection of pre-activation signals. Hubbard & Federmeier (2021) used RSA to quantify the correlation between neural signals measured just before and after the presentation of a potentially predictable word, finding a similarity signal that was sensitive to contextual constraint. Given the increased use of RSA with EEG to study prediction in language, it is important to ascertain how the number of EEG channels (spatial density) might influence the power of the observed similarity signal. To address this, we are building on Hubbard and Federmeier (2021), recording EEG to sentences varying in constraint. Using RSA to compare EEG activity patterns elicited by pre-final and final words, we are replicating the finding that peak similarity is observed in an early window (100–230 ms) after word presentation and is modulated by sentence constraint, indicating pre-activation of the final word. Critically, we are evaluating the effect of varying the number of EEG channels (from 10–60) used for the RSA analysis. Initial findings suggest that similarity measures increase with more channels, but it is unclear if higher density improves power to detect condition-related differences. This work will ultimately provide valuable insight for any researcher using the RSA technique.

Topic Area: LANGUAGE: Other

E59 - Encouraging Gesture for Increased Macro-linguistic Narrative Production

Ted Jenkins[1]; [1]Rhode Island College, [2]New York University

A. Introduction: Manual hand movements are often associated with reducing the cognitive load associated with micro-linguistic language production tasks. However, it is not known if encouraging these gestures can lead to macro-linguistic improvements for speakers. B. Methods: 18 adults (18-45 years old) without any neurological damage were recruited to retell an unfamiliar story under two conditions (i.e., T1 and T2). In both conditions, participants were presented with a series of pictures outlining the story and then asked to retell the story. During T1, the participant was asked to retell the story; during T2, participants were asked to clap 30 times before retelling the story. A total of at least 7 days elapsed between T1 and T2. Measures of story quality (i.e., lexical diversity, sentential subordination, and narrative organization) were used to compare stories retold in T1 and T2 using paired sample t testing. C. Results: Baseline data for T1 and T2 (i.e., short story retell at beginning of T1 and T2) showed no significant gesture or story quality before each session. Narrative quality and gesture frequency was significantly higher in T2 than T1 for lexical diversity, sentential subordination, and narrative organization ($p<.05$; see appendix A). D. Conclusion: The presence of a gestural training (i.e., T2) seemed to increase gesture and linguistic production compared to the control (i.e., T1). Increasing/encouraging gesture is thought to involve more cognitive resources, increase linguistic performance, and may be a valuable modality for language intervention.

Topic Area: LANGUAGE: Other

E60 - Automated connected speech classification of language impairment in acute stroke

Lokesha Pugalenthi[1] (lp60@rice.edu), Junyi Jessy Li[2], Tatiana Schnur[3]; [1]Rice University, [2]University of Texas at Austin, [3]University of Texas, Houston

Using connected speech to assess language impairment quantitatively is rare due to time constraints associated with elicitation, transcription and scoring. We predicted language impairment during acute left hemisphere (LH) stroke using connected speech to discriminate between controls, patients with language impairment, and without. We analysed connected speech narratives of 74 patients with LH acute stroke (50 with language impairment; tested within an average 3.9 days post-stroke) and 85 controls (age-, education- matched to language impairment group, p's > 0.1; AphasiaBank, MacWhinney et al., 2011). We derived 22 lexical-semantic and syntactic linguistic features and individual narrative embeddings (OpenAI text-embedding-3-large model; 2024) as input to classification algorithms to compute balanced accuracy discrimination success. Nested cross-validation determined best classification algorithm and internal hyperparameters. Leave-one-out cross-validation generalized results across participants. Permutation analysis computed each feature's contribution to classification performance. We achieved excellent differentiation (99% balanced accuracy, Logistic Regression) between controls and acute stroke patients with language impairment. Features affecting classification performance > 5% include mean sentence length, median utterance length, number of narrative words, degree of phrase elaboration. We achieved promising discrimination (73% balanced accuracy, Support Vector Classifier) between LH with and without language impairment. Features affecting classification performance > 5% include words per minute, mean word length, proportion closed-class to narrative words produced, number narrative words, and morphological complexity of tensed main clause verbs. Our results constitute an important step toward an automated assessment of language impairment from connected speech to facilitate referrals for speech-language therapy in the setting of acute stroke.

Topic Area: LANGUAGE: Other

E61 - Engagement of language-specific and domain-general neural mechanisms in native and second language comprehension

Agata Wolna[1,2], Aaron Wright[1], Evelina Fedorenko[1], Zofia Wodniecka[2]; [1]MIT, Cambridge, USA, [2]Jagiellonian University, Kraków, Poland

Unbalanced bilinguals exhibit greater engagement of domain-general resources when speaking in their second language (L2), a pattern which has been attributed to domain-general control mechanisms managing concurrent activation of both languages. However, it remains unclear whether the neural differences between L1 and L2 processing extend to language comprehension and whether they vary depending on the utterance complexity. We addressed this question in an fMRI study in which 30 Polish-English bilinguals silently read words, sentences, and stories in L1 and L2. Additionally, using functional localizer tasks, we identified individual participants' language and domain-general multiple-demand (MD) networks. Neural responses during the reading tasks were analyzed to assess the effects of language (L1 vs. L2) and utterance complexity (words vs. sentences vs. stories) within these networks. Results revealed that the language network exhibited stronger activation for sentences and stories compared to single words while the MD network showed no such differences. We also found that reading in L2 also elicited consistently higher activation than L1 in the language network and the MD network. Interestingly, this difference was modulated by the stimulus type, with no difference between L1 and L2 in single word processing but significant differences between languages in reading sentences and stories. These findings provide new insights into the neural mechanisms underlying bilingual language processing. First, we show that comprehension in L2 is linked to stronger responses in both the language and the MD systems. Our results also suggest that these differences are more pronounced in more complex materials than single words.

Topic Area: LANGUAGE: Other

E62 - A Transcranial Direct Current Stimulation Study of Speech Error Monitoring

Nathan Caines[1] (ncaines@ucsc.edu), Megan Boudewyn[2]; [1]University of California Santa Cruz

Speech production is a complex, multi-step process, and yet speech error rates are surprisingly low. This is thought to be attributable to an error monitoring mechanism, although accounts differ as to the nature of this mechanism and the extent to which error monitoring during speech relies on domain-general cognitive control processes. The goal of the current study was to use transcranial direct current stimulation (tDCS) to test the hypothesis that prefrontal-cortex-supported error monitoring circuits (and their electrophysiological correlates) support error monitoring during speech. Specifically, we will assess speech error rates and neural oscillations in the theta band (4-7 Hz) during a tongue twister task. In this within-participants study (current N = 13), participants will complete the tongue twister task while EEG is recorded after receiving 20 minutes of prefrontally-targeted tDCS stimulation versus sham. Preliminary results suggest that prefrontal-cortex-targeted tDCS reduces speech error rates on the tongue twister task compared to sham (Stim:2.39%, Sham:6.8%). Once data collection is complete, behavioral analysis will compare error rates across tDCS protocol conditions. EEG data analysis will examine theta power in the period immediately preceding speech production on tongue-twister trials. We predict that speech error rates will be significantly reduced for PFC tDCS compared to sham stimulation. We also predict that increased theta power in the pre-production period of tongue twister trials will be elicited in the PFC tDCS conditions compared to sham stimulation. This pattern of results would align with speech production models that posit prefrontally-mediated error monitoring mechanisms.

Topic Area: LANGUAGE: Other

E63 - Reading Skills are Associated with Neural Activation Variability during Spoken and Written Word Processing

Adianes Herrera-Diaz[1,2], Yishai Pérez-Ponce[2], Rachael M. Harrington[2,3], Robin Morris[1,2,4], Jeffrey G Malins[1,5,6], C. Nikki Arrington[1,2,4,5]; [1]Department of Psychology, Georgia State University, Atlanta, GA, USA, [2]Georgia State/Georgia Tech Center for Advanced Brain Imaging, Atlanta, GA, USA, [3]Department of Communication Sciences and Disorders, Georgia State University, Atlanta, GA, USA, [4]Georgia State University/Georgia Institute of Technology/Emory University Center for Translational Research in Neuroimaging and Data Science (TReNDS), Atlanta, GA, USA, [5]Department of Neuroscience, Georgia State University, Atlanta, GA, USA, [6]Mayo Clinic, Department of Cardiovascular Medicine, Rochester, MN, USA

Introduction: Research suggests that neural activation variability within specific brain regions may be a useful biomarker of cognitive flexibility and adaptability. As part of an ongoing study, we explored whether baseline single word reading in young adults is associated with the average level of functional brain activation and variability during a functional language and reading task. Methods: Twenty-two young adults (mean age: 20.82; 15 female) completed a standardized measure of speeded sight word and pseudoword reading fluency as well as an fMRI-picture word identification task that involved matching written or spoken words to picture cues. Whole-brain analysis based on the general linear model was used to identify activated regions during the processing of spoken versus written words. Scores on sight word and pseudoword efficiency subtests were correlated with mean and variance of activation estimates of brain regions associated with the reading network. Results: Sight word and pseudoword reading efficiency subtests were positively associated with both average level and neural activation variability in supramarginal gyus (SMG), angular gyrus (AG), middle and inferior temporal gyri (MTG; ITG) and inferior frontal gyri, pars triangularis and opercularis (IFGpt; IFGop) during written word processing (Pearson's r: 0.43-0.51, $p < 0.05$) . Composite scores were specifically associated with neural activation variability in SMG, MTG, ITG, IFGpt and IFGop during spoken word processing. (Pearson's r: 0.45-0.49, $p < 0.05$). Conclusions: These findings suggest that neural variability during print and speech processing may play an important role for reading performance in young adults.

Topic Area: LANGUAGE: Other

E64 - Effects of accent variation on Mandarin-English intrasentential code-switching perception using electroencephalography

Khushi Nilesh Patil[1], Philip Monahan[2]; [1]University of Toronto

Code-switching is the use of multiple languages in a single utterance and often results in "costs" observed in behavioral measures (Thomas & Allport, 2000; Costa & Santesteban, 2004; Olson, 2017). Anticipatory phonetic cues appear to reduce such costs (Fricke et. al, 2016; Shen et. al, 2020). The current study investigates whether speaker accent mitigates switch costs using event-related potentials (ERP) in EEG. Here, speaker accent provides natural, language-specific phonetic cues during sentence comprehension. Previous ERP findings on code-switching in the auditory modality report N400 and LPC effects (Fernandez et. al, 2019; Yacovone et. al, 2021). Foreign accents also modulate ERP responses to otherwise unexpected speech patterns in the syntactic domain (Hanulikova et. al, 2011); however, no published results (to our knowledge) examine how accent interacts with code-switching. To address this gap, we test Mandarin-English bilingual listeners in English-to-Mandarin code-switched sentences and unilingual English sentences that vary in the accent of the English (Canadian accented English vs. Mandarin accented English); for example, "I bought a shū bāo (backpack) for school" vs. "I bought a backpack for school", in a Canadian or Mandarin accent. Given existing research, we expect N400 and LPC effects in code-switched sentences relative to unilingual sentences. Moreover, Mandarin-accented code-switched sentences will induce smaller N400 and LPC effects compared to Canadian-accented sentences, as listeners may use cues available in the Mandarin accent to anticipate the switch. This research provides insight into neurophysiological mechanisms underlying code-switching and deepens our understanding of phonetic variation and cross-linguistic interactions in the multilingual brain.

Topic Area: LANGUAGE: Other

E65 - Navigating the Neural Landscape of Language Comprehension at Millimeter/Millisecond scale: fMRI-EEG fusion analysis

Clair Min Kyung Hong[1] (min.kyung.hong@vanderbilt.edu), Katherine Aboud[2]; [1]Vanderbilt University

To comprehend written or spoken language, the brain must rapidly coordinate communications across the whole brain to build a coherent internal representation. While decades of work have identified neural signals underlying language comprehension (LC), key limitations in brain imaging have prevented the real-time (millisecond) and whole-brain (millimeter) characterization of LC. We addressed these methodological constraints by using a novel application of fMRI/EEG fused multimodal brain imaging methods in healthy adults (n = 30) to identify the spatio-temporal progression of neural network engagement supporting LC in the one second following comprehension. We identified five key functional brain networks and leveraged text feature analysis to determine each component's sensitivity to specific cognitive dimensions of LC: occipitotemporal perceptual word processing network (associated ERP peak at ~250ms), temporoparietal semantic meaning retrieval network (~400ms), posterior default mode inferential network (~500ms), frontotemporal semantic integration network (~600ms), and a goal-directed comprehension network with default mode and frontoparietal control network nodes (~700ms). Interestingly, posterior DMN activations (~500 ms) related to inferential processing acted as a "hinge point" between early word reading and later higher-order networks: high LC performers showed increased reliance on this bottom-up inferential network, which coincided with decreased reliance on top-down semantic integration areas. These findings suggest that naturalistic LC is characterized by rapid trade-offs between perceptual, core language, and higher-order cognitive networks, and the dynamics between these systems are dependent on expertise. These findings provide insights into the neural mechanisms supporting fluent language processing and offer a methodological framework for investigating related clinical disorders.

Topic Area: LANGUAGE: Other

E66 - Modulation of Cognitive Control and Reading &Language Networks through Noninvasive Brain Stimulation: pilot results for in-scanner tACS

Katherine Aboud[1], Clair Min Kyung Hong[2], Andrew Janson[3]; [1]Vanderbilt University

Reading comprehension is critical for success, but one in five US adults struggle to understand written text. Despite extensive research, effective interventions remain elusive. To address this urgent need, we employed a cutting-edge, in-scanner non-invasive brain stimulation intervention targeting specific network pathways supporting positive RC outcomes. Previous work has found that communication between cognitive control network (CCN) and reading and language network (RLN) hubs supports greater resilience to difficulty during reading comprehension. Here, we present our preliminary findings from in-scanner high-definition transcranial alternating current stimulation (HD-tACS) with a novel application of joint independent component analysis (jICA) of fMRI and EEG data. We administered low-intensity tACS (2 mA; individualized theta frequency) to the left dorsolateral prefrontal cortex (DLPFC) and/or the left angular gyrus (AG) for 25 minutes while participants read expository text passages in the MRI scanner. We found early evidence that stimulation, compared to sham, impacts reading comprehension measures and modulates areas important for comprehending text, including areas in the default mode network. Furthermore, functional connectivity analysis from a 7-minute pre- vs. post-stimulation resting-state fMRI showed increased connectivity between frontal and parietal lobes after stimulation. This increased connectivity suggests more efficient cognitive control mechanisms such as facilitating semantic integration, retrieval, and maintenance of relevant contextual information. This pilot study lays out a framework in which to implement non-invasive brain stimulation in the enhancement of discourse comprehension and provides insight into the effects of stimulation on brain network activation.

Topic Area: LANGUAGE: Other

E67 - Brain regions associated with Chinese reading development: a multiple-task fMRI study

Wenwen Zhuang[1,2], Yaxi Yang[2], Li-Hai Tan[1,2,3,4,5]; [1]Guangdong-Hongkong-Macau Institute of CNS Regeneration and Key Laboratory of CNS Regeneration (Ministry of Education), Jinan University, Shenzhen Campus, China, [2]Center for Language and Brain, Shenzhen Institute of Neuroscience, Shenzhen, China, [3]Guangdong Innovation Platform of Translational Research for Cerebrovascular Diseases, Shenzhen, China, [4]Neuroscience and Neurorehabilitation Institute, University of Health and Rehabilitation Sciences, Qingdao 266071, Shandong, China, [5]University International College, Macau University of Science and Technology, Macau, China

Chinese reading uniquely integrates phonological and semantic information with its logographic script, posing distinct cognitive demands. While core regions have been implicated, the interaction and developmental adaption of these regions remain underexplored. This study employed a multiple-task design to identify shared networks and investigate developmental changes in neural plasticity during Chinese reading. Fifty native Chinese speakers (29 children: 18 males, 11 females; 9.83-11.58 years; 21 Adults: 10 males, 11 females; 18.75-25.58 years) participated, completing three tasks: Lexical decision, Homophone judgment, and Semantic judgment. Individual activation t-maps were generated using the general linear model. Task effects were further analyzed via one-sample t-tests (FDR-corrected, $P<0.05$, spatial extent>10 voxels), with accuracy as a covariate. Shared networks were subsequently identified by intersecting activation maps, and spatial consistency between groups was quantified using the Dice coefficient. The shared network included left-lateralized regions such as the inferior frontal (triangular and opercular) gyrus, occipital cortex, fusiform gyrus, lingual gyrus, precentral gyrus, inferior temporal cortex, middle frontal gyrus, and superior parietal cortex, along with bilateral regions including the inferior frontal (orbital) gyrus, middle cingulum cortex, insula, supplementary motor area, and medial superior frontal cortex. Children showed more widespread activation, while adults displayed a more specialized and efficient network. High spatial consistency between groups (Dice coefficient>0.7) included the left inferior frontal gyrus, supplementary motor area, medial superior frontal gyrus, and inferior occipital region. This study highlights shared neural circuits and development differences in neural organization during Chinese reading, reflecting adaptive changes in neural specialization across development.

Topic Area: LANGUAGE: Other

E68 - Neural Correlates of Reading in Congenitally Blind and Sighted Individuals: The Role of Left vOT

Maria Czarnecka[1,2] (mhczarnecka@gmail.com), Florencia Martinez Addiego[2], Marcin Szwed[1]; [1]Jagiellonian University, Krakow, Poland, [2]Georgetown University, Washington DC, US

A key process in reading is the mapping of written symbols to meaning. The left ventral occipitotemporal cortex (vOT) is thought to serve as a crucial interface for this function. This study investigates the factors shaping the development of neural correlates of reading—whether they arise from innate shape sensitivity enhanced by visual experience or from experience-independent mechanisms. To address this, we conducted an fMRI study with 21 congenitally blind and 21 sighted participants, who read words via touch (Braille) or vision (print), respectively. Stimuli were designed to engage different processing levels: low-level (visual for print, spatial for Braille), orthographic, and semantic. Using representational similarity analysis (RSA), we found that both orthographic and semantic processing are present in the left vOT of blind individuals, indicating that this region develops its reading-related role even without visual experience. The main difference between groups emerged at the low-level processing stage: in sighted participants, it was localized in the early visual cortex, whereas in blind participants, it engaged sensorimotor regions. These results show that, despite differences in low-level sensory processing, the role of the left vOT in reading remains consistent regardless of visual experience.

Topic Area: LANGUAGE: Other

E69 - Examining the Causal Role of Putative Reading Areas in Individuals with Varying Reading Skills and Reading Difficulty History

Zhichao Xia[1] (zhichao.xia@uconn.edu), Nikki Arrington[2], Brianna Kinnie[1], Robin Morris[2], Fumiko Hoeft[1]; [1]University of Connecticut, [2]Georgia State University

The causal role of the putative reading network remains an open question. Continuous theta-burst stimulation (cTBS), which can suppress/activate neural activity in targeted regions, offers a promising approach. This study investigated the effect of cTBS on the left temporo-parietal cortex (LTPC), right temporo-parietal cortex (RTPC), and left precentral gyrus (LPrCG). 114 young adults with varying reading skills, including some with histories of reading difficulty (RD), were recruited. Before and after cTBS, participants performed rhyming and identity judgment tasks under “suppression” (covertly repeating /dop/) and “interference” (hearing /dop/) contexts. We hypothesized that cTBS to LTPC and LPrCG would impair performance under the suppression context, as the rhyming judgment task load will increase under covert speech due to its recruiting both the phonology (that includes LPTC) and articulation (LPrCG) systems. In contrast, the interference context would only reduce performance for cTBS to LTPC because it would tax only the phonological system. As hypothesized, the results revealed (1) cTBS to LTPC significantly impaired rhyming under suppression (accuracy) and interference (accuracy, reaction time, and variance); (2) cTBS to LPrCG significantly impaired rhyming under suppression (accuracy), with greater effects in participants with severe RD history. Additionally, cTBS to RTPC impaired accuracy under the interference context. cTBS did not significantly impair the performance in the control orthography conditions. These findings support the critical role of LTPC in phonological processing and LPrCG in articulation. This study also supports suggestions that articulation may serve as a putative compensatory strategy in individuals with RD history.

Topic Area: LANGUAGE: Other

E70 - Representational similarity analysis of brain potentials reveals event/schematic activation during fictional language comprehension

Melissa Troyer[1] (melissa.troyer@gmail.com), Ryan J. Hubbard[2]; [1]University of Nevada Las Vegas, [2]University at Albany, State University of New York

One under-explored contributor to individual variability in prediction during language comprehension is relevant domain knowledge. Individuals with more knowledge could have MORE SUCCESSFUL predictions of upcoming linguistic input, but they might engage in prediction LESS, as they stand to learn less from comparing their predictions to the input. To explore this, we used representational similarity analysis (RSA) to analyze existing data wherein EEG was recorded as individuals with a range of knowledge about Harry Potter (HP) read general-topic vs. HP sentences, each ending with a predictable or unpredictable critical, sentence-final word. If highly-knowledgeable individuals are more likely to engage in active prediction, then neural similarity measured between ERPs to penultimate and critical words should be graded according to HP knowledge for HP-predictable (but not unpredictable) words and not in general-topic sentences, as these final words should be pre-activated more strongly. We did not observe such a relationship, although HP knowledge reduced the speed of the onset of neural similarity changes. However, HP sentences led to greater overall pre-final to final word similarity across participants compared to general-topic sentences. This difference was robust and sustained sustained across time. HP sentences seem more likely than general-topic sentences to engender construction of a rich mental model of events being described; thus, we suggest that RSA may detect event/schematic information (e.g., situation models) activated during language comprehension, rather than word-by-word prediction. In future work, we aim to use converging methods to further clarify the role of domain knowledge in prediction during language comprehension.

Topic Area: LANGUAGE: Semantic

E71 - Probing Prediction-Related Processes in Language Using an EEG Word Stem Completion Paradigm

Hui-Sun Chiu[1] (hschiu2@illinois.edu), Ryan J. Hubbard[2], Kara D. Federmeier[1]; [1]University of Illinois, [2]University at Albany

Humans process words rapidly, with active prediction of upcoming words as a key mechanism. Event-related potential (ERP) sentence processing studies have delineated the consequences of prediction for later word processing, with accurate predictions facilitating semantic access (N400), and prediction violations engaging later brain mechanisms (anterior positivity). It has been harder, however, to probe prediction formation itself. To do this, we used a word stem completion task wherein participants saw word stems (e.g., bro_) that they were asked to mentally complete and were then presented with either (1) a probable completion (e.g., brother), (2) an improbable completion (e.g., bronze), or (3) a pseudoword (e.g., *brom). The word stems varied in their predictive strength towards a particular completion (constraint), measured by entropy. In Experiment 1, participants reported match/mismatch upon seeing completions, while in Experiment 2, they performed a lexical decision on the completion and then typed in their original prediction. In both experiments, we observed a reduced N400 for completions that matched or that were inflectionally or derivationally similar to the participant's prediction. Although there was no anterior positivity effect for low entropy improbable completions in Experiment 1, a reliable anterior positivity effect emerged in Experiment 2, mirroring findings from sentences and potentially offering insights into the task sensitivity of the anterior positivity. Critically, in both experiments, ERPs measured at the word stem revealed a central-posterior negativity (600-850 ms) that was graded by entropy (more negative to high-entropy/low constraint stems) suggestive of an effect related to prediction formation.

Topic Area: LANGUAGE: Semantic

E72 - A Research Proposal: Gender-associated English Adjectives and Their Influence on Readers' Assumptions about Genders in Non-indicative Contexts

Yiran Jiang[1] (yiran.jiang.26@dartmouth.edu); [1]Dartmouth College

The purpose of this tentative research is to investigate how gender-associated adjectives (masculine, feminine, gender-nonconforming, non-binary) influence readers' assumptions about the gender of an unspecified subject in non-indicative contexts. Participants will be asked to indicate the gender of the subject after reading a given text containing these gender-associated, sometimes stereotypical and negatively connotated, adjectives. During the first part of the experiment, 50 English adjectives will be evaluated by a group of participants on a chart of gender temperament (inclusive of femininity to masculinity), which will be represented as a combination of a numerical number corresponding to the assumed closest gender temperament and an alphabetical letter showing the intensity of that selected quality. In the second part of the experiment, 50 prompts each containing the 50 adjectives will be shown to a different group of participants, who will be asked to identify the gender of the unspecified subject in the prompt. My hypothesis is that gender-associated adjectives in English will influence readers' assumptions about genders in non-indicative prompts, given that these gender-associated adjectives are linked to socially constructed representations of expected gender performance and characteristics. I will run a regression and Chi-square test (dependent variable being nominal) on STATA and see whether the correlation between femininity-masculinity and gender assumptions will be statistically significant. This research will help elucidate whether humans make internal judgments of genders based on pragmatic connotations.

Topic Area: LANGUAGE: Semantic

E73 - The Language-Specific Neural Basis of Word Learning from Context

Tengwen Fan[1] (tfan1@lsu.edu), Julie Schneider[2]; [1]Louisiana State University, [2]University of California, Los Angeles

Word learning (WL) from context relies on the activation of brain regions typically associated with language processing. The overlapping neural activation between WL and language processing might suggest a level of neural efficiency where the brain repurposes existing circuits for new learning, explaining rapid vocabulary acquisition. By examining these overlaps, the current study explores how the brain supports both the acquisition and use of language, aiding both theoretical advancements and practical applications. Eighteen adults completed an auditory WL task (Momsen et al., 2022) and auditory language localizer task (Scott et al., 2016) in the MRI scanner. Using a Group-Constrained Subject-Specific (GCSS) analysis, we identified subject-specific brain networks underlying WL and language processing. The left Inferior Frontal Gyrus (LIFG), Frontal Orbital Cortex (LOFC), Precentral Gyrus (LPC), Supramarginal Gyrus (LSMG), bilateral Superior Frontal Gyrus (SFG), Frontal Pole (FP) and the Cingulate Gyrus (CG) were engaged during WL, and the bilateral temporal lobe (superior, middle and inferior), LOFC, left Pre- and bilateral Post-Central Gyrus, LIFG, left FP, right SMG and bilateral Cerebellum were engaged during language processing. Using Local Pattern Similarity Analysis (LPSA) within these language specific regions, we found positive cross-task correlations in the LIFG ($t(14) = 2.68$, $p = 0.02$) and right Cerebellum ($t(14) = 2.12$, $p = 0.05$). These findings are the first to define the auditory WL network in individual brains and suggest that existing language circuits in the LIFG and the right Cerebellum are integral for successful WL, facilitating rapid vocabulary acquisition.

Topic Area: LANGUAGE: Semantic

E74 - Characterizing the effects of content, task and modality on task-driven semantic processing in the brain

Jin Li[1] (jli3618@gatech.edu), Anna Ivanova[1]; [1]Georgia Tech

Humans have a unique ability to flexibly select relevant information from our vast knowledge of the world (i.e., semantic knowledge) based on various task demands. Prior work posits the existence of semantic demand/semantic control regions, which enable such task-driven semantic processing. However, it remains unclear 1) whether these regions respond to diverse semantically demanding tasks regardless of the underlying semantic content of the stimuli and 2) whether they are distinct from adjacent language regions and multiple-demand (MD) regions, given their anatomical proximity. In this functional magnetic resonance imaging (fMRI) study, we examine neural responses to sets of stimuli that vary in content (still objects, object events and human actions) and modality (pictures vs. sentences) across two semantic tasks, a perceptual task, and a passive viewing paradigm. We hypothesize that task-driven semantic demand regions (if they exist) would show significantly higher responses to semantic tasks than to the perceptual and the passively viewing tasks, independent from the specific task being performed, stimulus content and stimulus modality. Using individual-specific fMRI localization, we provide a detailed functional profile of these putative semantic demand regions along with a direct within-participant comparison to the language and MD regions. This study will shed new light on how flexible task-driven semantic processing is implemented in the brain.

Topic Area: LANGUAGE: Semantic

E75 - Language Experience and Top-Down Prediction in Bilingual Phoneme Perception.

Sarah Wang[1] (ssiwang@ucdavis.edu), Agnes Gao[1,2], Tamara Swaab[1]; [1]University of California, Davis, [2]Gunma University

This study investigates how second language experience influences phonological prediction during speech perception in bilinguals. Specifically, we examine whether Spanish-English heritage speakers and English-dominant late learners of Spanish rely on top-down predictions or bottom-up perceptual processing to categorize phonemes during word recognition. Participants ($N = 40$ per group) will be tested in two experiments with monolingual English and monolingual Spanish contexts. They will complete a two-word priming paradigm in which a visual prime is followed by an auditory target word that begins with a voiced or voiceless plosive consonant (/b/, /p/, /d/, /t/, /g/, /k/). Voice Onset Time (VOT), the time between the release of a plosive consonant and the onset of vocal fold vibration, serves as a key cue for distinguishing voiced and voiceless consonants. VOT durations differ systematically between Spanish and English: in Spanish, voiced plosives have VOTs starting before 0 ms, while in English, voicing begins later. Participants will perform a phoneme categorization task, identifying the first consonant of the target word. The experiment manipulates semantic relatedness (Related, Unrelated) and VOT (Voiced, Ambiguous, Voiceless). We will use Event-Related Potentials (ERPs) and analyze auditory N1 and N400 components. The N1, sensitive to VOT duration, is expected to reflect participants' reliance on predictive context versus bottom-up acoustic cues, while the N400, sensitive to semantic relatedness, will indicate the facilitative effects of prediction on word recognition. Findings will provide insights into bilinguals' use of top-down predictions and bottom-up cues across their dominant and less-dominant languages.

Topic Area: LANGUAGE: Semantic

E76 - L2-Specific vs. General Bilingual Factors in Predictive Processing: Linking Aperiodic EEG Activity and N400 Facilitation in Sentence Contexts

Katherine Sendek[1] (ksendek@ucdavis.edu), Tamara Swaab[1]; [1]University of California - Davis

It is debated whether bilinguals predict in their second language (L2), with current theories proposing differences in predictive processing between bilinguals and monolinguals due to either L2-specific differences in experience or general bilingual effects. However, few studies have investigated neural effects of bilingual language experience on prediction. In the present study we examined effects of language experience on sentence processing within Mandarin-English bilinguals using EEG during reading, compared to English monolinguals. The goals of the study were to isolate the potential impact of bilingual experience (L2-specific or general bilingual) on prediction and examine if neural differences modulate predictive processing. We measured the amplitude of the N400 to critical words that were either highly predictable or not in sentence context, and the slope of the aperiodic oscillatory activity in the 0-30Hz range prior to the onset of the critical words. Previous findings from our lab in monolinguals showed that a steeper aperiodic slope was associated with larger N400 effects, reflecting enhanced prediction facilitation. Preliminary results of the present study showed a significant N400 effect of cloze probability for both groups, supporting the presence of bilingual prediction in L2. Moreover, the aperiodic slope was significantly steeper overall for bilinguals, suggesting heightened predictive activity, possibly resulting from the need to manage two linguistic systems. Finally, we replicated our finding that a steeper aperiodic slope was associated with greater N400 effects. This relationship was modulated by bilingual experience within bilinguals, but did not indicate an impact of L2-specific factors over general bilingual ones.

Topic Area: LANGUAGE: Semantic

E77 - Distinct Neural Representations of Phonological and Semantic Predictions and Prediction Errors in Speech Comprehension

Yi Du[1] (duyi@psych.ac.cn), Baihan Lyu[2], Xiuyi Wang[3]; [1]Institute of Psychology, Chinese Academy of Sciences, [2]Department of Psychology, University of Chinese Academy of Sciences

Introduction: The integration of external linguistic inputs with internal predictions from long-term memory is critical for language comprehension. While neural correlates of phonological and semantic prediction have been studied in natural language processing, how top-down prediction and bottom-up perception are co-represented at these levels remains poorly understood. Methods: This fMRI study investigates the neural representation of phonological and semantic information under congruent, absent, and incongruent conditions. Twenty-nine native Chinese speakers were exposed to idiomatic phrases with manipulated final characters, creating Expected, Missing, and Unexpected conditions. We used multiple regressive representation similarity analysis and partitioned the variances uniquely explained by perceived and predicted phonological and semantic information across conditions. Results: In the Missing condition, stronger phonological representations were observed in production-related precentral gyrus, and stronger semantic representations in default mode network regions (e.g., angular gyrus), suggesting a prediction-by-production mechanism and semantic prediction from long-term memory. In the Unexpected condition, distinct frontal and temporal areas encoded phonological and semantic information for perceived incorrect words versus predicted correct words, indicating separate hierarchical representations for bottom-up and top-down processing when predictions are violated. Additionally, the Unexpected condition elicited increased activations in auditory, attention and control systems, with bilateral superior temporal gyrus encoding the extent of subjective and calculated prediction errors (i.e., implausibility and surprisal). Conclusion: Our findings delineate distinct neural pathways for sound-to-meaning mapping and those representing phonological and semantic predictions and prediction errors. Further analysis will explore regions involved in computing and resolving prediction errors, elucidating the brain's adaptive mechanisms in language comprehension.

Topic Area: LANGUAGE: Semantic

E78 - Semantic ERP Correlates in Processing of the Visual Programming Language ScratchJr

Emily Nadler[1] (emily.nadler@bc.edu), Jason Geller[1], Marina Bers[1]; [1]Boston College

In recent years, there has been a growing emphasis on early childhood coding education. However, this effort is met with limited scientific understanding of the cognitive mechanisms underlying the processing of computer programming (Fedorenko et al., 2019). Research indicates that traditional programming languages, such as Python, evoke neural responses similar to those observed in natural language processing, including N400 and P600 event-related potentials (ERPs; Kuo & Prat, 2024). This study seeks to extend these findings to ScratchJr, a visual programming language designed for children. Prior work proposes that spoken, written, and visual languages share a common cognitive architecture. We aim to: 1. Investigate whether ScratchJr elicits neural signatures comparable to natural language (specifically N400 and semantic P600 responses), and 2. Explore how experience level with ScratchJr modulates these effects. Up to forty adults and forty children will complete a baseline coding assessment, followed by an electroencephalogram (EEG) measurement involving a congruency task with trials containing lines of ScratchJr code paired with either congruent or incongruent animations. We will analyze neural responses in time bins associated with N400 and P600 components, focusing on how expertise modulates neural responses. Pilot data from seven experienced participants revealed minimal N400 and consistent P600 effects. We hypothesize that, with the full dataset, semantic irregularities will elicit both N400 and P600 effects, with expertise diminishing N400 and enhancing P600 responses. Findings could advance understanding of programming and language processing, potentially shaping educational policy and pedagogical norms for early childhood computer science curricula.

Topic Area: LANGUAGE: Semantic

E79 - Investigating the Effect of Foreign Accents on Sensitivity to Word Predictability in Speech Comprehension

Shang-En Huang[1] (sehuang@ucsd.edu), Ian Martindale[1,2], Seana Coulson[1,2]; [1]University of California, San Diego, [2]San Diego State University

Previous research on foreign accents has revealed inconsistent findings regarding their effect on predictive processing. Across studies, comparisons of familiar local versus less familiar foreign accents have revealed larger, smaller, and similar sized N400 predictability effects. Here we recorded EEG as 18 participants listened to local or foreign-accented sentences with more versus less predictable endings. For example, “Ben’s so stubborn he can never admit he’s wrong (more predictable) / drunk (less predictable)”. ERPs time-locked to the first word in each sentence revealed the P2 was larger for local than foreign accented speech, consistent with previous literature suggesting better acoustic feature extraction. In ERPs time-locked to sentence-final words, mean amplitude measurements (250-600ms) were more negative for unpredictable than predictable words in both local (ClozeHi-Low = -2.01microvolts, p<.001) and foreign (ClozeHi-Low = -1.29microvolts, p = 0.019) accents. Interestingly, the N400 to unpredictable words peaked earlier for local (357ms) than foreign (418ms) accents (t(17) = 2.47, p<.05). Predictability effects 500-1000ms were larger for local than foreign accents (AccentLocal-Foreign = -1.71microvolts, p = .002). Further, accent effects were significant for predictable (AccentLocal-Foreign = -1.05microvolts, p = .010) but not unpredictable words. This suggests that participants were better able to anticipate words in sentences spoken with more familiar accents. In sum we find that predictability effects were slightly delayed for foreign accented speech, and were less pronounced in ERPs following the N400. Overall, results suggest that while local and foreign accents are acoustically different, listeners utilize similar predictive mechanisms to perceive incoming speech.

Topic Area: LANGUAGE: Semantic

E80 - Predictive Pre-Activation During Language Comprehension Is Preserved in Older Adult Readers

Ryan Hubbard[1] (rhubbard2@albany.edu), Kara Federmeier[2]; [1]University at Albany, SUNY, [2]University of Illinois, Urbana-Champaign

Language comprehension involves multiple processes, including the engagement of neural mechanisms to predict upcoming words in order to more quickly and efficiently comprehend information. Eye-tracking and ERP-based research have shown that effects of word predictability are reduced for older adult readers, but little work has investigated age-related effects on neural signals of pre-activation, measured prior to target words. In young adult readers, we previously used representational similarity analysis (RSA) to compare patterns of EEG activity before and after target words, and found evidence that word representations were pre-activated. Here, we used this RSA technique to re-analyze two combined EEG datasets with older adult readers (total N = 41) to determine if aging impacts pre-activation. Results showed that a pattern of pre-activation similar to that found in younger adult readers was present for older adults, although the overall magnitude of pattern similarity was reduced. Importantly, we used linear mixed-effects regression analyses to demonstrate that the magnitude of neural pre-activation was related to the predictability of the target word, suggesting predictive pre-activation of upcoming word features, a pattern also found in young adults. Unlike younger adults, older adults appeared to engage additional frontal cortical resources when predicting words, and the time-course of neural similarity changes differed between age groups. Overall, our results suggest that some forms of anticipatory processing during language comprehension are preserved with age, and highlight the importance of examining neural processing prior to predictable or unpredictable stimuli to better understand the mechanisms of prediction.

Topic Area: LANGUAGE: Semantic

E81 - Neural Responses to gender stereotypes in a word-face priming paradigm

Francesca Pesciarelli[1,2] (francesca.pesciarelli@unimore.it), Luana Serafini[1]; [1]University of Modena and Reggio Emilia, [2]San Diego State University

The present study aims to extend our previous priming works on the neural correlates of gender stereotypes in language to human face processing. We recorded Event-Related Potentials (ERPs) to a pronoun (lui “he” or lei “she”) or face (male, female), preceded by grammatically marked or stereotypically associated words (e.g., amica “friend”, badante “caregiver”). Participants were asked to categorize the gender of the pronoun or face. The ERPs showed a larger LPP for male participants to feminine pronouns preceded by grammatically masculine than feminine primes and larger N400, P300, and LPP (limited to women for female faces) for faces when preceded by grammatically incongruent than congruent primes. Interestingly, faces showed a gender stereotype asymmetry: a larger N400 to male faces, and a larger P300 to female faces, when preceded by stereotypically incongruent than congruent primes. The present results revealed that faces are influenced more strongly by gender stereotypes than linguistic stimuli. These results could provide new insights for future research in the context of biased communication.

Topic Area: LANGUAGE: Semantic

E82 - Cognitive Control Recruitment by Linguistic Cues during Discourse Comprehension

Ma Angela Edith Montiel[1] (anmontie@ucsc.edu), Megan A. Boudewyn[1]; [1]University of California, Santa Cruz

From a linguistics perspective, discourse connectives serve as cues about information. Causal connectives like “therefore” signal that upcoming information will be consistent with prior context, whereas concessive connectives like “nevertheless” signal that upcoming information will be contradictory to the previous context. From a cognitive neuroscience perspective, concessive connectives could be considered cues that alert the reader whether the upcoming information will be in conflict with the information received thus far. In other words, connectives may serve as a cognitive control signal to resolve future conflict. In this study, EEG data will be collected from 40 participants. Participants will read three-sentence stories in four conditions: contradictory causal (ICL), contradictory concessive (ICE), non-contradictory causal (CCL) or non-contradictory concessive (CCE). For example, “Elizabeth had a history exam on Monday. She took the test and aced/failed it. SO/YET, she went home and CELEBRATED wildly.” We will analyze ERPs and theta band power time-locked to the connectives and subsequent critical word. If connectives signal a need for domain-general cognitive control, we expect to see an increase in theta at the connective for concessive versus causal conditions. Alternatively, connectives may serve to facilitate processing later in the sentence when the conflict is encountered rather than as a preparatory signal. We expect to see this reflected as an increased positivity at the post-connective critical words specifically in the ICL condition relative to the ICE condition, in the absence of a theta difference at the concessive itself.

Topic Area: LANGUAGE: Semantic

E83 - Continuous Speech Comprehension in Monolingual and Bilingual Speakers

Haoyin Xu[1] (hyx002@ucsd.edu), Seana Coulson[1]; [1]University of California, San Diego

Research has shown that bilingual speakers experience greater difficulties than monolinguals in producing and comprehending low frequency words. However, traditional laboratory tasks were used in most earlier studies, raising questions about its generalizability to real world settings. Here, we investigated how bilingual language experience influences neural tracking of naturalistic continuous speech materials. Specifically, we examine whether differences in speech tracking and word frequency sensitivity between monolingual and bilingual speakers arise from language fluency or language experience (i.e. Monolingual vs. Bilingual). EEG data were recorded from 28 healthy subjects (13 monolingual, 15 bilingual speakers) as they watched excerpts of Ted Talks. Throughout the experiments, the clips alternated between audio-only and audiovisual modalities. EEG data were analyzed using the temporal response function (TRF) method to decode audio envelope and word frequency tracking performance, yielding a reconstruction accuracy score for each participant. These scores were then analyzed with mixed effect models to explore the relationship between language experience, stimulus modality and neural tracking. Analysis of audio envelope reconstruction revealed that both speaker groups exhibited better audio envelope tracking in audiovisual than audio-only modalities (estimates = 0.11, CI = [0.06, 0.15]). Analysis of word frequency reconstruction scores showed that bilinguals exhibited marginally better tracking of word frequency than monolinguals (estimates: 0.10, CI: [-0.01, 0.21]), regardless of stimulus modality. These findings suggest that visual input facilitates speech perception in both speaker groups. In addition, consistent with previous behavioral findings, bilinguals are more sensitive to word frequencies in naturalistic materials.

Topic Area: LANGUAGE: Semantic

E84 - Development of Language Selection in Bilingual Children: A Longitudinal EEG Study

Noemi X. Diaz[1] (nxdiaz@ucdavis.edu), Tamara Y. Swaab[2]; [1]University of California-Davis

Efficient language selection is a fundamental challenge for bilingual speakers, particularly during childhood when cognitive control and language proficiency are still developing. This study investigates how bilingual children navigate language selection during word production and how their abilities change over time. The longitudinal study will focus on three groups of Spanish-English bilingual children in 2nd and 4th grades: (1) children with Spanish as their dominant language immersed in English at school, (2) children with English as their dominant language immersed in Spanish at school, and (3) children raised bilingually from birth. Participants will perform three picture-naming tasks designed to manipulate semantic relatedness and translation equivalence between their two languages. EEG will be recorded during these tasks to measure neural activity associated with word retrieval and language interference. Key measures include N400 amplitude, which reflects lexical-semantic competition, as well as naming latency and accuracy. Longitudinal comparisons will explore changes in language interference and efficiency over time, analyzing how second language proficiency and cognitive control development influence bilingual word production. We predict that children in all groups will show greater language interference effects, reflected in larger N400 amplitudes and slower naming latencies, in 2nd grade compared to 4th grade. However, children raised monolingual before learning a second language in school are expected to exhibit stronger interference from their dominant language than children raised bilingually, particularly in translation equivalence tasks. These findings will provide insights into how bilingual experiences shape the neural and cognitive mechanisms underlying language selection during development.

Topic Area: LANGUAGE: Semantic

E85 - Eye-gaze, reference and race

Dr Veena D. Dwivedi[1] (vdwivedi@brocku.ca), Haorong Ding[1]; [1]Brock University

We examined how healthy young adults interpreted sentences when combined with the visual cue of still faces depicting differing eye-gaze (direct vs. averted). We also investigated whether the race of the face (Caucasian vs. East Asian) would impact sentence interpretation. In two web-based studies, monolingual English-speaking participants (mostly Caucasian) were asked to read sentences where direct objects were specific or non-specific e.g., "The kid climbed that/a tree…", and rate their acceptability, on a scale of 1-7. In the absence of previous linguistic context, use of specific "that" as in "that tree" should be less acceptable than non-specific "a tree". In the first experiment (N=90), these sentences were paired with emotionally neutral Caucasian faces, and in the second study (N=90), with East Asian faces. Results revealed that ratings for sentences with specific reference were significantly lower than those with non-specific reference in both studies. Next, we predicted that averted gaze, ostensibly a form of visual pointing, would improve judgments for sentences using specific "that". It did not. Rather, results with Caucasian faces (N=90) revealed that averted gaze improved ratings for sentences using non-specific "a/an". Perhaps averted eye-gaze can bolster meaning, when underspecified (as indicated by non-specific "a/an"), but cannot repair ungrammaticality (as indicated by specific "that"). The same sentences stimuli, when paired with East Asian faces, yielded no effects of gaze at all. These findings reveal that still faces, i.e., without any acoustic cues such as accent, can modulate simple sentence interpretation tasks, due to race.

Topic Area: LANGUAGE: Semantic

E86 - Distinct Roles of N300 and N400 in Semantic Priming

Hannah Kim[1], Joseph Dien[1], Donald Bolger[1]; [1]University of Maryland, College Park

There has been increasing interest in how the frontal N300 (Franklin, Dien, Neely, Waterson, & Huber, 2007; Frishkoff, 2007; Kumar, Federmeier, & Beck 2021) contrasts with the posterior N400. The N300fz emanates from the posterior cingulate (O'Hare, Dien, Waterson, & Savage, 2008) whereas the N400 has been linked to the left superior temporal gyrus and the left inferior frontal gyrus (van Petten and Lukka, 2006). Intriguingly, a study (Rhodes, & Donaldson, 2008) reported N400 effects only for simultaneous word pairs with associative (versus semantic) relations, but did not consider the N300. In this report, 69-channel EEG data were recorded from 40 participants performing a lexical decision task. The prime-target relations (associative, category coordinates, and semantic similarity) under automatic and controlled conditions were varied blockwise. Behavioral analyses indicated associative and category priming at the short SOA and all three types at the long SOA. The N300fz windowed measure revealed associative and category priming at both SOAs. The N400 windowed measure revealed all three types of priming, but only at the long SOA. We suggest that the N300fz reflects an automatic associative semantic process whereas the N400 reflects a more controlled generalized semantic process. By this account, the N300fz reflects the initial semantic retrieval of the individual words from an ASA semantic network, whereas the N400 reflects a more contextualized semantic assembly process in a connectionistic network, drawing on more sources of information. This differentiation can help inform models of semantic processing and the role of different cortical regions in language comprehension.

Topic Area: LANGUAGE: Semantic

E87 - Differences between Bilingual and Monolingual's Cognitive Functions Using ERP

Aram Akbari[1,] (aram.akbari@bruins.belmont.edu), Emily Stripling[1,], Kristie Stephens[1,], Karlie Souder[1,], Liam Feinberg[1,], Emma Chacon[1,], Dara Olopade[1,], Smyth Harper[1,], Michael Oliver, PhD[1]; [1]Belmont University

It has been suggested that bilinguals may possess a cognitive advantage compared to monolinguals due to frequent task switching between languages. Previous research highlights this advantage in older adults as it has been suggested that engaging in additional languages may be a protective factor against neurodegenerative disorders. However, findings regarding younger adults are mixed regarding whether such advantages exist. As such, this study investigated if being bilingual in young adulthood related to a cognitive advantage over monolingual counterparts demonstrated as faster lexical access, better response inhibition, and improved memory. A total of 33 participants (18 English-speaking monolinguals and 15 primary English speaking and varied second language bilinguals) were asked to complete computerized cognitive assessments, including the Lexical Decision-Making Test and the Stop Signal task, while brain activity was measured simultaneously using electroencephalography (EEG). Once completed, participants completed the Bilingual Language Profile to assess language use and proficiency. Behaviorally, there were no significant differences in lexical access, inhibitory control, or memory between groups. However, findings revealed faster P300 latency in bilinguals during the memory task and greater N400 amplitude on the lexical task. Although, no bilingual advantage was exhibited behaviorally, our results reveal cortical differences between monolinguals and bilinguals suggesting improved cortical activation to the processing of words, and faster retrieval of words from memory. Findings of the current study imply that while no younger bilinguals do not exhibit a specific behavioral advantage, over time repeated use can strengthen these neural pathways, potentially leading to cognitive advantages with aging.

Topic Area: LANGUAGE: Semantic

E88 - Thunder and Lightning: Vision Language Model Representations Predict EEG Response Differences to Visual vs Auditory Attributes in Property Verification

Harshada Vinaya[1] (hyadav@ucsd.edu), Sean Trott[1], Seana Coulson[1]; [1]University of California San Diego

A key criticism of using LLM vectors as proxies for human semantic representations is the evidence that humans also rely on sensorimotor experiences in the world. However, vision language models (such as CLIP) operationalize semantic representations that integrate textual and visual information. Here, using representations acquired from CLIP, we ask whether these LLM representations informed with vision can predict differences in human EEG response to words for visual ("red") versus auditory ("loud") attributes presented in a property verification task. EEG was recorded as participants (n=18) indicated whether properties ("red") were typical for the preceding concepts ("apple"). Our dependent variables were the mean amplitude measurements of single-trial EEG responses to properties during the early (300-400ms) and late (400-500ms) phases of the N400. We then modeled the EEG using mixed effects models with random intercepts for subjects, items, and electrodes, and fixed effects of word frequency, modality of the property word (auditory versus visual), and semantic distance measurements using GloVe and CLIP embeddings calculated as cosine between the vectors for concept and property words. The early phase of the N400 was significantly predicted by word frequency (β=0.4), CLIP (0.4), modality (-0.6), and interaction between modality and CLIP (-0.3) showing differential effects predicted by CLIP based on the sensory attributes. The late phase, however, was predicted only by CLIP (0.2). Findings suggest human semantic representations accessed early in the N400 during this task may incorporate visual information.

Topic Area: LANGUAGE: Semantic

E89 - Functional Near Infrared Spectroscopy-Based Adaptive Language Mapping in People with Post-Stroke Aphasia and Neurologically Healthy Controls

Erin Meier[1] (e.meier@northeastern.edu), Veronica Fletcher[1], Esprit Ange Andraos[1], Caela Hung[1], Priyansh Khare[1], Isabelle Cotenoff[1], Leanna Ugent[1], Gengchen Wei[1], David Lin[2], Meryem Yücel[3]; [1]Northeastern University, [2]Harvard Medical School, [3]Boston University

Most neuroimaging studies in people with post-stroke aphasia (PWA) have not sufficiently controlled for task difficulty, which has contributed to mixed findings about the roles of left versus right hemisphere regions and the multiple demand (MD) network in recovery. In this study, we used a functional Near-Infrared Spectroscopy (fNIRS)-based Adaptive Language Mapping (ALM) Semantic Matching task (Wilson et al., 2018) to determine the extent to which 15 PWA and 15 controls recruit language versus MD regions when task difficulty is controlled at the subject level. The ALM fNIRS task included alternating blocks of experimental (semantic matching) and control (letter strings matching) trials. Data were acquired with daisy-chained 8x8 NIRx NIRSport2 devices and were preprocessed in Homer3 (Huppert et al., 2009). A trend towards between-group differences in semantic match accuracy (FDR-p= 0.059) was driven by two PWA with severe aphasia. Controls activated left inferior frontal gyrus pars opercularis (LIFGop) and triangularis (LIFGtri), left mid to posterior superior temporal (LSTG) and middle temporal (LMTG) gyri, and right IFG. PWA activated mid LSTG and LMTG with variable patterns from patient to patient. PWA had significantly lower activity than controls in LIFGop, LIFGtri, LSTG, and left inferior temporal gyrus ($p < 0.05$). Neither group significantly activated right hemisphere or MD regions. The motivation for this study was to address a central methodological limitation of previous functional imaging studies in PWA (i.e., task difficulty confounds) using a promising imaging modality, fNIRS. The next steps include investigation of relationships between single-subject fNIRS and language task data.

Topic Area: LANGUAGE: Semantic

E90 - Downstream behavioral consequences of parafoveal semantic processing in natural reading: Evidence from co-registered eye movements and EEG

Allyson Copeland[1] (allyson.copeland@psych.utah.edu), Brennan Payne[1]; [1]University of Utah

Wrap-up effects—processing increases at sentence boundaries—have been relatively well-documented in the behavioral reading literature. However, ERP research has generally avoided systematic study of these effects (Stowe et al., 2018). One exception is Ditman and colleagues (2007), who showed that readers reactivated N400 violation effects at sentence-final words along with reading time wrap-up effects. In addition, they showed that larger N400 target word amplitudes predicted longer sentence-final reading times. We were interested in whether we would observe similar sentence boundary reactivation effects for expectancy and plausibility violations in naturalistic sentence reading. We recorded simultaneous eye movements and fixation-related potentials (FRPs) while participants read constraining sentences with expected, unexpected (but plausible), and anomalous target words. First, we showed evidence of a parafoveal N400 effect when time-locking to the pre-target word, such that N400 amplitude was largest to the anomalous target word condition, followed by unexpected and expected words. We also found that readers had longer regression path durations on sentence-final words in the anomalous condition compared to both unexpected and expected, and made more first-pass regressions out of region for anomalous items compared to expected, consistent with wrap-up re-activation effects. Critically, subjects that had reduced parafoveal N400 amplitudes (on average) showed larger sentence-final wrap-up effects for the anomalous condition compared to the expected condition, suggesting that early parafoveal semantic processing has downstream behavioral consequences for subsequent integrative re-reading processes at the end of sentences.

Topic Area: LANGUAGE: Semantic

E91 - Age-related changes in alpha and beta oscillatory dynamics during semantic processing in children and adolescents

Zhiying Shen[1,2,3] (mike.shen@boystown.org), Anel Zhussubali[4], Augusto Diedrich[1,2,3], Wai Hon Lee[1,2], Elizabeth Heinrichs-Graham[1,2,3]; [1]Institute for Human Neuroscience, Boys Town National Research Hospital, Omaha, NE, USA, [2]Center for Pediatric Brain Health, Boys Town National Research Hospital, Omaha, NE, [3]Creighton University School of Medicine, Omaha, NE, [4]Brown University, Providence, RI

Ample evidence supports a left-lateralized semantic cognition network with well-defined regions, but the spatiotemporal profile of these network hubs and how their dynamics change throughout development is still poorly understood. The present study aims to characterize the neural dynamics of the semantic network in a neurotypical, developmental sample of 7-15-year-olds. A total of 67 participants completed a semantic judgment task during magnetoencephalography (MEG), during which two words were auditorily presented in succession and participants were instructed to determine whether the words were semantically related. MEG data was preprocessed, coregistered with MRI, and transformed into the time-frequency domain. Significant oscillatory responses were source imaged using beamforming, and the effects of age and brain-behavior relationships were evaluated. We found age-related improvements in task accuracy, reaction time, and processing time. Significant oscillatory responses were found in alpha and beta frequencies shortly after the onset of the second word throughout a distributed left-lateralized network. Whole-brain correlations revealed stronger decreases in beta activity (i.e., more negative relative to baseline) with increased age throughout the left language network, including the middle temporal gyrus, middle frontal gyrus, spt, middle occipital gyrus, precuneus, and precentral gyrus. These age-related changes in neural activity were significantly related to language ability. We found that semantic processing is served by the development of beta dynamics in multiple regions in the semantic network. These data underlie the importance of beta activity in the development of language ability in youth, which may serve as an important biomarker for language dysfunction in pediatric clinical populations.

Topic Area: LANGUAGE: Semantic

E92 - Integrating discourse information in a second language: Evidence from event-related potentials

Alison Gabriele[1] (gabriele@ku.edu), Münir Özturhan[1], José Alemán-Bañón[2], Andrew Collins[3], Braden Swaim[1], Xiao Yang[4], Manuel Carreiras[5], Simona Mancini[5], Lesa Hoffman[6], Robert Fiorentino[1]; [1]University of Kansas, [2]Stockholm University, [3]University of Texas at Austin, [4]Northeastern University, [5]Basque Center on Cognition, Brain and Language, [6]University of Iowa

Second language (L2) learners have been observed to struggle in the integration of discourse information during referential processing, but the source of the difficulty is not well understood (e.g., Sorace, 2011). We examine whether the ability to update the discourse context is one possible source of divergence between native speakers (L1) and L2 learners. We used event-related potentials (ERPs) to examine the processing of overt pronouns (she) in Spanish-speaking learners of English in Spain (n=40) and English native speakers (n=28) and in three contexts: Baseline (Condition 1): an unambiguous context where the pronoun can be resolved using a gender cue (e.g., 'she' refers to Kate not Adam), Ambiguous (Condition 2): a context where the pronoun is ambiguous because there are two gender-matching accessible antecedents (Kate/Annie), and Updating (Condition 3): a context where there are two gender-matching potential antecedents in the story (Kate/Annie) but only one is accessible (Kate) because the other individual ultimately does not participate in the activity described in the discourse. We examined whether participants yielded an Nref, an ERP component linked to referential ambiguity, in the ambiguous Condition 2 as compared to the Baseline, but not in Condition 3, where only one antecedent is ultimately accessible. L1-English speakers yielded a significant negativity (400-800ms) in Condition 2, but not in Condition 3. In contrast, L2-English learners yielded significant negativities in this time window in both Conditions 2 and 3 suggesting that learners are sensitive to referential ambiguity but have difficulty integrating information from the discourse to resolve it.

Topic Area: LANGUAGE: Semantic

E93 - Parafoveal N400 fixation-related potential effects vary as function of eye movement behavior (i.e., word skipping) during natural sentence reading

Sara Milligan[1] (smilliga@usf.edu), Elizabeth Schotter[2]; [1]University of South Florida

Decades of neurolinguistic research using event-related brain potentials (ERPs) to study the in-the-moment language processing in the brain is limited by the use of rapid serial visual presentation (RSVP) to present the words in the sentence one word at a time. Although this research has established the N400 component, a robust and reliable response that is sensitive to semantic expectancy, it is unclear how this response relates to eye movement decisions when the reader has control over where and for how long to direct their attention, and can pre-process upcoming words before fixating them.

To determine how eye movements relate to the N400, we co-registered EEG and eye tracking to measure fixation-related brain potentials during natural sentence reading. We manipulated parafoveal previews of target words so that the previewed word was either (1) expected, (2) an anomalous orthographic neighbor of the expected word, or (3) an anomalous instance of the. We split trials based on whether the reader skipped or fixated the word and found a parafoveal N400 effect in response to the anomalous neighbor, which occurred only when the word was skipped, and a parafoveal N400 effect in response to the anomalous the, which was present regardless of skipping. This pattern suggests that (1) some N400 effects are yoked to behavioral eye movement decisions, (2) eye movement behavior is largely determined prior to complete comprehension based on partial linguistic processing, and (3) language processing continues after the eyes have moved on.

Topic Area: LANGUAGE: Semantic

E94 - Neural patterns reflect quiz performance in novice sign language learners

Megan E. Hillis[1] (megan.e.hillis.gr@dartmouth.edu), David J. M. Kraemer[1]; [1]Dartmouth College

Studies of language processing have demonstrated that the same concept cued by homologous words in two different languages can evoke partially shared neural patterns, often attributed to underlying semantic meaning. However, it is unclear at what point in the learning trajectory this overlap may emerge, and whether individual differences in this neural signal can reflect comprehension. Forty English speakers with no prior experience in American Sign Language (ASL) completed a series of brief online lessons followed by fMRI scanning. During the scan, they viewed single-word video clips of ASL signs that they had learned as well as new, unstudied words. Using representational similarity analysis (RSA), we identify brain regions where neural patterns reflect semantic relationships between the stimuli, indicating that activity in these regions tracks word meaning. Then, we demonstrate that in several of these regions, including the left inferior frontal gyrus, left temporal pole, and bilateral early visual areas, the difference between responses to studied versus unstudied ASL words predicts student performance on a recall quiz immediately before the scan as well as one week later. Our results provide evidence for the ability of multivariate neuroimaging analysis approaches to detect individual-level shifts in understanding in the earliest stages of language learning.

Topic Area: LANGUAGE: Semantic

E95 - Cognition in Absentia: An EEG Investigation of Internally Driven Semantic Retrieval

Yaqi Xu[1] (yxu293@ucsc.edu), Megan Boudewyn[1]; [1]UC Santa Cruz

The N400 is a well-studied neural marker of lexical-semantic processing, but accounts vary as to the specific underlying cognitive processes it reflects. The goal of this study was to test whether N400-like responses are present during lexical-semantic retrieval in the absence of an external stimulus. Participants read highly constraining sentences with sentence-final words in three conditions: expected, unexpected and absent (N=37). An auditory tone accompanied the presentation of every word (including the empty character string in the absent condition) in order encourage participants to anticipate the occurrence of a sentence-final word at a specific time. Preliminary results found that, just as with visually-presented words, sentence-level semantic fit and word frequency of the final words was a significant predictor of amplitude in the absent condition ($p<0.05$). We plan to use representational similarity analysis (RSA) to further compare the similarities between the three conditions. If our RSA results show a greater similarity between the expected-present and expected-absent conditions than between those conditions and the unexpected condition, it would suggest that the N400 can be used to measure internally-driven semantic retrieval. This pattern of results would also support semantic retrieval accounts of the N400, as an N400-like response should always be present during lexical-semantic retrieval, even in the absence of an external stimulus, if the N400 reflects the relative ease of the retrieval of lexical-semantic information from long-term memory.

Topic Area: LANGUAGE: Semantic

E96 - Concept Feature Diagnosticity: a new metric to quantify conceptual access

Anna M. Keresztesy[1,2] (anna_keresztesy@urmc.rochester.edu), Muzi Li[1], Jessica M. Smith[1], Frank E. Garcea[2], Bradford Z. Mahon[1]; [1]Carnegie Mellon University, [2]University of Rochester

Semantic representations are commonly modeled in terms of elementary features (e.g. CAT = {<fur>, <eats mice>, <purrs>}). Concept-feature models have traditionally studied how features are generated from concepts. Here we define and study a new way to quantify concept-feature relationships, which we term diagnosticity. Diagnosticity refers to the proportion of target responses (e.g., 'cat') that are spontaneously generated when naive participants are given a feature in isolation (e.g., 'eats mice'). Across four Experiments we demonstrate the validity and power of diagnosticity to account for variance in the speed with which healthy participants complete semantic verification tasks. In the core paradigm, participants were presented with a written item name and a semantic feature that was either true of the concept or not. Participants indicated whether the feature was associated with the item by pressing a button (Exp 1) or responding verbally (Exp 2). In Exp 3, a separate group of participants were presented with isolated features and were tasked with generating the corresponding concept name. We found that target production in the free-response task of Exp 3 predicted 70% of the variance in decision times in Exps 1 and 2: highly diagnostic features (those that elicited the target concept most consistently) were associated with shorter verification latencies in Exps 1 and 2. Exp 4 replicated the full pattern with a new and large set of items and new group of participants. These findings suggest that the dynamics of information access is from semantic features to concepts during semantic verification.

Topic Area: LANGUAGE: Semantic

E97 - Distinct temporal lobe areas modulate language representations in the left inferior frontal gyrus.

Benedikt Winzer[1] (benedikt_winzer@urmc.rochester.edu), Rishika Chikoti[1], Madalina Tivarus[2,3], Emma Strawderman[1], Steven Meyers[1,2], Kevin Walter[1], Webster Pilcher[1,4], Bradford Mahon[1], Frank Garcea[1,3,4]; [1]Department of Neurosurgery, University of Rochester Medical Center, [2]Department of Imaging Sciences, University of Rochester Medical Center, [3]Department of Neuroscience, University of Rochester Medical Center, [4]Del Monte Institute for Neuroscience, University of Rochester Medical Center

The left inferior frontal gyrus (LIFG) is a key area supporting verbal fluency, but its specific functional roles in word production are topics of continued research. Here we test whether the LIFG integrates the outputs of lexical semantic processing and phonological encoding supported by the left anterior temporal lobe (LATL) and left posterior temporal gyrus (LPSTG), respectively. This framework predicts that participants with lesions to the LATL will exhibit weaker functional MRI (fMRI) responses in the LIFG when engaging in a category fluency task, whereas participants with lesions to the LPSTG will exhibit relatively weaker fMRI responses in the LIFG when engaging in a letter fluency task. The prediction was tested via a retrospective analysis of 52 participants with brain tumors who took part in a category fluency and a letter fluency task while undergoing fMRI. We used an atlas-defined LIFG to extract fMRI responses during each task, and lesion-symptom mapping to test which lesion sites were associated with reduced fMRI responses in the LIFG. In support of our hypothesis, we found that participants with lesions involving the LATL exhibited weaker fMRI responses in the LIFG during the semantic fluency task. In contrast, participants with lesions involving the LPSTG exhibited weaker fMRI responses in the LIFG during the letter fluency task. Our finding suggests that left inferior frontal gyrus underlies single word production by integrating semantic and phonological representations prior to word articulation.

Topic Area: LANGUAGE: Semantic

E98 - Dynamic duo: Insights from a dual-unit predictive coding model of lexico-semantic processing

Samer Nour Eddine[1] (snoure01@tufts.edu), Trevor Brothers[3], Thomas Hansen[1], Gina Kuperberg[1,2]; [1]Tufts University, [2]Massachusetts General Hospital, [3]North Carolina Agricultural and Technical State University

Hierarchical predictive coding is a biologically plausible algorithm for approximating Bayesian inference in the cortex. A key feature is the use of two functionally distinct units each level of the cortical hierarchy: “State units” that infer representations, and “error units” that encode information that is not predicted by state units at the level above (prediction error). Until now, this algorithm has not been implemented in the language domain. Here, we describe a predictive coding model that infers word meaning from orthographic form. Our simulations leverage the state-error distinction in predictive coding to explain why we are faster to respond to primed/predicted words versus unprimed/unpredicted words, despite producing a smaller evoked response (300-500ms: the N400): State units encoding primed/predicted words accumulate activity more quickly, driving the faster behavioral response, while activity within error units is more effectively suppressed, leading to the smaller evoked response. Finally, our model predicts a dissociation between behavioral and neural measures for targets preceded by form-related primes. Our empirical findings confirmed this striking dissociation. In an event-related potential experiment (N=22), the N400 amplitude was smaller to form-primed targets (wire-WIFE < gear-WIFE), while in a behavioral experiment (N=64), participants took longer to make semantic categorization judgments to the same targets. These findings situate language comprehension within the broader context of predictive coding research and demonstrate how the unique properties of predictive coding can explain key brain-behavior relationships during language processing.

Topic Area: LANGUAGE: Semantic

E99 - Neuro-anatomic Substrates Supporting Category and Letter Fluency: Evidence from Voxel- and Connectome-based Lesion-Symptom Mapping

William Burns[1] (william_burns@urmc.rochester.edu), Emma Strawderman[1,3], Benedikt Winzer[1], Steven Meyers[1,2], Tyler Schmidt[1], Kevin Walter[1], Webster Pilcher[1,4], Bradford Mahon[1,5], Frank Garcea[1,3,5]; [1]Department of Neurosurgery, University of Rochester Medical Center, [2]Department of Imaging Sciences, University of Rochester Medical Center, [3]Department of Neuroscience, University of Rochester Medical Center, [4]Del Monte Institute for Neuroscience, University of Rochester Medical Center, [5]Department of Psychology, Carnegie Mellon University

Verbal fluency is a neuropsychological assessment requiring participants to produce words from a semantic category (hereafter, category fluency), or words beginning with a specific letter (hereafter, letter fluency). Prior research suggests that engaging in category fluency emphasizes semantically-guided lexical retrieval, whereas engaging in letter fluency emphasizes phonological encoding of lexical-semantic representations. Here, 55 participants with lesions in the pre-operative phase of their neurosurgical care took part in the category fluency and letter fluency task, as well as a high-resolution T1 scan and diffusion MRI. Voxel-based and connectome-based lesion-symptom mapping related lesion sites and structural disconnectivity,

respectively, to performance in the two fluency tasks. Two hypotheses were tested: (1) That lesions involving the left inferior frontal gyrus, the left anterior temporal lobe, and the underlying white matter would be associated with fewer items produced in the category fluency task (controlling for performance in the letter fluency task); and (2) That lesions involving the left posterior superior temporal gyrus, the left anterior supramarginal gyrus, and the underlying white matter would be associated with fewer items produced in the letter fluency task (controlling for performance in the category fluency task). Results confirmed both hypotheses: We provide causal lesion evidence that distinct lesion sites and structural disconnectivity patterns uniquely account for performance across the category and letter fluency tasks. Our results suggest that interactive yet dissociable networks underlie lexical-semantic and phonological processing to constrain the selection of words when engaging in the verbal fluency task.

Topic Area: LANGUAGE: Semantic

E100 - Disambiguating Semantic Processing and Executive Function in Post-Stroke Aphasia

Ryan Dixon[1] (rldixon@email.sc.edu), Dirk Den Ouden[1], Julius Fridriksson[1], Rutvik Desai[2], William Matchin[1]; [1]Department of Communication Sciences and Disorders, University of South Carolina, [2]Department of Psychology, University of South Carolina

Semantic processing, the ability to access or apply conceptual knowledge, can be impaired in neuropsychological populations and is commonly assessed with standard non-linguistic picture verification measures such as the Pyramids and Palm Trees Test (PPT) and Kissing and Dancing Test (KDT). However, prior research suggests these measures have substantial executive function demands. We aimed to assess this claim in 79 post-stroke aphasia patients. First, we assessed whether the PPT and KDT have significant convergent validity with semantic processing as assessed through the Western Aphasia Battery (WAB) comprehension subscore and the Northwestern Assessment of Verbs and Sentences (NAVS) verb and sentence comprehension tests, including the Wechsler Adult Intelligence Scale (WAIS) matrices test as a control for executive function demands. Second, we assessed whether these measures predict damage to areas widely implicated in conceptual-semantic processing. The results revealed that the PPT and KDT significantly correlated with performance on the WAB-R and NAVS comprehension measures, but this relationship disappeared when WAIS matrices was included as a covariate, suggesting the convergent validity of the PPT and KDT may be driven by a shared executive function component. After controlling for multiple comparisons, the PPT only significantly related to damage to the posterior cingulate gyrus and the KDT did not significantly relate to damage to any semantics-related brain regions, unlike the linguistic comprehension measures which significantly related to several of these regions. These results indicate that the PPT and KDT may have limited utility in assessing conceptual-semantic deficits in left-hemisphere chronic stroke survivors.

Topic Area: LANGUAGE: Semantic

E101 - Processing of quantifier scales in deaf and hearing users of German Sign Language (DGS) – preliminary results from a truth-value-judgement-task

Elena Georgia Mpadanes[1], Agnes Villwock[1]; [1]Rochester Institute of Technology

Scalar implicatures (SI) are made when statements like “some guests have arrived” are interpreted as a negation of “all guests have arrived”. While SI processing has been extensively studied in hearing monolinguals (see Politzer-Ahles, 2020), little research has examined the role of language acquisition and sensory experience in sign language users. A prior study on deaf bimodal bilinguals of ASL and English suggests that English-ASL bilinguals process SI similarly to monolingual English speakers (Davidson, 2014). This ongoing study investigates how deaf and hearing users of German Sign Language (DGS) process SI in written German. So far, participants include (i) 18 deaf L1 signers of DGS & German, (ii) 19 hearing L1 signers of DGS & German, (iii) 21 hearing L2 learners of DGS, and (iv) 20 hearing non-signers (controls). A truth-value judgment task assesses accuracy and response time across 224 trials, where participants judge the truthfulness of German sentences containing einige/alle (“some/all”; presented word-by-word with 500 ms each) in context of a preceding picture. During the behavioral task, we record the EEG. Preliminary findings exhibit significant differences in response times between signers and non-signers ($p < .01$), suggesting that language experience influences the timing of SI processing. While all groups derive SI from quantifier scales, rejection rates for underinformative trials vary depending on language background. Both deaf and hearing DGS users make scalar inferences, aligning with Davidson (2014). This indicates that SI processing is shaped by both sensory and linguistic experience, supporting the universality of conversational principles across modalities.

Topic Area: LANGUAGE: Semantic

E102 - Chunking Constrains Prediction during Language Comprehension

Jiajie Zou[1,2] (jiajiezou@zju.edu.cn), Nai Ding[1]; [1]Zhejiang University, [2]Ernst Strüngmann Institute, Frankfurt, Germany

Speech is a highly rapid sequence with complicated internal structures. Prediction and chunking are two possible mechanisms for the brain to efficiently process speech and they are often viewed as separate or even opposing mechanisms. Here, we investigate whether the two mechanisms interact and hypothesize that the chunk structure in speech modulates how the brain predicts basic linguistic items, i.e., morphemes. In three magnetoencephalography (MEG) experiments in Mandarin Chinese, we characterize neural prediction of morphemes using the neural response to morpheme surprisal and analyze how this response is modulated by chunks, i.e., major linguistic constituents. We demonstrate that the MEG surprisal response is significantly stronger for morphemes belonging to the ongoing chunk than morphemes across a chunk boundary. This chunk-boundary effect on morpheme prediction is further modulated by the certainty of a chunk boundary. The conclusions are also confirmed by analyzing open dataset of MEG responses to English narratives. In summary, these results strongly suggest that the brain employs a chunk-based prediction strategy and more precisely predicts items within a chunk.

Topic Area: LANGUAGE: Syntax

E103 - Examining sensitivity to subject-verb agreement in a second language (L2): An event-related potential (ERP) investigation

Xuan Wang[1] (xuan.wang@ku.edu), Alison Gabriele[1], Robert Fiorentino[1]; [1]University of Kansas

We used ERPs to investigate sensitivity to subject-verb agreement in Chinese-speaking learners of English. The Morphological Congruency Hypothesis (Jiang et al., 2011) posits that subject-verb agreement presents a challenge for L2 learners whose native language (L1) does not instantiate agreement (e.g., Chinese), particularly when learners are tested using tasks that minimize the use of metalinguistic knowledge. Since previous L2 ERP studies have largely utilized grammaticality judgment tasks, the extent to which L2 learners can potentially show nativelike responses in the absence of metalinguistic tasks remains unclear. Participants (N=25 upper-intermediate L1-Chinese/L2-English learners and N=26 L1-English speakers) read 80 target sentences and 160 fillers word-by-word, with a comprehension question rather than a grammaticality judgment after each sentence, to avoid drawing attention to metalinguistic information. Target sentences included 40 grammatical sentences and 40 sentences with subject-verb agreement violations (e.g., The librarians at the desk sometimes nap/*naps on the job). ERPs time-locked to the onset of the verb were analyzed in the 300-500ms (N400) and 500-900ms (P600) time-windows. L1-English speakers showed a significant positivity (P600) in the 500-900ms time window for subject-verb agreement violations. L2 learners exhibited a positivity that was evident in the 300–500ms and 500–900ms time-windows, and which was modulated by proficiency such that higher proficiency scores (English LexTALE) were associated with a larger positivity. These findings provide neural evidence that adult L2 learners can demonstrate sensitivity to agreement violations for grammatical features not instantiated in the L1 even when the task does not require the use of metalinguistic knowledge.

Topic Area: LANGUAGE: Syntax

E104 - Differentiating endogenous and entrained delta-band rhythms in the brain: a naturalistic story-listening experiment

Leonardo zeine[1,2] (leonardo.zeine@gmail.com), David Peoppel[3]; [1]Ernst Strüngmann Institute for Neuroscience, [2]Max Planck School of Cognition, [3]New York University

Spoken language, unlike written text, is a continuous and overlapping signal that lacks explicit cues for segmentation. In this study, we investigate the role of neural delta-band oscillations (<4 Hz) in segmenting linguistic information at the phrasal level. Magnetoencephalography (MEG) data were collected from 10 native English speakers as they listened to four stories from the NYU-BU Contextually Controlled Stories Corpus (NUBUC) in two conditions: (1) a fluent, unedited version and (2) a version with artificially removed pauses. Segments longer than 150 ms with an average amplitude below 0.15% of the normalized amplitude were identified and extracted in the no-pause condition. Using a temporal response function (TRF) approach, we could disentangle neural activity in the delta range, such as responses to sentence onsets, from activity that naturally correlates with slow fluctuations in the audio signal, caused by pauses. In the no-pause condition, relative pitch processing was enhanced in the right superior temporal gyrus, while predictive processes, modeled by entropy and surprise regressors, were globally suppressed. These findings suggest a compensatory reorganization within the language network to adapt to the absence of pauses and maintain comprehension, as well as an interaction between syntactic and prosodic representations during naturalistic language processing.

Topic Area: LANGUAGE: Syntax

E105 - Neuro-Generative Grammar: Universal Physics, Natural Syntax and Language-Chunk Assembly Circuits (LCACs)

Donald O'Malley[1] (d.omalley@neu.edu), Jessy Xue[1]; [1]Northeastern University

Generative Grammars, because they lack substantive Semantic Construction (SemCon), are unable to actually generate sentences. Moreover, the neuronal machinery of SemCon is opaque to both introspection and current neurotechnologies. The complexity of modern sentences poses further challenges, but an alternative is to focus instead on the minimum-viable neuronal circuits needed at the outset of hominid language and subsequently for neocortical evolution and expansion. Language arises from Tagging: our uniquely hominid ability to attach signs to Real-World Items (RWIs). Both the symbolic Tag-store and the naturally-associated RWIs are richly interconnected with other semantic items including actions, properties, auditory/visual events and relationships. These innate neocortical constructs constitute a Universal Physics and enable a Natural (proto) Syntax which can be implemented by prefrontal, working-memory sequencing circuits. Subsequently, order-dependent meaning, based upon clan convention, required novel adaptations/circuits to understand, produce and disambiguate phrases like Hyena kill Thag vs. Thag kill Hyena. We present LCACs: candidate neuronal circuits to implement proto-syntax as well as increasingly complex constructs in line with Jackendoff and Audring's Relational

Morphology (RM; Texture of the Lexicon, 2020). By means of compact schemas, RM avoids GenGram's most elaborate complexities: RM-schemas are more readily translated into neuronal word-sequencing algorithms. A virtue of our neuro-generative grammar / LCACs approach is that basic pattern-recognition machinery, in conjunction with the evolved Tagging/Symbolic layer, directly enables many kinds of schemas such as add -er (bake => baker) or -en (thick => thicken). Our lengthy, modern sentences also require an expanded, Tag-specific "sentence memory" (WM) system.

Topic Area: LANGUAGE: Syntax

E107 - Whole-brain white matter variation across childhood environments

Sofia Carozza[1,2] (scarozza@bwh.harvard.edu), Isaiah Kletenik[1,2], Duncan Astle[3], Lee Schwamm[4], Amar Dhand[1,2]; [1]Harvard Medical School, [2]Brigham & Women's Hospital, [3]University of Cambridge, [4]Yale School of Medicine

Early-life adversity has been associated with structural differences in several major white matter tracts. While there is reason to expect that such microstructural changes may in fact be observed throughout the adversity-exposed brain, and that these global changes are relevant for cognitive difficulties, evidence in support of these hypotheses remains lacking. This poster aims to test these possibilities in data from the Adolescent Brain Cognitive Development (ABCD) study (N = 9,082, female = 4,327). Using partial least squares (PLS) regressions, we found extensive cross-sectional associations with lower white matter fractional anisotropy (FA) and streamline count in the brains of 9- and 10-year-old children exposed to a range of experiences, including prenatal risk factors, interpersonal adversity, household economic deprivation, and neighborhood adversity. A matching analysis implicated reductions in FA in later difficulties with mental arithmetic and receptive language. Furthermore, a PLS path analysis showed that white matter FA mediates the detrimental effect of adversity on cognition across domains later in adolescence. These findings advance a white matter-based account of the neural and cognitive effects of adversity, which supports developmental theories that emphasize the role of inter-regional connectivity in regional maturation.

Topic Area: NEUROANATOMY

E108 - Distinct brain age gradients reflect diverse neurobiological hierarchies.

Nicholas Riccardi[1] (riccardn@email.sc.edu), Sarah Newman-Norlund[1], Julius Fridriksson[1], Chris Rorden[1], Leonardo Bonilha[2]; [1]University of South Carolina, [2]School of Medicine Columbia

Introduction: "Brain age" is a biomarker of brain health, often used as a single global metric. However, this global approach may overlook the influence of nonuniformly distributed neuroaxes (gene expression, cerebral blood flow, etc.). Here, we used a region-specific brain age approach to investigate spatial brain aging patterns in 167 neurologically intact adults (aged 20–79 years) and related these patterns to known neuroaxes and behavioral performance, including cognitive status. Methods: T1-weighted MR images were analyzed with volBrain's BrainStructureAges to estimate brain ages for 104 cortical regions. Regional brain age gaps (regiBAG) were calculated as the difference between estimated and chronological ages. Behavioral measures included MoCA, visual acuity, hearing, balance, and gait speed. Exploratory factor analysis identified six regiBAG patterns explaining 95% of variance. Linear regression related these patterns to region-specific rankings from 10 neuroaxes, and stepwise regression linked participant-level regiBAG patterns to behavior while controlling for age, sex, and education with FDR correction. Results: Regional loading scores from the six factors significantly aligned with neuroaxes (R^2 range=.05–.56, p's<.05), with gene expression being the strongest predictor. Participant-level regiBAG patterns predicted behavioral performance beyond age, sex, and education (adj. R^2 range=.07–.59, p's<.002). For example, greater regiBAG in the ventral visual stream related to worse visual acuity, and greater regiBAG in right temporoparietal regions related to lower MoCA scores. Global brain age did not predict behavior. Conclusion: Spatial patterns of brain aging align with hierarchical neurobiological gradients and have distinct behavioral correlates, offering a more nuanced framework than global brain age.

Topic Area: NEUROANATOMY

E109 - Neurodevelopment in Adolescence: Alcohol's Impact and the Role of Prevention Programs

Sanjana Kalagara[1] (sk766@duke.edu), Jennifer E. Lansford[1]; [1]Duke Unviersity

Adolescent alcohol consumption is a significant public health concern, with 62% of 12th graders having abused alcohol. The adolescent brain, undergoing significant structural and functional changes until the mid-20s, is particularly susceptible to alcohol-induced alterations in key areas such as the prefrontal cortex, hippocampus, and nucleus accumbens. Investigating alcohol use among adolescents and prevention programs targeting various levels of influence is essential for remedying this issue. This work aims to explore the neurodevelopmental effects of alcohol during adolescence through a systematic review of peer-reviewed scientific literature focusing on neuroimaging data. The databases used for searching articles were PubMed, Web of Science, and APA PsychInfo, and the article analysis was conducted using Covidence software guided by the PRISMA criteria. The articles (N = 1739) were analyzed through an initial title/abstract review followed by a full text review. Inclusion criteria focus on studies published after 2000, involving adolescents aged 10-19, with a non-alcohol using control group, and utilizing neuroimaging techniques such as fMRI or MRI. Articles that did not meet these criteria were excluded. Next, the full text review (N = 246) will begin, and standardized data will be extracted from the articles.

Simultaneously, professionals in the prevention education industry will be interviewed regarding their experiences with alcohol prevention programs. These interviews will be conducted between January and March 2025. The novel findings collected from the Systematic Review and interviews have the potential to make significant contributions to alcohol research and be used to inform programs and policies in schools.

Topic Area: NEUROANATOMY

E110 - Hippocampal volume changes accompanying chronic methamphetamine use are related to use frequency and sex

Alisha L. Schaefer[1] (aschaefer13@huskers.unl.edu), Robert J. Roy, Nicholas A. Hubbard, Hillary Schwarb; [1]University of Nebraska-Lincoln

Over the last decade, methamphetamine use has become an escalating epidemic throughout the United States. Methamphetamine use has been linked to several health and cognitive issues, including disrupted memory. However, evidence for methamphetamine-related changes in memory-structures in the brain (i.e., hippocampus) is mixed with possible sex-differences reported. Inconsistencies likely arise from small sample sizes, variability in length of abstinence, and samples that do not equally represent males and females. To address these issues, the current study (N=148) recruited 74 community-dwelling individuals currently using methamphetamine (37 male and 37 female) and 74 non-users (37 male and 37 female). Groups were matched on age, sex, and handedness. Participants completed questionnaires assessing past and current methamphetamine-use patterns and DSM-V criteria for methamphetamine use disorder. Group differences in left and right hippocampal volume were evaluated. Exploratory analyses assessed sex differences in hippocampal volume and the relationship between volume and use frequency. We found that individuals with chronic methamphetamine-use experience had significantly smaller hippocampal volumes compared to non-users, and this difference was similar for males and females. Interestingly, use patterns had a significant positive correlation with left and right hippocampal volume, such that individuals who reported using methamphetamine more frequently had larger hippocampi than those who used less frequently, but only for female participants. These findings underscore potentially disparate impacts of chronic methamphetamine use on hippocampus structure for females versus males. Characterizing, quantifying, and understanding these differences is critical for effectively evaluating treatment program efficacy throughout recovery across the sexes.

Topic Area: NEUROANATOMY

E111 - Neural Correlates of Cognitive Functions in Veterans with Gulf War Illness

Yu Zhang[1] (yu.zhang@va.gov), G. Marina Veltkamp[1], Maxine Krengel[1], Peter Bayley[1], Ansgar Furst[1,2]; [1]War Related Illness and Injury Study Center, VA Palo Alto Health Care System, [2]Stanford University

Background: Impaired cognition is a core symptom of Gulf War Illness (GWI), a complex multifactorial condition affecting veterans of the 1990-91 Gulf War. Little is known about the neural correlates of this condition in mid-aged veterans with GWI, and this study examined the relationship between regional brain volumes (which we previously demonstrated to be potentially reduced in GWI) and measures of neurocognitive performance. Methods: Structural magnetic resonance imaging (MRI) and Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) data were collected from 158 veterans (Age=48±6, 87% Male) with GWI. Volumes of bilateral subcortical and brainstem regions were measured using FreeSurfer. A cognitively impaired group (CI-GWI, N=133, age= 47±9) and a cognitively normal group (CN-GWI, N=25, Age=49±6) were defined based on a cutoff value (1 SD below the mean) of the RBANS total index. Group differences and correlations were tested after adjusting for age, sex, education, severity of PTSD, depression and traumatic brain injury. Results: Volumes of the whole brainstem, pons, and nucleus accumbens were substantially smaller ($p \leq .01$), and the hippocampus was marginally smaller ($p=.03$), in CI-GWI compared to CN-GWI. Linear regression showed that a smaller pons was associated with impaired delayed-memory recall ($p=.02$); smaller nucleus accumbens was associated primarily with more severe depression ($p<.01$), and secondarily with lower immediate-memory recall ($p=.01$); smaller hippocampus was associated with increasing age ($p<.01$). Conclusion: Cognitive impairment in GWI is associated with damage to the brainstem and other deep brain structures, which may be related to comorbid conditions and specific military environmental exposures.

Topic Area: NEUROANATOMY

E112 - Specific anatomical associations of math and reading achievement while taking into account domain general abilities

Kenny Carlson[1] (keca6141@colorado.edu), Marie Banich[1,2], Dan Leopold[1,3], Laurie Cutting[4], Erik Wilcutt[1,3]; [1]Institute of Cognitive Science, University of Colorado Boulder, [2]Department of Psychology & Neuroscience, University of Colorado Boulder, [3]Institute of Behavioral Genetics, University of Colorado Boulder, [4]Department of Psychology, Vanderbilt University, Nashville, TN, USA

Because levels of math and reading achievement are often correlated, the present study examined whether neuroanatomical features of the brain associated with each of reading and math achievement are overlapping or distinct, which to our knowledge has only been examined once before. Using FreeSurfer we examined potential relationships between composite measures of reading and math and brain neuroanatomy (volume, thickness, surface area) in a sample of 136 youth aged 10 to 17. Using robust composite measures of each of reading and math achievement and correcting for whole brain size, we observed that greater reading achievement is associated with reduced thickness of the right inferior supramarginal gyrus (r-iSmG) and the right inferior angular gyrus (r-iAnG). No associations were observed between brain morphology and math achievement. To examine the specific contributions of each academic domain, when they are considered simultaneously in the same regression model, higher reading achievement is again associated with reduced thickness of the r-iSmG, and r-iAnG. Higher math achievement is associated with decreased thickness of the right orbitalis region of the IFG. Suggesting that these are domain-specific associations, they remain robust when measures of either executive functions or processing speed are also included in the regression model. Whether these associations reflect that particular neurological substrates may enable better academic achievement in each of these domains or indicate that domain-specific achievement leads to increased pruning and refinement of cortical regions will need to be determined by future longitudinal studies.

Topic Area: NEUROANATOMY

E113 - Prevalence and clinical significance of incidental findings in pre-treatment MRI for rTMS in treatment-resistant MDD

Claire A Ho[1] (cah4022@med.cornell.edu), Jeremy Levit[2], Nicola Manfredi[1], Megan E Chang[1], Indira L Summerville[1], Jolin Chou[1], Megan Johnson[1], Hayley Seltzberg[1], Lindsay W Victoria[1], Charles J Lynch[1], Immanuel G Elbau[1], Conor Liston[1], Benjamin Zebley[1]; [1]Weill Cornell Medicine, [2]NewYork-Presbyterian Hospital

The use of MRI screening before repetitive transcranial magnetic stimulation (rTMS) for major depressive disorder (MDD) is a topic of debate. MRI can identify pathologies that contribute to depressive symptoms or increase seizure risk but is costly and of uncertain utility. This is partially due to previous reports of no significant differences in incidental findings (IFs) between psychiatric and healthy populations, with clinically significant IF rates of 0.9% (Russel et al., 2024). We report preliminary findings from two ongoing randomized trials evaluating TMS for treatment-resistant MDD, which used structural MRI for neuronavigation. Analysis of 179 scans by neuroradiologists identified 60 IFs (33.5%) in total. Most prevalent were white matter hyperintensities (8.9%), parenchymal volume loss (3.9%), and pituitary/sellar lesions (2.8%). Sixteen IF (8.9%) were clinically significant and warranted clinical follow-up, exceeding reported rates. Six (3.4%) presented serious safety concerns warranting study exclusion due to elevated seizure risk, all lesions with mass effect. These findings suggest the rate of relevant MRI findings may be higher than previously assumed in psychiatric populations. Pre-TMS MRI serves two key purposes: identifying seizure risk factors, such as lesions, cerebrovascular abnormalities, or traumatic brain injury sequelae, and detecting brain-structural causes of depression, such as autoimmune-mediated lesions or prefrontal and pituitary tumors. The higher-than-reported prevalence of risk-bearing findings in our sample may reflect characteristics of treatment-resistant populations, suggesting these abnormalities are more common in this group. If confirmed, these results support the use of pre-treatment MRI for TMS in both clinical and research settings.

Topic Area: NEUROANATOMY

E114 - Using neuroanatomical features to predict receptive language selectivity in middle frontal gyrus in individual brains

Rebecca Belisle[1] (rbelisle@bu.edu), Emily Stephen[1], Tyler Perrachione[1]; [1]Boston University

Strictly selective and highly focal nodes of a receptive language network can be reliably localized in individual brains. In particular, a language-selective area situated proximal to posterior middle frontal gyrus (pMFG) and precentral gyrus, is prominent in individual brain maps but often missing from group averages because its precise location varies considerably across individuals with respect to macroanatomical landmarks. Here, we aimed to characterize the structural underpinnings of this functionally defined region that is of particular interest due to its potential correspondence with Area 55b, a region recently implicated in language. Inspired by work showing that structural connectivity can predict the location of functionally specialized visual areas in individual brains, we used an elastic net linear regression framework to predict the location of individuals' pMFG language area using cortico-cortical connectivity, cortico-subcortical connectivity, and local cytoarchitectural features (e.g., intracortical myelin) in N=25 adults with normal language abilities. We estimated the optimal hyperparameters and generalization error using nested leave-one-subject-out cross-validation. Our model based on individual neuroanatomical features predicted the location of language-selective tissue near pMFG with an AUC significantly above chance, consistently outperforming group-average fMRI maps. Features positively predictive of the pMFG language area included connectivity with the insula and inferior parietal lobule, and negatively predictive features included intracortical myelin and connectivity to areas associated with visuomotor functions. These findings suggest that specific structural features may be linked to the precise location of receptive language areas in individual brains.

Topic Area: NEUROANATOMY

E115 - Trajectories of thalamic resting state connectivity in the Adolescent Brain Cognitive Development Study

Caroline Ostrand[1] (ostra092@umn.edu), Paul Collins[1], Monica Luciana[1]; [1]University of Minnesota

Functional connectivity between the thalamus and cortex is increasingly recognized as important for higher-order cognition. Alterations in the development of thalamo-cortical networks may contribute to the emergence of pathology including schizophrenia. To date, there has been minimal longitudinal research examining normative developmental trajectories of thalamo-cortical resting state networks. The aim of the current study was to characterize age-related changes in resting state functional connectivity (rsFC) between the thalamus (thal) and the frontoparietal (FPN), salience

(SN), and default mode (DMN) networks across adolescence. Participants included 2,459 youth (spanning 9 to 15 years of age) with complete resting state data across three waves of the Adolescent Brain Cognitive Development Study, an epidemiologically-informed consortium study across 21 data collection sites that is following adolescents from age 9 into young adulthood. Mixed-effects models were constructed to examine the functional form of age with rsFC of thal-SN, thal-FPN, and thal-DMN after accounting for head motion, within-subject variance, and study site. Best fitting models were selected using Bayesian Information Criteria. Findings indicated that a linear relationship between age and rsFC was best when modeling thal-SN, thal-FPN, and thal-DMN rsFC. Thal-SN and thal-FPN rsFC significantly decreased with age (p's <.05), with the most pronounced effect observed for thal-SN (standardized β= -.197, p<.001). These findings suggest that rsFC of thalamocortical networks including the SN and FPN decreases during adolescence with some variation depending on the network examined. Analyses are in progress to associate connectivity patterns with cognitive function.

Topic Area: NEUROANATOMY

E116 - In-Silico Structure Analysis on Interactions Between Amyloid-Beta 42 Variants and Lecanemab

Leo Wang[1] (leohy.wang08@gmail.com); [1]Developing Virtue Secondary School

Alzheimer's disease (AD) is characterized by cognitive decline linked to amyloid-beta 42 (Aβ42) plaque accumulation, disrupting neural networks and promoting neurotoxicity. This study investigates how specific Aβ42 mutations, such as D23N and E22G, influence binding interactions with Lecanemab, a recently approved antibody that targets Aβ42 aggregates to slow cognitive decline. Computational modeling was conducted using AlphaFold for structure prediction, ChimeraX for structural analysis, and HADDOCK for docking simulations, allowing for comparison of binding affinities and structural stability between wild-type and mutant Aβ42. Statistical analysis (e.g, ANOVA) were applied to validate differences in binding stability and affinity across various mutations with Lecanemab. Structural analysis through HADDOCK revealed that D23N significantly enhances binding stability, characterized by favorable HADDOCK scores, lower RMSD, and increased Van der Waals interactions. In contrast, the E22G mutation demonstrated reduced binding affinity, with fewer hydrogen bonds and a more flexible binding conformation. These results suggest that genetic variations in Aβ42 may impact the efficacy of Lecanemab, underscoring the potential for personalized medicine approaches in AD treatment to optimize therapeutic benefits based on individual genetic profiles. Future research should validate these computational findings experimentally, focusing on how genetic profiles may influence therapeutic responses to better target cognitive preservation strategies.

Topic Area: OTHER

E117 - Non-invasive electrical stimulation modulates resting-state thalamocortical functional connectivity

Byoung-Kyong Min[1] (min_bk@korea.ac.kr), Jeehye Seo[1]; [1]Korea University

The thalamus plays a crucial role in regulating cortical networks, including the central executive network (CEN) and the default mode network (DMN), which are essential for cognitive processing and resting-state activity. Examining thalamocortical functional connectivity provides insights into how information is transmitted between subcortical and cortical regions. This study aimed to investigate how phase-dependent transcranial alternating current stimulation (tACS) targeting the CEN and DMN affects resting-state thalamocortical connectivity. Twenty-seven participants underwent resting-state fMRI under three conditions: resting-state without tACS, 45°-phase-lag tACS, and 180°-phase-lag tACS. Stimulation was applied to representative nodes of the CEN (bilateral dorsolateral prefrontal cortex [dlPFC] and posterior parietal cortex [PPC]) and the DMN (medial prefrontal cortex [mPFC] and posterior cingulate cortex [PCC]). Functional connectivity and modularity analyses were conducted to examine tACS-mediated changes in resting-state thalamocortical connectivity. In the 45°-phase-lag tACS condition, resting-state functional connectivity between higher-order thalamic nuclei (e.g., the mediodorsal thalamus) and the CEN/DMN was significantly reduced compared to the 180°-phase-lag tACS condition, indicating a tACS-phase-sensitive decrease in thalamic-CEN and thalamic-DMN synchronization. In contrast, resting-state thalamocortical connectivity in attention-related networks was enhanced during the 45°-phase-lag tACS condition, suggesting differential engagement with attention processes. Modularity analysis revealed phase-dependent reorganization, with changes in hub roles and network centrality across phase-lag conditions. Overall, these findings provide evidence for the critical role of phase-dependent tACS in modulating resting-state connectivity between the thalamus and cortex, underscoring its importance for effective tACS-based neuromodulation.

Topic Area: OTHER

E118 - Effects of Dementia on Incident Post-COVID Conditions (PCC) in Patients with SARS-CoV-2 (COVID-19)

Nicholas Kendrick[1], Michael Horberg[1], Ejaz Shamim[1], Celeena Jefferson[1], Eric Watson[1], Lily Fathi[1], Seohyun Kim[1]; [1]Kaiser Permanente Mid-Atlantic Permanente Medical Group, Mid-Atlantic Permanente Research Institute

Dementia is associated with a heightened acute response to SARS-CoV-2, but limited data exist on Post-COVID Conditions (PCC) in people with dementia (PWD). This retrospective study assessed PCC incidence in PWD compared to people without dementia (PWoD) within Kaiser Permanente Mid-Atlantic States (KPMAS). We used KPMAS electronic health records to identify adult patients ≥65 years with a positive PCR and/or antigen test for COVID-19 between 1/1/2020-1/31/2022. PWD were defined using ICD-10 dementia-related codes within four years prior to their first positive COVID-19 test and were matched 1:3 to PWoD by sex, age group, race/ethnicity, test month, and medical service area. PCC incidence was defined as the occurrence of at least one of 17 conditions within 30–180 days post-index date, and not in the four years before and/or 29 days after the index date. Relative risk of PCC and its identified 17 conditions, along with odds ratios for demographic analysis, were calculated between PWD and PWoD. A total of 373 PWD were matched to 1,119 PWoD, with both groups predominantly black (56%) and female (54%), and a median age of 76.8 years. PCC occurred in 22.8% of PWD and 23.3% of PWoD (RR=0.97 [0.79-1.21]). Only the risk of "genitourinary symptoms and ill-defined conditions" was higher in PWD (RR=1.80 [1.02-3.19]). Demographic factors such as age, race/ethnicity, and sex did not influence PCC risk in PWD. We found no increased risk of PCC among PWD compared to matched PWoD in age, race, and sex. Demographic characteristics in PWD were not associated with PCC.

Topic Area: OTHER

E119 - Effects of Active Exploration versus Passive Observation on Spatial Learning, on Spatial Memory, and Map Drawing.

LaTajah Lambey[1] (llambey3@gatech.edu), Scott Moffat[1]; [1]Georgia Institue of Technology

Active navigation is characterized by direct interactions with the environment, including making decisions that guide learning and determining how much time is spent gathering “sufficient” knowledge. In contrast, passive observation involves watching another navigator’s view. Here, the spatial information learned is bounded by what the actor experiences. The literature on the differences between active and passive learning is widely inconsistent. Performance between actors and observers seems to depend on the task-goal requirements involving spatial layout memory or object memory. This study examines the effects of the mode of learning – active exploration with a joystick or passive observation by video-- on spatial ability, including spatial memory, spatial efficiency, and map drawing. Participants learned to navigate with a joystick through a spatial environment to learn the locations of 6 objects and the environment layout. Active navigators moved freely about the environment while being recorded for yoked-control observers to watch later. Each participant drew an overhead map diagram of the environment and was given an object recall search task. Preliminary analysis indicated no significant differences between actors and observers on landmark recall or map drawing. Actors had faster movement speeds during recall trials, $t(43) = -2.498$, $p= .0164$. Correlation analysis showed that mental rotation ability was positively associated with recall accuracy and map drawing. The results showed that the advantages of being an actor in this navigation task were primarily restricted to improvements in the motor demands of moving through the environment, with negligible advantages in acquiring spatial knowledge and cognitive mapping.

Topic Area: OTHER

E120 - Developing a virtual reality assessment to quantify navigational impairments in aging and early Alzheimer's disease

Annie R. Kim[1] (annieek@student.ubc.ca), Afsoon G. Mombeini[1], Isaac G. Morgan[1], Adam W. Lester[1], Inzaghi Moniaga[1], Talia C. Apel[1], Manu S. Madhav[1]; [1]University of British Columbia

Spatial navigation impairments are among the earliest cognitive deficits observed in Alzheimer’s disease (AD), preceding symptoms such as memory loss. However, existing spatial navigation tests are often limited in ecological validity and fail to effectively distinguish between egocentric (self-referenced) and allocentric (environment-referenced) navigation. To address these limitations, we developed a novel virtual reality (VR) task designed to quantify age- and disease-related changes in navigation abilities and identify potential behavioural biomarkers for cognitive impairment. In this immersive VR task, participants must keep track of their starting position and two distant landmarks as they navigate along paths of increasing complexity in a naturalistic 3D environment. Navigation performance is assessed using pointing tasks, with three primary metrics: egocentric error, allocentric error, and allocentric consistency. Data collection is currently ongoing with cognitively healthy young and older adults to establish baseline measures during normative aging. In the next phase, we will recruit individuals with early AD to examine and compare navigational impairments in this population. We hypothesize that older adults will show increased allocentric deficits compared to young adults, with additional egocentric impairments in the AD population. The resulting behavioural data will be analyzed using traditional statistical analysis and machine learning techniques to estimate patterns indicative of AD-related cognitive impairment. Results from this project will be combined with future rodent studies to allow for cross-species comparisons that deepen our mechanistic understanding of AD-related navigation impairments. The ultimate goal is the development of a sensitive, navigation-based behavioural biomarker to facilitate early AD detection and monitoring.

Topic Area: OTHER

E121 - Globus pallidus iron levels relate to cognitive impairment in Alzheimer‘s disease: Evidence from an in vivo MRI-based meta-analysis

Marthe Mieling[1] (m.mieling@uni-luebeck.de), Clara Wiskow[1], Nico Bunzeck[1,2]; [1]Department of Psychology, University of Lübeck, Ratzeburger Allee 160, 23562 Lübeck, Germany, [2]Center of Brain, Behavior and Metabolism, University of Lübeck, Ratzeburger Allee 160, 23562 Lübeck, Germany

Iron plays an essential role in brain metabolism and, therefore, cognitive functioning. However, region specific iron level increases during healthy and, even more so, pathological aging, in particular Alzheimer's disease, can have detrimental effects. Although this notion has been supported by several single studies, meta-analytic evidence of a relationship between iron levels, as measured with in vivo MRI, and Alzheimer's disease (AD) is still missing. We used a meta-analytic approach of 22 in vivo MRI experiments with, in total, 685 AD patients and 1104 healthy controls (HC). All studies employed iron sensitive markers, such as R2* or QSM, and reported effects in specific brain regions, including the putamen, caudate nucleus, globus pallidus, hippocampus, and thalamus, that were further analyzed here. We also investigated the relationship between iron levels in AD and cognitive performance as measured with the Mini-Mental-Status-Examination (MMSE). In all regions of interest, iron level increases were significant in AD compared to HC, with the most pronounced effects in the putamen followed by the caudate. Importantly, in AD globus pallidus iron levels showed a negative correlation with MMSE performance. Our results provide unique evidence for the notion that iron level increases, especially within basal ganglia structures, which provide a hub for cognitive information processing, are a characteristic hallmark of AD. While this may relate to neurodegeneration, amyloid plaques and tau pathologies, our findings suggest that iron level increases can help to explain and possibly predict cognitive decline in AD.

Topic Area: OTHER

E122 - Dev-Atlas: A new Reference Atlas of Functional Brain Networks for Adolescents

Gaelle Doucet[1] (gaelle.doucet@boystown.org), Callum Goldsmith[1], Katrina Myers[1], Danielle Rice[1], Grace Ende[1], Lucina Uddin[2], Marc Joliot[3], Vince Calhoun[4], Tony Wilson[1]; [1]Boys Town National Research Hospital, Boys Town, NE, USA, [2]University of California Los Angeles, Los Angeles, CA, USA, [3]Groupe d'Imagerie Neurofonctionelle-Institut des maladies neurodégénératives (GIN-IMN) UMR 5293, Bordeaux University, CNRS, CEA, Bordeaux, France, [4]Tri-Institutional Center for Translational Research in Neuroimaging and Data Science (TReNDS), Georgia State University, Georgia Institute of Technology, and Emory University, Atlanta, GA, USA

Adolescence is a critical period for neural changes, including maturation of the functional brain networks. The spatial and functional organization of these networks shows major age-related changes across the lifespan, but particularly during adolescence. Yet, there is currently no reference functional brain atlas derived from typically-developing adolescents. In this context, the aim of this study was to construct and validate a reference functional brain atlas based on typically-developing youth aged 8 to 17 years. We term this new atlas, "Dev-Atlas". For this, we utilized datasets from three large developmental projects (Philadelphia Neurodevelopmental Cohort, the Pediatric Imaging, Neurocognition, and Genetics study, and the Lifespan Human Connectome Project – Development). We also used an independent smaller sample collected at Boys Town National Research Hospital, for replication (n=214, 53% males, mean age=12.23 (2.63) years). After strict quality control analyses and preprocessing, our final main sample was 1,391 individuals (47% males, age=13.56 (2.7) years). For each individual dataset, the first-level analysis was carried out using probabilistic single-subject Independent Component Analysis (ICA), followed by the multiscale individual component clustering algorithm (MICCA). We further conducted linear model analyses to test the effect of age and sex on each identified network. We identified 24 reproducible networks classified within 6 domains (Default-Mode, Cognitive Control, Salience, Dorsal Attention, SensoriMotor, and Visual). Large effects of age were detected but only very limited sex differences. We have created Dev-Atlas, an atlas of reliable functional brain networks based on typically-developing children and adolescents. Dev-Atlas is freely available to the research community.

Topic Area: OTHER

E123 - A Spectroscopy Study of the Brain: Exploring Sex Differences in Healthy Older Adults

Angela Gushue[1,2] (agushue25@cmc.edu), Craig Stark[1], Poortata Lalwani[1]; [1]University of California Irvine, [2]Claremont McKenna College

Cognitive decline and aging-related disorders, such as Alzheimer's Disease, disproportionately affect patients based on sex, but the mechanisms underlying these skewed effects are unknown. This proton magnetic resonance spectroscopy (H-MRS) study seeks to understand if sex disparities in aging exist in neurochemical concentrations of older adult brains. Sixty-seven participants, ranging from 60 to 85 years of age, underwent the Montreal Cognitive Assessment (MoCA) and H-MRS. Concentrations of myo-inositol, total creatine, total NAA, and total choline were calculated in the dorsal posterior cingulate cortex, left hippocampal cortex, left medial temporal gyrus, left primary sensorimotor cortex, and right dorsolateral prefrontal cortex. The extensive number of variables inspired dimensionality reduction approaches, such as Principal Component Analysis and Factor Analysis. Each dimension primarily correlated to several metabolites in one brain region. Logistic regression with 10,000 permutation significance tests and multiple regression were conducted with dimension scores to evaluate their relationship with sex, age, and MoCA scores. Our evidence suggests that a collection of metabolites in the medial temporal gyrus is a reliable predictor of sex. We also found that hippocampal and dorsal posterior cingulate metabolites are associated with age and MoCA scores, respectively. These three findings demonstrate H-MRS's utility in detecting differential neurometabolic changes underlying sex, age and cognitive differences. Critically, we provide compelling evidence that biological sex cannot be overlooked in research examining pharmaceutical targets for slowing or reversing age-related pathology and cognitive decline.

Topic Area: OTHER

E124 - Atypical Cortical Resting States in Adolescent Females and Males with ASD

Stacy Moppert[1] (stacymop@buffalo.edu), Eduardo Mercado[1]; [1]University at Buffalo

Autism spectrum disorder (ASD) is a prominent neurodevelopmental disorder. Its causes remain elusive due to its heterogenous nature. To better understand the neural mechanisms contributing to ASD, resting-state functional magnetic resonance images (rs-fMRI) from the Autism Brain Imaging Data Exchange (ABIDE) network were examined from children ages 7-12 years old. Images from 32 females, (16 ASD; 16 TD) and 32 males (16 ASD; 16 males) were analyzed to assess variations in intrinsic functional connectivity. We used voxel-wise measures to examine within- and between-group differences in connectivity in both males and females with ASD. All children with ASD were observed to have atypical connectivity in the frontal lobes, occipital, and temporal lobes. Additionally, in females intrinsic functional connectivity was increased in the precuneous cortex and right frontal orbital cortex. In contrast, males showed increased connectivity in the thalamus, left occipital cortex, and intracalcarine cortex. The overall findings suggest that female and male children with ASD have overlapping but distinctive brain differences from other children. This result is consistent with prior findings indicating that, in general, brain alterations associated with ASD are similar in males and females.

Topic Area: OTHER

E125 - Neuroimmunological Mechanisms of Psychosis - a Network Perspective with The Virtual Brain

Christoph V. M. Huettl[1,2] (christoph.huettl@charite.de), Konstantin Bülau[1,2], Leon Martin[1,2], Luise Da Costa Zemsch[1,2], Rico A. Schmitt[1,2], Michael Schirner[1,2], Leon Stefanovski[1,2], Petra Ritter[1,2,3]; [1]Berlin Institute of Health at Charité – Universitätsmedizin Berlin, Charitéplatz 1, 10117 Berlin, Germany, [2]Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt- Universität zu Berlin, Department for Neurology and Experimental Neurology, Brain Simulation Section, Charitéplatz 1, 10117 Berlin, Germany, [3]Bernstein Center for Computational Neuroscience Berlin, Berlin, Germany

Psychosis is a severe psychiatric syndrome, with long-term quality of life most impaired by negative symptoms such as avolition and anhedonia, and cognitive deficits affecting memory and reasoning. Beyond genetic factors and substance abuse (e.g. cannabis and other hallucinogens), increasing evidence points to inflammatory imbalances —marked by elevated pro-inflammatory cytokines and imaging-based inflammatory biomarkers —as key factors for the development of psychosis. Functional connectivity (FC) changes have been found to be predictive for specific symptom profiles. While clinical trials with immunomodulatory therapies have shown significant e.g.: cognitive improvements the underlying mechanisms remain unclear, limiting personalized treatments. For the first time, this study integrates neuroinflammatory biomarkers, FC alterations, and behavioral symptoms of Psychosis in one framework. Using data from the Human Connectome Project for Early Psychosis (HCP-EP), FC and network-metrics like integration and segregation were derived from minimally preprocessed fMRI data, while brain simulation-based metrics were computed using the neuroinformatics platform The Virtual Brain (TVB: www.thevirtualbrain.org) . Symptoms were assessed using a comprehensive set of questionnaires, including PANSS and WASI-II. Our Findings demonstrate that inflammatory biomarkers significantly predict symptom severity, with FC changes acting as relevant mediators. The results shed light on the question which psychotic symptoms are closely related to inflammatory processes providing potential targets for immunomodulatory therapies. This approach may also enhance our understanding of Psychosis as a concept, adding to a growing body of evidence suggesting different mechanisms underlying this one diagnostic label.

Topic Area: OTHER

E127 - Brain functional connectivity, but not neuroanatomy, captures the interrelationship between sex and gender in preadolescents

Athanasia Metoki[1] (nasia.metoki@gmail.com), Roselyne Chauvin[1], Evan M. Gordon[1], Timothy O. Laumann[1], Benjamin P. Kay[1], Samuel R. Krimmel[1], Scott Marek[1], Anxu Wang[1], Andrew N. Van[1], Noah J. Baden[1], Vahdeta Suljic[1], Kristen M. Scheidter[1], Julia Monk[1], Forrest I. Whiting[1], Nadeshka J. Ramirez-Perez[2], Deanna M. Barch[1], Aristeidis Sotiras[1], Nico U.F. Dosenbach[1]; [1]Washington University in St. Louis, [2]Harvard University

Understanding sex differences in the adolescent brain is crucial as these differences are linked to sex-specific neurological and psychiatric conditions. Predicting sex from adolescent brain data may offer insights into how these differences influence neurodevelopment. Recently, attention has shifted toward exploring socially-identified gender (distinct from sex assigned at birth), recognizing its explanatory power. This study evaluates whether resting-state functional connectivity (rsFC) or cortical thickness more effectively predicts sex and sex/gender alignment (the congruence between sex and gender) and investigates their interrelationship in preadolescents. Using data from the Adolescent Brain Cognitive Development (ABCD) Study, we applied machine learning to predict sex and sex/gender alignment from rsFC and cortical thickness. rsFC predicted sex more accurately (86%) than cortical thickness (75%). Brain regions most effective in predicting sex belonged to association (default mode, dorsal attention, and parietal memory) and visual networks. The rsFC classifier trained on sex/gender aligned youth was more accurate in classifying unseen youth with sex/gender alignment than unalignment. In females, their rsFC sex profile was positively associated with sex/gender alignment. However, neither rsFC nor cortical thickness predicted sex/gender alignment. These findings highlight rsFC's ability to capture the complex relationship between sex, gender, the brain's functional connectivity, and neuroanatomy.

Topic Area: OTHER

E128 - When does an external sound become part of a dream? An exploration of EEG predictors, real-time signals, sleep stage, and temporal factors

Daniel Morris[1] (danielmorris2027@u.northwestern.edu), Gabriela Torres-Platas[1], Karen Konkoly[1], Tashi Lhamo[1], Tenzin Tenkyong[2], Stanzin Wangden[3], Lobsang Wangdue[4], Dorji Lotus[5], Sonam Damdul[6], Lhundup Choeden[2], Amchok Lobsang[7], Ken Paller[1]; [1]Northwestern University, [2]Sera Mey Monastery, [3]Drepung Gomang Monastery, [4]Rato Monastery, [5]Tashi Lhunpo Monastery, [6]Drepung Loseling Monastery, [7]Gaden Shartse Monastery

External stimuli occasionally make their way into a dream, based on dream recall after awakening. Many stimuli do not, perhaps because their intensity is not optimal, or because sensory information is gated during sleep. Attention may also be relevant; a strong attentional focus on dream content may detract from sensory processing. Furthermore, experiences during sleep are often quickly forgotten, especially during the sleep-to-wake transition. Here, we implemented multiple methods of probing sleepers' perceptual experiences to test the degree to which sensory perception persists during sleep. First, we awoke sleepers at varying delays following auditory stimulus presentation, allowing us to test the degree to which retrospective reporting on sensory perception during sleep is temporally limited. Second, we asked sleepers to respond to sounds via breathing signals that can be executed even while sleeping, such as sniffing. These real-time responses allowed us to probe conscious perception directly during sleep, overcoming the memory disruption that can occur during the transition from sleep to wakefulness. We collected data from 20 participants using a serial-awakening protocol with a total of 124 awakenings (both from NREM and REM sleep). In ongoing analyses, we characterize the prevalence of accurate sensory perception across sleep stages and seek to identify the neural correlates of sensory perception during sleep. Along with our quantitative results, we also interpret our findings in relation to ideas from the Tibetan-Buddhist philosophical tradition, integrating the interdisciplinary expertise of our research team, which includes six Tibetan monastic scholar-scientists.

Topic Area: OTHER

E130 - Efficacy and safety of Kami Guibi-tang in elderly patients with insomnia and memory complaints: A randomized, double-blind, placebo-controlled trial

Seung-Yeon Cho[1], Kyeonghwa Lee[1], Seong-Uk Park[1], Jung-Mi Park[1], Chang-Nam Ko[1]; [1]Kyung Hee University, Seoul, Republic of Korea

Introduction: Insomnia is prevalent among elderly individuals and is often associated with cognitive decline and a poor quality of life. While pharmacological treatments are available, they pose risks of dependency and adverse effects, particularly in older populations. Kami Guibi-tang (KGT), a traditional herbal medicine, may improve sleep quality and cognitive function, but its efficacy and safety in elderly patients with insomnia remain underexplored. Methods: This randomized, double-blind, placebo-controlled trial evaluated the efficacy and safety of KGT in improving sleep quality, cognitive function, and quality of life in elderly patients with insomnia. Thirty-four elderly participants were randomly assigned to receive either KGT or a placebo for 12 weeks. The primary outcome was the change in Pittsburgh Sleep Quality Index-Korean (PSQI-K) scores. Secondary outcomes included the Insomnia Severity Index-Korean (ISI-K), the Seoul Neuropsychological Screening Battery-Dementia (SNSB-D), the Short-Form 36 Health Survey (SF-36), and the Short-Form Geriatric Depression Scale (S-GDS). Safety was monitored through vital signs, laboratory tests, electrocardiograms (ECGs), and reports of adverse events. Results: Both the KGT and placebo groups showed significant improvements in sleep quality (PSQI-K, ISI-K). However, the KGT group demonstrated greater cognitive gains, particularly in memory and executive function. Depression scores (S-GDS) also improved in the KGT group. No adverse events were associated with KGT. Conclusion: KGT is a potentially effective and safe treatment for improving sleep and cognition in elderly patients with insomnia. Larger studies are needed to confirm these findings and to explore the long-term effects of KGT.

Topic Area: OTHER

E131 - Investigating the flexible network architecture of intelligence

Ramsey R. Wilcox[1,2], Babak Hemmatian[1,3], Lav R. Varshney[3,4], Aron K. Barbey[1,2,3,5,6]; [1]Decision Neuroscience Laboratory, Center for Brain, Biology & Behavior, University of Nebrask, [2]Department of Psychology, University of Nebraska, [3]Beckman Institute for Advanced Science & Technology, University of Illinois, [4]Department of Electrical & Computer Engineering, University of Illinois, [5]Department of Psychology, University of Illinois, [6]Department of Bioengineering, University of Illinois

The network neuroscience theory posits that general intelligence (g) arises from the brain's ability to flexibly recruit regions across networks in response to changing task demands. Central to this is the brain's modular yet efficiently integrated global topology. Modularity allows for specialized processing within local networks, while efficient integration enables system-wide communication to enable complex cognition. This balance supports the brain's ability to adapt to novel and shifting cognitive demands. Traditional theories, which focus on isolated regions or networks, fail to capture the adaptive nature of the human connectome, highlighting the need for a more integrative approach to understanding intelligence. To investigate how the brain's flexible topology contributes to intelligence, we conducted a connectome-based predictive modeling study in 245 healthy adults. Participants completed a mental set-shifting task during functional MRI. Parametric modulators modeled changing task demands (e.g., stimulus complexity), where higher demand required greater functional flexibility. Diffusion-weighted MRI was used to map white matter connections, and advanced network analysis integrated functional and structural data to generate task-derived networks. Results demonstrate that g is: (i) better predicted by networks engaged during high-demand trials ($R^2 = 0.19$) compared to low-demand trials ($R^2 = -0.02$); (ii) supported by connections between multiple networks; and (iii) significantly associated with the modularity ($\beta = -0.79$; $p = 0.01$) and efficiency ($\beta = 2518.00$; $p = 0.01$) of these networks. These findings underscore the importance of neural flexibility and the brain's modular yet integrated organization in supporting adaptive behavior, offering new insights into the dynamics of intelligence.

Topic Area: OTHER

E132 - Neural Correlates of Contemplative Sleep Practices

S. Gabriela Torres Platas[1] (susana.torresplatas@northwestern.edu), Daniel Morris[1], James Glazer[1], Karen Konkoly[1], Ema Demšar[2], Michael Sheehy[3], David Germano[3], Ken Paller[1]; [1]Northwestern University, [2]Monash University, [3]University of Virginia

Recent neuroscientific advances have provided new ways to investigate dream experiences. For centuries, Buddhist traditions have described advanced forms of contemplative practice during sleep. Tibetan Dream Yoga is a suite of such practices that includes waking-imagination exercises and strategies to induce lucid dreaming—awareness of the dream state while one is still in the dream. Evidence suggests that these practices can produce a virtual environment for training in various dream scenarios that results in adaptive insights for one's waking life. In this study, we assess the feasibility of studying highly trained dream-yoga practitioners in a laboratory. Individuals were interviewed to document their prior contemplative training before visiting a sleep laboratory for overnight sessions with standard polysomnographic recordings. Participants were trained to associate specific sounds with a small set of lucid-dream experiences. Then, during Rapid-Eye Movement (REM) sleep, these sounds were presented to help individuals achieve lucid dreaming and perform specific tasks. Participants used combinations of distinctive eye-movement and respiratory signals to communicate to back to experimenters. These signals thus provided a time-stamp for their dream experiences in polysomnographic data. After waking, participants completed a micro-phenomenological interview and a battery of standard questionnaires and cognitive testing. Our results demonstrate the feasibility of a multidisciplinary approach to studying neural correlates and the phenomenology of contemplative sleep practices. We aim to produce a comprehensive understanding of these contemplative sleep practices and neural correlates to gain insights into how individuals can use their sleep to produce various waking benefits.

Topic Area: OTHER

E133 - Person-specific changes in brainstem-cortical functional connectivity during cognitive and affective tasks: a 7T fMRI study of humans

Philip Deming[1] (p.deming@northeastern.edu), Ajay Satpute[1], Karen Quigley[1], Philip Kragel[2], Marta Bianciardi[3], Larry Wald[3], Tor Wager[4], Ji-Kyung Choi[5], Jiahe Zhang[1], Lisa Feldman Barrett[1], Yuta Katsumi[3], Jordan Theriault[1]; [1]Northeastern University, [2]Emory University, [3]Massachusetts General Hospital and Harvard Medical School, [4]Dartmouth College, [5]University of California San Francisco

The brain is thought to be a degenerate system: different structures can produce the same function. This implies that the circuits recruited for task performance may be person-specific. Recent efforts to characterize person-specific brain function have largely focused on cortical networks, omitting critical neuromodulatory brainstem nuclei. Thus, we explored person-specific changes in functional connectivity (FC) between brainstem and cortical regions (imaged in 7 Tesla fMRI) during cognitive and affective tasks relative to resting-state. In 72 healthy adults (mean age=27.0 +/- 6.4 years, 32 women), we estimated FC between 360 cortical and 58 brainstem regions during resting-state and tasks (N-back working-memory, Trier social stress). We tested rest vs. task stability of the full brainstem-cortical connectome and of individual connections, separately using group-average and subject-level approaches. In group-average analyses, task connectomes correlated highly with the resting-state connectome (working-memory: r=.93; stress: r=.96), as in prior work. However, subject-level task connectomes only moderately correlated with the resting-state connectome (M r=.64 for each task). Furthermore, within-subject bootstrapping revealed task-related changes varied widely between subjects. For example, although group-average analyses revealed changes in dorsal attention connections to cholinergic brainstem nuclei during the working-memory task, only around 10% of subjects displayed this pattern. Virtually all subjects displayed task-related changes in connections between multiple brainstem neuromodulatory systems and multiple cortical networks, but no two subjects displayed the same pattern of changes. In sum, task-related changes in the brainstem-cortical connectome were person-specific, a characteristic of a degenerate system that would have been hidden by group-aggregate analysis alone.

Topic Area: OTHER

E134 - Cannabis use, cognitive functioning, and dementia risk: an observational and Mendelian randomization study

Saba Ishrat[1] (saba.ishrat@stx.ox.ac.uk), Klaus Ebmeier[1], Anya Topiwala[1]; [1]University of Oxford

Cannabis use for medical and recreational purposes has increased significantly over the past decade. While adverse effects on neurocognitive performance have been reported in adolescents and young adults, its impact on cognition and dementia risk in older adults remains unclear. This study examines the association between lifetime cannabis use, cognitive performance, and dementia risk in older adults. We analysed data from approximately 15,000 to 18,000 lifetime cannabis users and 48,000 to 56,000 controls in UK Biobank, to assess observational associations between cannabis use and cognitive performance. Multiple linear regression and linear mixed-effects models were conducted in R to examine cross-sectional and longitudinal changes, respectively, while adjusting for potential covariates. Additionally, bidirectional two-sample Mendelian randomization analyses were used to investigate potential causal relationships. After false discovery rate correction, lifetime cannabis use was associated with better performance on Numeric Memory ($\beta = 0.110$, $p < 0.001$), and Fluid Intelligence test ($\beta = 0.239$, $p < 0.001$) compared to controls. However, cannabis users experienced greater cognitive decline over time compared to controls in Fluid Intelligence ($\beta = -0.012$, $p < 0.001$) and Trail Making (A) test ($\beta = 0.135$, $p < 0.001$). Genetically-predicted 'cannabis dependence/abuse' or 'lifetime cannabis use' was not associated with cognitive functioning or with all-cause or vascular dementia. Lifetime cannabis users had better cross-sectional performance but experienced faster decline over time in observational analyses. Genetically-predicted cannabis use did not associate with cognitive or dementia phenotypes, suggesting that higher cross-sectional cognitive performance of cannabis users may be due to residual confounding.

Topic Area: OTHER

E135 - Early cerebellar damage disrupts typical cognitive development in pediatric tumor patients

Rebecca Tegiacchi[1] (rt6202a@american.edu), Claire Gellner[1], Elizabeth Malloy[1], Meredith Goyette[2], Karin Walsh[2], Catherine Stoodley[2]; [1]American University, [2]Children's National Medical Center

Children with developmental cerebellar damage are at increased risk for a range of adverse long-term outcomes. Different cerebellar subregions support different functions, suggesting that motor, cognitive, and behavioral outcomes will depend on the location of the lesion within the cerebellum. Further, the cerebellum is considered a "learning machine", and previous studies have indicated that earlier cerebellar damage is associated with poorer long-term outcomes. We hypothesized that developmental cerebellar damage disrupts skill learning in a lesion- and age-specific manner. We used longitudinal motor, cognitive and behavioral neuropsychological scores to determine the relationship(s) between lesion location, age of tumor, and behavioral outcomes in 53 children with a history of cerebellar tumor (32 male, 21 female; age at diagnosis 6.7±4.1 years). We predicted that neuropsychological scores would decline over time in a lesion-specific manner, indicating loss of learning in specific domains, and that younger age at resection will be associated with a steeper drop in performance over time. Anterior and medial lesions were associated with impaired motor scores, and lesions in the posterolateral cerebellum were associated with cognitive deficits, reflecting established cerebellar functional subregions. Children who underwent tumor resection at a younger age (<4 years) showed a greater decrease in standard scores over time compared to patients with tumor resections later in development (>12 years), indicating that cerebellar learning mechanisms are important for typical development. These preliminary findings indicate that the location of lesion within the cerebellum and age at tumor resection are both predictors of long-term behavioral outcomes in pediatric cerebellar patients.

Topic Area: OTHER

E136 - Directed breathing during sleep in healthy adults and potential applications to sleep apnea

Erika M. Yamazaki[1], Hrayr Attarian[2], Phyllis C. Zee[2], Ken A. Paller[1]; [1]Northwestern University, [2]Northwestern University, Feinberg School of Medicine

Respiration is easily controlled and manipulated during wakefulness, yet we lose this ease of respiratory control during sleep. Previous studies have found that when sounds associated with specific memories are reintroduced during sleep, those specific memories are reactivated. Some studies have also shown that behavioral responses can sometimes be elicited by sounds presented during sleep. Here, we sought to determine the extent to which a learned respiratory response can be reactivated and performed during sleep. We tested this question in 10 young, healthy participants who trained to synchronize their breathing to an auditory stimulus during wake over multiple days. Subsequently, the stimulus was reintroduced during sleep. The degree of synchronization of breathing to the sound and changes in respiration were measured. Our quantitative strategy identified multiple trials of apparently successful synchrony, but due to their rarity we cannot rule out that these reflect chance occurrences rather than genuine respiratory responses. Across all trials, we failed to observe systematic changes in respiratory measures in response to cues during sleep. Although behavioral reactivation was unclear overall in our initial study, variants of these procedures may be more successful at producing occasional responses. Furthermore, our study question opens the door to investigate cases of decreased respiratory control during sleep, such as in sleep apnea. Currently, we are in the early stages of using a modified protocol to determine whether auditory cues during sleep, following conditioning with those cues, can terminate partial or complete respiratory pauses in patients with obstructive sleep apnea.

Topic Area: OTHER

E137 - Psilocybin-Assisted Therapy for Relapse Prevention in Alcohol Use Disorder: A randomized control trial

Nathalie M. Rieser[1,2] (nathalie.rieser@bli.uzh.ch), Raoul Bitar[1], Simon Halm[1], Christina Rossgoderer[1], Ladina P. Gubser[1], Maeva Thevenaz[1], Yara Kreis[1], Robin von Rotz[1], Carlos Nordt[1], Flora Moujaes[1], Etna J.E. Engeli[1], Andres Ort[1], Erich Seifritz[1], Franz X. Vollenweider[1], Marcus Herdener[1], Katrin H. Preller[1]; [1]Psychiatric University Hospital Zurich, [2]Johns Hopkins University

Background: Psilocybin has shown promising therapeutic potential; however, its effectiveness in preventing relapse following withdrawal treatment for alcohol use disorder (AUD) remains uncertain. This study assessed whether a single dose of psilocybin, combined with brief psychotherapy, could reduce relapse rates and alcohol use in patients with AUD. Methods: In this single-center, double-blind, randomized clinical trial, we included participants with an AUD who had completed withdrawal treatment within six weeks prior to enrollment. Participants were randomized (1:1) to receive either a single oral dose of psilocybin (25 mg) or placebo (mannitol), in combination with psychotherapy. The primary outcomes were abstinence and mean alcohol use at 4-week follow-up. Outcomes: In total, 37 participants (female:male = 14:23; psilocybin=18, placebo=19) completed the 4-week follow-up. We found no significant differences between groups in abstinence duration (p=0.55; psilocybin mean = 16.8 days; placebo mean = 13.8 days, Cohen's d=0.15) or mean alcohol use per day (p=0.51; psilocybin median = 0.48 standard alcohol units; placebo median = 0.54, Cohen's d=0.11) at either 4-week or 6-month follow-up (abstinence: Cohen's d=0.10; alcohol use: Cohen's d=0.08). Participants in both groups reported a reduction in craving and temptation to drink alcohol after the dosing visit, with an additional reduction observed in the psilocybin group. Furthermore, we found decrease depression scores and increased quality of life post psilocybin administration, but not placebo. Interpretation: A single dose of psilocybin combined with brief psychotherapy may not be sufficient to reduce relapse rates or alcohol use in patients with AUD following withdrawal treatment.

Topic Area: OTHER

E138 - Lateral Prefrontal Cortex is Similarly Associated With Color Source Memory and Spatial Source Memory

Carolina E Carneiro[1] (carneir@bc.edu), Haley A Fritch[2], Ashley C Steinkrauss[1], Robert S Ross[3], Scott D Slotnick[1]; [1]Boston College, [2]Broad Institute, Massachusetts Institute of Technology & Harvard University, [3]Johns Hopkins University

Source memory refers to retrieval of contextual information (e.g., whether an object was presented on an indoor vs. outdoor scene, red vs. green background color, left vs. right spatial location, etc.). Although source memory has been associated with the lateral prefrontal cortex, the parietal cortex, and the medial temporal lobe, it is unknown whether different types of source memory are associated with the same brain regions. In this fMRI study, during spatial memory encoding, line drawings of objects or animals were presented to the left or right of fixation. During spatial memory retrieval, participants classified old or new items as "left", "right", or "new." During color memory encoding, line drawings of objects or animals were presented at fixation on a red or green background. During color memory retrieval, participants classified old or new items as "red", "green", or "new". A conjunction analysis between spatial memory hits vs. new correct rejections and color memory hits vs. new correct rejections revealed common activity in the left dorsolateral and ventrolateral prefrontal cortex, the right dorsolateral prefrontal cortex, bilateral inferior parietal lobule, bilateral retrosplenial cortex, and bilateral thalamus. The contrast of spatial memory hits versus color memory hits produced activity in the left hippocampus, bilateral parahippocampal cortex, bilateral primary visual cortex and extrastriate cortex, bilateral intraparietal sulcus, and the right thalamus. There were no activations for the opposite contrast. These findings suggest the lateral prefrontal cortex is similarly associated with spatial and color source memory, while other regions are preferentially associated with spatial memory.

Topic Area: OTHER

E139 - Creative Flow as Optimized Processing: EEG evidence during jazz improvisation

David Rosen[1,2] (drosen9@jh.edu), Yongtaek Oh[1], Christine Chesebrough[1], Fengqing (Zoe) Zhang[1], John Kounios[1]; [1]Drexel University, [2]Johns Hopkins University

Using a creative production task, jazz improvisation, we tested alternative hypotheses about the flow experience: (A) that it is a state of domain-specific processing optimized by experience and characterized by minimal interference from task-negative default-mode network (DMN) activity versus (B) that it recruits domain-general task-positive DMN activity supervised by the fronto-parietal control network (FPCN) to support ideation. We recorded jazz guitarists' electroencephalograms (EEGs) while they improvised to provided chord sequences. Their flow-states were measured with the Core Flow State Scale. Flow-related neural sources were reconstructed using SPM12. Over all musicians, high-flow (relative to low-flow) improvisations were associated with transient hypofrontality. High-experience musicians' high-flow improvisations showed reduced activity in posterior DMN nodes. Low-experience musicians showed no flow-related DMN or FPCN modulation. High-experience musicians also showed modality-specific left-hemisphere flow-related activity while low-experience musicians showed modality-specific right-hemisphere flow-related deactivations. These results are consistent with the idea that creative flow represents optimized domain-specific processing enabled by extensive practice paired with reduced cognitive control

Topic Area: OTHER

E140 - The prevalence of allergy and other inflammatory disorder in those with treatment-resistant depressive symptoms

Megan Johnson[1] (mej4003@med.cornell.edu), Megan Chang[1], Jolin Chou[1], Claire Ho[1], Indira Summerville[1], Immanuel Elbau[1], Benjamin Zebley[1], Conor Liston[1], Lindsay Victoria[1]; [1]Weill Cornell Medicine

Previous research supports a complex interaction between the immune system and mood disorders. The hypothalamus, which acts as the junction between the nervous, immune, and neuroendocrine system, may be of particular interest in investigating the link between immune system dysfunction and clinical and cognitive symptoms of mood disorders. This link is particularly relevant to major depressive disorder (MDD); the hypothalamus has been shown to play a role in key depressive symptoms, including deficits in sleep, appetite, and goal-directed behaviors. Using a sample of 245 participants with treatment-resistant MDD, we investigated the association between immune response and depressive symptoms. We assessed the self-reported presence of allergies, one of the most common markers of immune deficiencies, in our MDD sample relative to the general population. We found a higher proportion of allergies in MDD (51.0% with allergies compared to CDC 2021 survey estimate of 31.8% in the general population). Interestingly, when stratified by depression severity, participants with mild to moderate depressive symptoms had a greater self-reported rate of allergies (55.1%) than participants with moderate to severe depressive symptoms (48.0%) (Cohen's d = 0.14). Our findings suggest that immune deficiencies may be linked to the symptoms of MDD, even in cases of mild symptom expression. Our findings also indicate that a key subgroup of mildly depressed individuals may benefit from personalized treatments that target the interaction between immune response and MDD symptoms via mechanisms of action of the hypothalamus, supporting further development of treatments focused on improving motivation, reward processing, and goal-directed behaviors.

Topic Area: OTHER

E141 - Structure-function dependencies in large-scale networks: Novel insights from the split brain

Tyler Santander[1] (t.santander@psych.ucsb.edu), Selin Bekir[1], Jessica Simonson[1], Theresa Paul[2], Valerie Wiemer[2], Henri Skinner[1], Lena Hopf[3], Anna Rada[3], Friedrich Woermann[3], Thilo Kalbhenn[3], Barry Giesbrecht[1], Christian Bien[3], Olaf Sporns[4], Michael Gazzaniga[1], Lukas Volz[2], Michael Miller[1]; [1]University of California, Santa Barbara, [2]University of Cologne, [3]Bielefeld University, [4]Indiana University

The structural architecture of the human brain is classically assumed to constrain and enable the emergence of large-scale functional networks. However, decades of network neuroscience research have highlighted that relationships between structural connectivity (SC) and functional network topology are not a trivial, 1:1 linear map—functional connectivity (FC) depends not only upon direct axonal connections, but also upon complex, polysynaptic signaling pathways. Split-brain patients present a unique opportunity to assess the nature of structure-function dependencies: callosotomy is a highly-selective surgical lesion to the largest white matter structure in the human brain, effectively severing communication between the cerebral hemispheres. Here we present data from seven adult callosotomy patients, six of whom were tested post-operatively and one both pre- and post-operatively (from one week to six months post-op). In two patients, surgery was halted short of a full transection, including one with only ~1 cm of splenium spared. Estimates of whole-brain SC were derived via diffusion tensor imaging; FC was assessed during resting-state and naturalistic movie-watching fMRI. For comparison, healthy adult controls were taken from the Human Connectome Project. We implemented polysynaptic communication models alongside methods from network control theory to probe differences in SC-FC relationships between controls and split-brain patients, characterizing marked variability in energy landscapes between partial and full splits. Generative models using simulated callosal lesions in controls further underscored that subcortical structural connections are insufficient to support widespread interhemispheric network function. Together, these findings provide novel insights into the extent to which whole-brain functional networks depend upon the corpus callosum.

Topic Area: OTHER

E142 - Cannabidiol-Enhanced Fear Extinction in Individuals with Social Anxiety

Finian Zakas[1] (fcx24001@uconn.edu), Skyler Sklenarik[1], Mia Tzikas[1], Aishwarya Benzy[1], Claudia Mizerek[1], Sarah Franzen[1], Riley McNaboe[1], Hugo Posada-Quintero[1], Kimberli Treadwell[1], David Tolin[2], Robert Astur[1]; [1]University of Connecticut, [2]Anxiety Disorder Center, Hartford Hospital

Anxiety disorders, characterized by intense fear, worry, and anxiety that impede daily functioning, are increasingly prevalent, affecting approximately 20% of 18–29-year-olds each year. Classical fear conditioning has been instrumental in guiding our understanding of anxiety. Research by Das and colleagues (2013) found that cannabidiol (CBD), the non-psychoactive component of the cannabis plant, enhanced fear extinction in healthy humans on a Pavlovian fear conditioning paradigm. However, further investigation is necessary to determine if CBD must be present for extinction or immediately after fear acquisition. Moreover, despite the prevalence of extinction-based treatments, CBD-enhanced extinction in anxiety disorder populations remains uninvestigated. To address this gap, we are investigating whether CBD administration immediately post fear acquisition enhances extinction in undergraduates with social anxiety. Participants are conditioned to fear one of two angry faces (young or old) through pairings with an aversive forearm shock (CS+) or shock omission (CS-). They then receive a 600mg oral dose of CBD or placebo immediately after fear acquisition, 45 minutes prior to fear extinction. Galvanic skin response (GSR) is collected for each participant along with visual analog scale (VAS) assessment of shock contingency and face fear as well as assessments on anxiety, trait/state anxiety, uncertainty tolerance, and cannabis use. We hypothesize that participants who received CBD will have enhanced fear extinction as compared to the placebo group. Our findings, in conjunction with a planned investigation of delayed CBD administration, will help elucidate optimal timing for CBD administration, with the intent of informing enhanced exposure therapy in clinical settings.

Topic Area: OTHER

E143 - Sudden Gains as an Indicator of Improved Depression Symptom Outcomes in iTBS TMS

Jolin Chou[1] (joc4023@med.cornell.edu), Indira Summerville[1], Megan E. Chang[1], Claire Ho[1], Megan Johnson[1], Nicola Manfredi[1], Hayley Seltzberg[1], Benjamin Zebley[1], Lindsay Victoria[1], Conor Liston[1], Nili Solomonov[1], Immanuel Elbau[1]; [1]Weill Cornell Medicine

Sudden gains, characterized by rapid, non-linear reductions in symptoms between consecutive treatment sessions, are a common phenomenon in psychotherapy. Previous research in psychotherapy for depression suggests sudden gains as a predictor of sustained post-treatment response. However, sudden gains and their effect on long-term outcomes have not been characterized in neuromodulation interventions like repetitive transcranial magnetic stimulation (rTMS) for depression. This study investigates sudden gains as a predictor of symptom improvement for individuals (n=89; aged 22-63 years) who responded to fMRI-guided intermittent theta-burst (iTBS) TMS targeting the frontoparietal and cognitive control networks of the prefrontal cortex. Participants completed 30 daily treatments over 6-8 weeks. Depression symptom severity was monitored using a standardized depression severity scale administered at baseline, weekly during treatment, and 1-, 4-, and 12-weeks post-treatment. Of the 89 responders, 17 (19%) experienced a sudden gain during treatment, which occurred uniformly across the 6-8 weeks of sessions. Results showed that from the end of treatment to 12-weeks post-treatment, depression severity scores were significantly lower among individuals who experienced a sudden gain compared to those who did not (M=4.35, SE=1.61, p=0.009). No difference was found in depression severity between the groups while individuals received active treatment (p=0.229). These results support prior findings associating sudden gains to improved post-treatment outcomes and extend this phenomenon as a potential indicator of treatment outcomes in TMS. Future research should examine the neurobiological characteristics of those who experience sudden gains during interventional treatments like TMS to better understand the clinical and cognitive mechanisms facilitating sustained improvement.

Topic Area: OTHER

E144 - Functional Cerebello-Basal Ganglia Networks and their Role in Cognitive and Motor Processes Across the Adult Lifespan

Ivan Herrejon[1], Grace Denny[1], Sydney Cos[1], Thamires Magalhaes[1], Jessica Bernard; [1]Texas A&M University

While research on the cerebral cortex has improved our understanding of aging, the cerebellum's role has been understudied. Similarly, aging impacts the basal ganglia making the cerebello-basal ganglia circuits of particular interest. However, it remains an open question how this circuit is impacted longitudinally and how it relates to cognitive and motor functions. The present study investigated the impact of aging in CB-BG networks. 96 participants, ages 35-96, completed two visits one year apart and a motor and cognitive battery. Afterward, participants underwent fMRI imaging. Images were analyzed using an ROI-to-ROI approach. In our one-year follow-up, we observed group differences between early middle adulthood (EMA) and older adults (OA), but not in EMA and LMA or LMA and OA, suggesting that EMA and OA have differences in FC in the CB-BG networks. Finally, when comparing each age group to itself one year later, we found patterns of mostly higher FC in EMA, LMA, and OA between and within regions, especially within the basal ganglia. This could imply that the circuits strengthen to scaffold other functions due to the impact of healthy aging. When investigating motor and cognitive sub-circuits and their association to task performance, we did not find significant results over time for cognitive (Stroop or Montreal Cognitive Assessment) or motor (Pegboard assembly or Sequence) tasks. Updating brain models to include the CB-BG circuit represents a novel approach to expand our knowledge of healthy aging.

Topic Area: OTHER

E145 - Parent-Child Neural Concordance in Arithmetic and Reading: Evidence from Task-Based fMRI Activation and Functional Connectivity Analyses

Aymee Alvarez Rivero[1,3], Lien Peters[2], Daniel Ansari[1]; [1]Western University, [2]Ghent University, [3]Harvard Graduate School of Education

Intergenerational transmission of cognitive abilities is well-established behaviorally, but neural-level similarities between parents and children remain largely unexplored. In this study, we examined parent-child neural concordance during arithmetic and reading tasks using functional MRI. Participants included parent-child dyads who completed phonological processing (rhyming), arithmetic verification, line comparison tasks. We assessed intergenerational effects using two approaches: (1) familial concordance in average activation of specific brain regions involved in arithmetic and reading, and (2) analysis of functional connectivity patterns. To detect family-specific relationships, concordance levels were compared to those obtained when children were paired with random adults. Our findings revealed significant parent-child concordance in activation of the bilateral inferior frontal gyrus and medial superior frontal gyrus during arithmetic, and in the hippocampus during reading. Permutation tests confirmed that these concordances were family-specific. These results provide direct evidence that intergenerational influences in arithmetic and reading abilities are also evident at the neural level and can be studied using task-based fMRI. However, functional connectivity patterns did not show family-specific associations, as parents and children were no more similar than random pairs. This contrasts with previous studies using resting-state data, suggesting that task demands may obscure familial similarities in functional connectivity. Overall, this work advances our understanding of the neural basis of cognitive abilities and their intergenerational transmission.

Topic Area: OTHER

E146 - Beneficial Effects of 40 Hz Stimulation on Post-Ischemic Recovery In Mice

Piergiulio R. Bressan[1] (pbressan@bu.edu), Rockwell P. Tang[1], Emily A. Long[1], John Jiang[1], Bradley C. Rauscher[1], David A. Boas[1]; [1]Neurophotonics Center, Boston University

Every year, millions of people worldwide suffer from focal cerebral ischemia, which leaves survivors with lifelong cognitive disability and decreased quality of life. Despite the burden ischemic stroke poses on society and the healthcare system, few effective treatments have been developed. Here, we investigate 40 Hz sensory stimulation (GENUS) as a post-stroke therapy to promote tissue recovery and restore behavioral function in a murine model. Research both in humans and mice has demonstrated the effectiveness of GENUS in Alzheimer's disease in evoking gamma oscillations in the brain, as well as vasomotion, which has been shown in stroke to be positively correlated with behavioral recovery. We hypothesized that GENUS would have ameliorating effects on the behavioral prognosis of ischemic stroke by promoting neuronal and vascular recovery via evoked vasomotion. We tested our hypothesis on a cohort of healthy and stroked mice, which were treated with GENUS for one hour. We used laser speckle contrast imaging to measure cerebral blood flow before, during, and after stimulation. Analysis of the power of vascular oscillations in the 0.2-0.4 Hz range revealed an average increase of 29% in oscillation power across the animals between before and after stimulation ($n=6$, $p=0.0312$). In another group of stroked mice, mice with greater power of vascular oscillations post-stroke had better behavioral outcomes. These findings align with our hypothesis and suggest that 40 Hz stimulation could have the potential to be used as a therapeutic approach for strokes in human patients.

Topic Area: OTHER

E147 - Validating Microglia Cell Line HMC3 to Study the B7-1/p75NTR Interaction

Emmanuel Makinde[1,2], Hrshita Das[2], Matthew Houpert[2], Bruce Carter[2]; [1]New York University Center for Neural Science, [2]Vanderbilt University Medical Center: Department of Biochemistry

The neuroimmune response is crucial to understanding neurodegenerative disease. Microglia are motile brain resident macrophages that surveil the brain, phagocytose pathogens, and release signaling molecules to regulate the tissue microenvironment. Microglia activity increases following the recognition of damage-associated molecular patterns (DAMPs), engulfment of pathogens or dying cells, and response to/production of pro- and anti-inflammatory cytokines to modulate inflammation. T-cells are also major players during the immune response. Cytotoxic T-cells perforate pathogens while helper T-cells support other immune cells. T-cell activation requires detection of two proteins on the microglia membrane: an antigen and a costimulatory factor called B7-1. Recent research identified a primate-specific interaction between the p75 neurotrophin receptor (p75NTR) and the B7-1 protein that contributes to the degradation of synapses in hippocampal neurons. Due to the primate-specificity of this interaction, we chose the Human Microglial Clone 3 (HMC3). The mechanism of the B7-1/p75NTR interaction is unknown. It is also unknown whether the HMC3 cell line is suitable for studying this interaction. In this study, we performed western blots and immunocytochemistry to study B7-1, and markers of inflammation and microglia. We observed increased B7-1 and Iba1 expression in HMC3 cells following lipopolysaccharide treatment, indicating that these cells appropriately respond to inflammatory stimuli. Interestingly, we also found that NLRP3 expression increases with lower doses of LPS. Validating this cell line will enable subsequent studies to investigate microglia-neuron cocultures under inflammatory conditions to clarify the mechanisms of this B7-1/p75NTR interaction, why it leads to synapse degradation, and further, neurodegenerative diseases.

Topic Area: OTHER

E148 - Neural mechanisms of depressive symptoms in bipolar disorder and major depressive disorder revealed by resting-state functional connectivity

Ayumu Yamashita[1,2] (ayumu722@gmail.com), Suzuka Narukawa[1,3], Yutaro Hori[1,4], Takashi Itahashi[5], Yuki Sakai[1,6], Saori Tanaka[1,7], Go Okada[8], Kouji Kamagata[9], Ryuichiro Hashimoto[1,5,10], Haruto Takagishi[11], Toshiya Murai[12], Koichi Hosomi[13], Yoshiyuki Hirano[14], Masaru Mimura[15], Koji Matsuo[16], Shinsuke Koike[17], Kiyoto Kasai[18,19], Hidehiko Takahashi[12], Takuya Hayashi[21], Mitsuo Kawato[1,6], Okito Yamashita[1,23]; [1]Advanced Telecommunications Research Institute International (ATR), Brain Information Communication Research Laboratory Group, [2]Graduate School of Information Science and Technology, The University of Tokyo, [3]The Graduate University for Advanced Studies, [4]College of Arts and Sciences, The University of Tokyo, [5]Medical Institute of Developmental Disabilities Research, Showa University, [6]XNef Inc., [7]Graduate School of Advanced Science and Technology, Nara Institute of Science and Technology, [8]Department of Psychiatry and Neurosciences, Hiroshima University, [9]Department of Radiology, Juntendo University School of Medicine, [10]Faculty of Humanities and Social Sciences, Tokyo Metropolitan University, [11]Brain Science Institute, Tamagawa University, [12]Graduate School of Medicine, Kyoto University, [13]Graduate School of Medicine, Osaka University, [14]Research Center for Child Mental Development, Chiba University, [15]School of Medicine, Keio University, [16]Faculty of Medicine, Saitama Medical University, [17]Graduate School of Arts and Sciences, The University of Tokyo, [18]Graduate School of Medicine, The University of Tokyo, [19]International Research Center for Neurointelligence, Institutes for Advanced Study, The University of Tokyo, [20]Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, [21]Center for Biosystems Dynamics Research (BDR), RIKEN, [22]Brain Connectomics, Graduate School of Medicine, Kyoto University, [23]Center for Advanced Intelligence Project (AIP), RIKEN

Both patients with bipolar disorder (BD) and major depressive disorder (MDD) have depressive conditions with similar depressive symptoms. However, the neurobiological mechanisms underlying these conditions may differ and remain largely unknown. Since this similarity frequently results in diagnostic errors and inappropriate treatment strategies, a deeper understanding of the neural basis of depressive symptoms and distinguishing between BD and MDD based on biological abnormalities is a critical challenge. Functional connectivity (FC), which defined as the temporal correlation of BOLD signals between brain regions, estimated using resting state fMRI (rs-fMRI) is a powerful tool to investigate biological abnormalities. Since it is easy to acquire large-scale data from multiple imaging sites, rs-fMRI can be analyzed by AI techniques. In this study, we extracted symptom factors using detailed depressive symptoms (subscales of BDI-II) of 1444 individuals and extracted FCs associated with each factor. We also constructed a brain network marker that discriminate between MDD and BD based on the FC patterns of MDD (N=824) and BD type I (N=81) and II (N=130). We found two to four symptom factors and each associated with different FCs. The results of 10-fold cross validation showed that MDD and BD were classified with AUC=0.7. Furthermore, our results showed that BD type I was more biologically distinct from MDD than BD type II. The identification of the neural basis of depressive symptoms can be used as a diagnostic support tool for disorders with similar symptoms, and leads to a better understanding of the relationship between BD and MDD.

Topic Area: OTHER

E149 - Obstetric outcomes and effects from COL6A3-associated-Bethlem myopathy: A case report

Ajay Nair[1] (ajay.nair@rockets.utoledo.edu), Sabeena Malik[2], James VanHook[1]; [1]University of Toledo College of Medicine and Life Sciences, [2]Promedica Neurosciences Center ProMedica Toledo Hospital Medical Complex

Introduction: Muscular myopathies affect various aspects of a patient's life, and have even been implicated in impacting a patient’s obstetric experience as well. Research on this topic is quite limited. Multiple papers have documented variable effects of different muscular pathologies on pregnancy, yet no study has been done outlining this process for bethlem myopathy. Here is a presented case of autosomal dominant COL6A3-associated bethlem myopathy with multiple pregnancies to help clear this gap in knowledge. Methods: The case report was conducted through a retrospective chart review along with interviewing the patient on obstetric and disease factors not included or detailed in the chart. Results: Despite being advised to avoid pregnancy, the patient had a 100% conceptions and delivery rate for three pregnancies. The patient’s symptoms of muscle wasting, spasms, cramps, numbness and pain that developed over the years improved during each pregnancy and continued, with significant reduction of pain, numbness, and weakness and noticeable decline in rate of muscle wasting. The patient experienced excessive back pain during birth, but had no issues contracting and delivered all children vaginally. The patient's second child had an extended NICU stay due to an umbilical cord abnormality. Conclusion: Bethlem myopathy remains a challenging condition to navigate for patients, but with the data provided, it can be assumed that pregnancies for these patients can be done under strict care and monitoring, potentially providing beneficial outcomes during and afterward.

Topic Area: OTHER

E150 - Association Between Cardiovascular Risk, Regional Brain Age Gap, and Cognition in Healthy Adults

Sriya Pallapothu[1] (sriyap@email.sc.edu), Roger D. Newman-Norlund[1], Nick Riccardi[1], Leo Bonilha[2], Julius Fridriksson[1], Chris Rorden[2]; [1]University of South Carolina, Columbia, [2]University of South Carolina School of Medicine, Columbia

Cardiovascular (CV) risk factors are known to adversely affect brain health, accelerating both neurodegeneration and cognitive decline. In this study, we examined the relationship between cardiovascular risk (QRISK3), brain health (brain age gap [BAG]), and cognition (MoCA scores). By including regional, in addition to the whole-brain age gap, we aimed to identify spatially distinct patterns of brain aging that are linked to CV risk and cognition, thereby offering a more precise framework for evaluating potential mechanistic pathways. High-resolution T1w MRI scans from 191 participants (25-79 years) were used to calculate global and regional BAGs using the volBrain pipeline. QRISK3, Relative Risk, and Heart Age Gap (HAG) captured cardiovascular risk, while the MoCA and its subscores measured cognitive function. An exploratory factor analysis identified four spatial patterns of accelerated brain aging, and Spearman correlations assessed the relationship between these four factors and CV risk / brain health. QRISK3, Relative Risk, and HAG were significantly correlated with global BAG (p’s < 0.05), independently of age. QRISK3 scores were associated with accelerated aging in cognition-related brain areas, including the thalamus, medial-frontal cortex, and anterior/middle cingulate cortex ($r = 0.15$, $p = 0.022$), as well as with lower MoCA subscores in the memory, attention, and visuospatial domains. These results suggest that certain brain regions and cognitive domains are disproportionately affected by CV risk factors, possibly due to a high metabolic demand and reliance on blood supply from cerebral small vessels. Ultimately, these findings highlight the importance of incorporating cardiovascular metrics in neurodegenerative risk assessments.

Topic Area: OTHER

E151 - Brain functional connectivity predicts depression and anxiety during childhood and adolescence: a connectome-based predictive modeling approach

Francesca Morfini[1] (f.morfini.work@gmail.com), Aaron Kucyi[2], Jiahe Zhang[1,3], Clemens C.C. Bauer[1], Paul A. Bloom[4], David Pagliaccio[4], Susan Whitfield-Gabrieli[1,3], Randy P. Auerbach[4]; [1]Northeastern University, [2]Drexel University, [3]Massachusetts General Hospital, [4]Columbia University

Neuromarkers of future depression and anxiety severity in youth could improve early identification, prevention, and intervention. We tested whether connectome-based predictive modeling (CPM) based on resting-state functional connectivity (FC): a) predicts future depression and anxiety severity during childhood and b) generalizes to adolescence. We used two independent, longitudinal datasets including children from the Adolescent Brain Cognitive Development (ABCD) study and adolescents from the Boston Adolescent Neuroimaging of Depression and Anxiety (BANDA). CPM with internal (within ABCD) and external validation (from ABCD to BANDA) used baseline whole-brain FC to predict depression and anxiety severity at a 1-year follow-up assessment. An ABCD-derived network, Symptoms Network for brevity, was validated within BANDA to test model applicability in adolescence -a peak period for the emergence of internalizing disorders. Participants with complete data were included from ABCD (n=3,718, 52.9% girls, ages 10.0±0.6) and BANDA (n=150, 61.3% girls, ages 15.4±0.9). In ABCD, FC predicted 1-year follow-up CBCL scores ($\rho=0.058$, $p=0.040$), correcting for CBCL baseline, sex, age, and mean head motion. External validation in BANDA indicated that the Symptoms Network predicted 1-year follow-up symptoms severity ($\rho=0.222$, $p=0.007$). The Symptoms Network included contributions from somatomotor, frontal associative areas, and subcortical regions, with heterogeneous FC profiles characterizing these connections. Brain functional connectivity may provide inroads for early identification of internalizing symptoms, which may inform preventative-intervention approaches prior to the emergence of affective disorders during a critical period of neuromaturation. Individual differences highlighted in our findings point to the need for individualized approaches in understanding neurodevelopment and mental health.

Topic Area: OTHER

E152 - Meditation and brain health: a 6-month multimodal longitudinal study of Inner Engineering

Sepideh Hariri[1,2] (shariri1@bidmc.harvard.edu), Kestutis Kveraga[1,2], Braiden Deschryver[2], Akila Rayapuraju[2], Sydney Freidopfer[2], Morgan Pratt[2], Nashaw Jafari[2], Preeti Reed[1,2], Balachundhar Subramaniam[1,2]; [1]Harvard Medical School, [2]Beth Israel Deaconess Medical Center

Introduction: Growing evidence supports meditation’s benefits for cognition, emotional resilience, mental health and potentially preventing neurodegenerative disease. While its neural effects are widely being studied, the interplay between meditation, brain function, physiological and psychological metrics remains unclear. Multimodal, longitudinal research is essential to deepen our understanding of this complex phenomenon and establish meditation as a scalable, evidence-based intervention. This study aims to quantify the impact of meditation on brain health and cognition over 6 months, using a multimodal approach combining neuroimaging, physiological, and behavioral outcomes in meditation-naïve participants. Methods: 80 meditation-naive subjects (40 intervention and 40 matched controls) are recruited and assessed at four time-points over six months. The intervention group practices Shambhavi Mahamudra Kriya, a daily 21-minute breath-based meditation taught through the Inner Engineering program offered by the non-profit Isha Foundation. Control participants continue their usual routines. The study measures include: (1) neuropsychological questionnaires for affect, cognitive-emotional regulation, and sleep, (2) behavioral tasks for executive function and working memory, (3) 128-electrode EEG during rest, meditation, and tasks, (4) fMRI for structural and functional brain changes during rest and task (5) low-density EEG headband during meditation and sleep, (6) Fitbit watch for sleep, HR, and HRV, (7) hair cortisol for long-term stress, and (8) blood markers for brain health. Results: While data collection is still ongoing, preliminary results show a significant increase in Cognitive Emotional Regulation scores, improved cognitive task performance, and changes in Late Positive Potential (LPP) amplitude in the meditation group over time, when compared to the controls.

Topic Area: OTHER

E153 - Role of early caregiver predictability in brain network flexibility during the first year of life

Priyanka Ghosh[1] (priyankaghoshmail@gmail.com), Laurel Gabard-Durnam[1]; [1]Northeastern University, Boston

Early brain development is significantly shaped by environmental influences, including primary caregivers’ behaviors. One key measure of caregiver behavior is maternal entropy, which reflects the degree of predictability in maternal interactions with the infant, for example, during play. We ask whether and how early maternal entropy during mother-infant play interactions shapes brain network flexibility, indexed by EEG microstate transitional probabilities between network configurations. As part of an ongoing longitudinal study in South Africa, we video-recorded naturalistic, dyadic interactions between infants and their primary caregivers during two timepoints (visit sessions). We calculated the predictability of caregivers’ behavior, focusing on vocalizing, object holding, and pointing. To calculate entropy scores, we hand-annotated videos in Datavyu, following established protocols (Davis et al., 2017). We also collected saline-based 128-channel resting-state EEG data from the same infants at both timepoints (2–6 months, N=242; and 6–12 months, N=249). EEG microstate transitional probabilities were computed using HAPPEv4.1. Our study aims to examine the relationship between maternal entropy during mother-infant interactions and the transitional probabilities of infant microstates, focusing on transitions between auditory/visual and attention microstate networks. We will apply linear mixed-effects models to investigate whether maternal entropy predicts infant microstate transition probabilities. We hypothesize that higher maternal entropy may correlate with more flexible microstate transitions, reflecting enhanced neural adaptability, whereas lower entropy may yield more rigid configurations. However, excessive caregiver unpredictability might also contribute to dysregulated infant brain function. Understanding these dynamics could help inform future interventions aimed at optimizing caregiver-infant interactions for healthy cognitive and emotional development

Topic Area: OTHER

E154 - Shifts in brain network topology during Isha Shoonya meditation

Riku Ihalainen[1,2], Sepideh Hariri[1,2], Kestutis Kveraga[1,2], Balachundhar Subramaniam[1,2]; [1]Beth Israel Deaconess Medical Center, Boston, Massachusetts, [2]Harvard Medical School, Boston, Massachusetts

Shoonya meditation, a practice of conscious non-doing and detachment from internal and external stimuli, has been linked to brain activity shifts, including increased gamma and theta power. We examined neural changes in 30 experienced meditators using resting EEG from a 5-minute eye-closed baseline and ~15 minutes of Shoonya meditation. Data were recorded with a 64-channel BrainProducts system, downsampled to 250 Hz, filtered (0.5–100 Hz), and notch-filtered (55–65 Hz) for line noise. Ten-second epochs underwent artifact rejection, with ICA aiding identification of eye-blink and muscle components. We analyzed the first and last clean 200 seconds of meditation (F20 and L20, respectively) and a 200-second baseline (EC). Power and functional connectivity (dwPLI) were assessed for delta, theta, alpha, beta, gamma1, and gamma2 bands. Graph-theoretical metrics were derived from binarized connectivity matrices, thresholded from 90% to 10% connectivity densities. Spectral power analysis showed a small theta power increase during meditation, indicating relaxed, internally focused attention. Alpha power decreased, especially in posterior regions, suggesting reduced cortical inhibition. Gamma-band connectivity (30–100 Hz, particularly high-gamma 65–100 Hz) decreased, implying less integrated sensory and cognitive processing. Simultaneously, global efficiency and participation coefficient in the gamma band increased, indicating more efficient information transmission despite reduced connectivity. Taken together, these results align with awareness detached from sensory and cognitive engagement. These preliminary findings suggest Shoonya meditation reorganizes brain networks to support internal cohesion and reduce external processing. Future research should examine how these shifts relate to reduced external/internal awareness and long-term effects of practice.

Topic Area: OTHER

E155 - Resting State Neuroelectric Function and Socio-Demographic Constructs in Children and Adolescents

Janis Gaudreau[1] (janis_gaudreau@uri.edu), Michelle Lim[1], Nicole Logan[1]; [1]The University of Rhode Island

Introduction: Children from lower socio-demographic backgrounds often exhibit differences in attention-related neural outcomes. Yet, the unique contribution of each socio-demographic factor has yet to be characterized. We aimed to investigate the variance of sociodemographic constructs associated with alpha and beta oscillations across childhood. Method: Participants (N = 781, 264 F) aged 5-21 (10.39±3.41) were included from the Child Mind Institute Healthy Brain Network. Bonferroni-adjusted linear regressions were conducted with age, sex, race/ethnicity, puberty, and SES variables (perceived neighborhood safety, occupational prestige, parent education, household income). Dependent variables included resting state electroencephalography (EEG) power bands: alpha 1 (A1: 6-9 Hz), alpha 2 (A2: 9-12 Hz), beta 1 (B1: 13-19 Hz), beta 2 (B2: 19-25 Hz) and beta 3 (B3: 25-30 Hz). Results: Higher household income was associated with lower A1 ($\beta = -0.012$, $p = .007$), A2 ($\beta = -0.01$, $p = .008$), and B1 power ($\beta = -0.007$, $p = .004$). Safer neighborhoods also showed lower associations with A1($\beta = -0.007$, $p = .046$) A2 ($\beta = -0.006$, $p = .034$) and B1 ($\beta = -0.004$, $p = .037$), while unsafe neighborhoods had stronger associations with B2 power ($\beta = 0.027$, $p = .032$). Conclusion: Perceiving to live in an unsafe neighborhood was associated with higher B2 power, possibly reflecting heightened alert states, whereas perceptions of safety and greater income were associated with lower A1, A2 and B1 power, possibly reflecting relaxed states. Future work should investigate feelings of anxiety as they relate to perceptions of safety and oscillatory power.

Topic Area: OTHER

E156 - Novelty processing in cannabis use and psychotic-like experiences

Ethan Campbell[1] (ecampbell@unm.edu), Jeremy Hogeveen; [1]University of New Mexico

The relationship between cannabis use and psychosis is complex and still a matter of ongoing investigation. While much research has focused on psychotic spectrum disorders, subclinical psychotic-like experiences (PLEs) represent a large portion of the psychosis spectrum and may elucidate how cannabis use can increase the risk of adverse psychological outcomes during the critical stage of neurodevelopment in adolescence through young adulthood. Aberrant salience attribution has been identified as a potential mechanistic link between PLEs and cannabis use, and specific forms of salience such as novelty may inform this relationship. To assess the role of novelty salience processing in cannabis and PLEs, 101 participants aged 13-21 were assessed for lifetime cannabis use frequency, PLEs, and fMRI during movie stimuli and a novelty bandit task. Replicating prior findings, weekly cannabis use frequency correlated positively with PLEs after controlling for alcohol and nicotine use ($\beta = .257$, $p = .012$). Forthcoming analyses will assess the dynamic connectivity of salience network hubs (dorsal anterior cingulate cortex and anterior insula) during movie-watching to identify ROIs that are engaged by narrative audiovisual stimuli for subsequent task-based analysis. Salience network hubs and these dynamically-engaged ROIs will then be assessed as a function of stimulus novelty and novelty-related decision-making, and these processes will be analyzed as potential mechanisms linking cannabis use frequency and PLEs. These findings will contribute to an understanding of cannabis neuropharmacology role and its potential role in PLEs as a function of aberrant neurobehavioral processing of novelty.

Topic Area: OTHER

E157 - Spontaneous brain activity during sleep reduces subjective and objective visual recognition misalignment

Fumiaki Sato[1] (fumiaki.sato@riken.jp), An Saotome[1], Ryosuke Katsumata[1], Mami Yamaji[1], Takeru Matsuda[1,2], Masako Tamaki[1,3]; [1]RIKEN Center for Brain Science, Japan, [2]The University of Tokyo, Japan, [3]RIKEN Cluster for Pioneering Research, Japan

How sleep changes insightful visual recognition remains a mystery. Prior knowledge, mediated by higher-order functions in the frontal cortex, has been shown to influence perceptual processing in the visual cortex for better visual recognition. However, it is unclear whether the sleeping brain reshapes this process and if so, how. Importantly, previous studies have not dissociated detection accuracy from subjective recognition, the neural processes of which may differ. By developing a novel task that dissociates these two, we tested the mechanisms of reshaping recognition during sleep. We recruited young, healthy adult participants. Before and after a 90-minute nap or break with polysomnography, they were presented with various types of binarized images and were asked to respond whether they had recognized the images via two-alternative forced choice and to report the content. Our results showed that the conditional probability (the likelihood that participants correctly recognized an image, given they reported they recognized it) was significantly improved only after the nap; that is, subjective recognition was more consistent with detection accuracy. We applied sparse modeling to investigate the relationship between performance and functional connectivity among brain regions in the theta band activity. Functional connectivity between the prefrontal cortex and visual cortex showed positive regression coefficients with changes in conditional probability. Thus, sleep plays a critical role in improving subjective recognition and detection accuracy, by bringing them into closer alignment. This effect is driven by theta-band functional connectivity between the prefrontal cortex and visual cortex, which may reshape perceptual processes during sleep.

Topic Area: THINKING: Problem solving

E158 - How You Rest May Determine Your Best: Prefrontal Cortex Resting State Activity as a Predictor of Problem-Solving Ability

Siena DeAngelo[1] (siena.deangelo@bruins.belmont.edu), Baie Ensio[1], Emily Stripling[1], Cristina Posada[1], Carole Scherling, PhD[1]; [1]Belmont University

Problem-solving tasks have been widely used in executive functioning research to investigate prefrontal cortex (PFC) activity. Anagram tasks serve as excellent models of verbal problem-solving (Murray, 2022), with previous literature showing increased centro-parietal, fronto-parietal, temporal, and PFC activity (Reineberg, 2018). Additionally, previous work shows a left hemispheric lateralization correlation with efficient problem-solving (Sinitsyn, 2020). The current study uniquely uses functional near-infrared spectroscopy (fNIRS) to probe PFC resting-state activity and brain laterality as a predictor of problem-solving performance. Thirty-eight undergraduates [23 F, mean age (SD)= 20.2 (1.4)] completed 8-minute resting state sessions (eyes-open and -closed; 8x8 PFC montage). Subsequently, they solved 10 anagram puzzles, categorized as either easy or difficult, and outcome measures of reaction time and number of attempts were extracted. Behavioral outcomes revealed slower reaction times in seconds for difficult [mean(SD)=93.2 (40)] vs easy trials [mean(SD)= 11.3 (18)] and more attempts for difficult [mean(SD)= 3.2 (1.4)] vs easy trials [mean(SD)= 1.6 (1.4)]. We hypothesized that fNIRS would reveal similar brain-laterality findings, with higher left resting-state activity correlating with overall better anagram problem-solving, particularly for difficult items. However, results revealed reversed brain-laterality effects, with higher right resting-state activity associated with more attempts on difficult anagram puzzles ($r_s(35)= 0.331$, $p= 0.030$). Overall, findings illustrate that fNIRS can measure PFC resting-state activity and potential brain lateralization. Furthermore, hemispheric lateralization and resting-state activity may modulate problem-solving task performances. Higher right involvement in association with verbal problem-solving is novel and warrants further investigation in other imaging modalities like fMRI for confirmation.

Topic Area: THINKING: Problem solving

E159 - Effects of Alpha and Gamma Band EEG Oscillations Over Prefrontal Cortex on Creative Cognition Using Transcranial Alternating Current Stimulation (tACS)

Necla Ece Yilmaz[1] (neclaece@gmail.com), Sevinch Rakhmonova[1], Aaron Kucyi[1], John Kounios[1], Evangelia G. Chrysikou[1]; [1]Drexel University

Literature on frontal alpha oscillations indicates that they are integral to creative cognition, supporting idea generation processes. This study examined the causal role of alpha band (10Hz) and gamma band (40Hz) neural oscillations for creative problem solving through transcranial alternating current stimulation (tACS). Twenty-five participants completed three counterbalanced sessions undergoing either 10Hz alpha, or 40Hz gamma, or sham stimulation over F3 and F4 electrode positions per the 10/20 EEG system, targeting frontal regions, bilaterally. Each session included pre-stimulation and post-stimulation EEG measures. During each session, participants performed a version of the Uncommon Uses Task (UUT), where they generated creative uses for 60 objects with different stimuli for each condition. Responses were scored for originality, appropriateness, and fluency with both human raters and AI (OSCAI). EEG data were analyzed for changes in alpha power. Originality scores on the UUT were significantly higher in the 10Hz alpha stimulation condition, whereas no effects were observed for the 40Hz gamma stimulation or sham conditions. Performance on a negative control arithmetic task remained unchanged across conditions, eliminating the possibility of general cognitive enhancement through stimulation. EEG analyses revealed changes in alpha power in frontal regions in the post-stimulation alpha band tACS condition compared to sham and pre-stimulation EEG, showing the influence of tACS on oscillatory dynamics. These findings demonstrate the direct facilitative impact of alpha band tACS on creative performance, supporting a causal relationship between alpha oscillations and ideation processes, as well as advancing our understanding of the neural dynamics underlying creativity.

Topic Area: THINKING: Problem solving

E160 - Do Learning Preferences Predict Fixation to Pictorial Examples in Design Problem Solving?

Leah Downie[1] (ld922@drexel.edu), Dong Ho Kim[2], Alexandra E. Kelly[1], John Gero[3], Evangelia G. Chrysikou[1]; [1]Drexel University, [2]Northwestern University, [3]University of North Carolina at Charlotte

Using pictures as examples during problem solving can lead to fixation, wherein solvers tend to replicate the solutions included in the examples even when they involve errors or are clearly suboptimal. Despite the significance of this finding for many educational and professional contexts where creative solutions are critical, very little research has examined the neurocognitive bases of this phenomenon. In this study, we hypothesized that individual differences in learning tendencies may contribute to the likelihood of a participant experiencing fixation during design problem solving. Specifically, we predicted that exemplar learners—individuals who tend to approach learning tasks by memorizing specific examples—may be more prone to fixation, relative to abstraction learners—individuals who tend to approach learning tasks by extracting general principles or rules and applying them to different situations. To examine this prediction, we administered healthy young adults learning tasks that classified them as either exemplar or abstraction learners, and design problem solving tasks that either included a pictorial example or did not include an example. We evaluated participant solutions for evidence of fixation and creative problem solving, per established procedures. Participants' perceptual, executive function, and creative abilities were also assessed. Analyses by learner and task type offered preliminary support for our predictions, showing that exemplar learners are more susceptible to design fixation than abstraction learners, with individual differences in perceptual and executive function abilities partially accounting for the observed effects. We discuss the implications of these findings for creative problem solving, as well as education more broadly.

Topic Area: THINKING: Problem solving

E161 - Neural Differences in Categorization Learning Can Predict Fixation to Examples During Problem Solving

Evangelia G. Chrysikou[1] (lilachrysikou@gmail.com), Alexandra E. Kelly[1], Dong Ho Kim[2], Julie Milovanovich[3], John Gero[3]; [1]Drexel University, [2]Northwestern University, [3]University of North Carolina at Charlotte

Design fixation refers to the tendency to reproduce elements of examples during problem solving, even when they represent clearly erroneous or inappropriate solutions. Although mechanical engineers frequently show evidence of design fixation, product designers are less susceptible to fixation effects during design problem solving. We hypothesize that—beyond disciplinary differences—individual differences in how participants approach learning tasks may partially underlie these effects: Abstraction learners tend to extract generalizable rules and apply them to new situations thus resisting fixation, whereas exemplar learners tend to memorize specific examples and reproduce them during learning thus increasing their susceptibility to fixation. In this study our goal is to provide behavioral and neural evidence of the two different learning profiles, and relate them to behavioral evidence of design fixation. Mechanical engineering and product design students are administered behavioral learning and design problem solving tasks. They are also asked to complete a category learning task while undergoing functional magnetic resonance imaging (fMRI). Structural and resting state fMRI measures are also collected during the imaging session. Our preliminary analysis examines neural differences in executive control and basal ganglia regions during the categorization learning task between participants who are classified as either abstraction or exemplar learners based on their behavioral performance on the learning task outside of the scanner. We also examine whether these neural differences predict participants' tendency to fixate to pictorial examples during problem solving. We discuss a neurocognitive framework for fixation to pictorial examples and its implications for theories of learning and creative problem solving.

Topic Area: THINKING: Problem solving

E162 - Creative Idea Generation in Hypnagogia

Nia McClendon[1], Alissa Gomez[1], Mark Beeman[2]; [1]Northwestern University

Sleep is an essential component of human life, playing a key role in cognitive functions such as creativity. Sleep onset, particularly the first stage of non-REM sleep (hypnagogia), has been proposed as a "creative sweet spot," facilitating insight-based problem-solving (Lacaux et al., 2021). The present study further investigates the relationship between hypnagogia and creative problem-solving using a diverse set of creativity tasks, including: matchstick puzzles, the Alternative Uses Task (AUT), and a tower-building task. Participants (n = 60) attempt all creativity tasks before and after an incubation period to assess changes in performance, and are randomly assigned to either a sleep incubation condition or a control condition. In the sleep condition, participants relax in a darkened room while wearing a Muse headband that monitors sleep stage activity. Serial awakenings are performed when the headband detects the participant has entered N1 sleep, the hypnagogic state. Participants in this condition hold a bottle containing a bell. When the bottle is dropped, the bell awakens participants, prompting them to report their last thought or visualization before re-entering the hypnagogic state. In the control condition, participants watch an unrelated video for the same duration of time, providing a neutral comparison to the sleep condition. After the incubation period, participants revisit unsolved puzzles and repeat the earlier creative tasks. Performance changes between the pre- and post-incubation attempts are analyzed to evaluate how hypnagogic sleep versus waking rest influences problem-solving ability and insight generation.

Topic Area: THINKING: Problem solving

E163 - A Cross-Linguistic Analysis of Aphasic Speech

Sreekar Baddepudi[1], Josh Van Zak[2]; [1]Evergreen Valley High School, [2]Cambridge University

Wernicke's aphasia (WA) is a neurological disorder caused by damage, often from a stroke, to specific language networks in the human brain. This damage results in speech that is spoken at a normal speed and rhythm, and with proper grammatical structure, but the content is usually incomprehensible. Research on people with WA typically focuses on linguistic errors in relation to a person’s native language. Studying these errors has failed to yield clear insights regarding specific neural mechanisms and damage behind particular WA symptoms. For instance, if certain linguistic errors are shared among WA patients who speak languages with different structures and syntax, then this realization may point to specific neural networks that are affected compared to those that may be more language-specific. The analog here is low-level vs. high-level programming languages. To evaluate this set of hypotheses, transcripts from native speakers of English, French, Japanese, and Cantonese (WA and healthy controls) were collected from the AphasiaBank (https://aphasia.talkbank.org/). A state-of-the-art large language model (Anthropic’s Claude v2) was used to perform an in-depth comparison of speech components and rules, ranging from grammar to coherence, across different representative languages. The model was able to identify signs of Wernicke’s Aphasia, such as neologisms, paraphasias, filler words, and word finding difficulty, as well as many commonalities between the languages. Based on this data, an interlinguistic computational analysis model for aphasic speech has been developed.

Topic Area: LANGUAGE: Other

Poster Session F

Tuesday, April 1, 2025, 8:00 – 10:00 am, Back Bay Ballroom/Republic Ballroom

F1 - The effect of mindfulness on emotion regulation and theta power in parents.

Rachel Eubanks[1], Bailey Shea[1], Bridget Cho[1], Brianne Coulombe[1], Laura Jelsone-Swain[1]; [1]University of South Carolina Aiken

Parenting can be highly rewarding but often includes significant stress from and lack of support for the emotional challenges parents commonly encounter. As research strongly indicates many beneficial outcomes stemming from positive parent-child relationships, it is imperative to understand ways in which to reduce parenting stress and facilitate positive parenting strategies. Emotion regulation (ER), the process of modulating and reducing negative affect, appears to be a critical skill for positive parenting. Mindfulness interventions may enhance ER capacity via neural mechanisms targeting affective systems, specifically involving midline theta activity. Therefore, we’re investigating the effect of an acute mindfulness session compared to a control session on ER and theta power in a sample of parents using EEG. Theta power and behavioral responses were measured during a computer-based emotion-regulation paradigm. Participants were shown neutral and negative images and asked to either maintain or reduce negative feelings utilizing cognitive reappraisal strategies. Using a Fast Fourier transform, theta power from electrodes F3, Fz, and F4 were averaged and compared between conditions and groups. Preliminary results indicated significantly greater theta power for all three regulation conditions (neutral, negative maintain, and negative decrease) in the mindfulness group. A large effect size was also found between groups in their behavioral reappraisal scores to the negative images, with the mindfulness reporting greater change; however, this did not reach statistical significance. Collectively our results support theta power as a potential neuromarker for induced mindfulness states, which may in turn support the role of acute mindfulness for use in parenting interventions.

Topic Area: EMOTION & SOCIAL: Emotion-cognition interactions

F2 - Influence of aging on medial frontal and hippocampal contributions to interactions between new and old route memories

Paulina Maxim[1], Scott D Moffat[1], Thackery I Brown[1]; [1]Georgia Institute of Technology

Research suggests that aging negatively impacts flexible navigation performance, likely due to memory integration and route-memory deficits. Our study tested young (YA, 18-35) and older adults (OA, 65-80) across two days in a virtual navigation task and used fMRI to test complementary views of how the medial temporal lobe and medial prefrontal cortex contribute to route planning and navigation from prior knowledge. We demonstrate a complex relationship between navigation strategy (familiar vs. shortcut), route directionality (forward vs. backward), and execution (efficiency of strategy). We saw no significant differences in navigation strategy and efficiency between age groups when taking shortcuts directionally aligned with familiar-but-longer routes. However, in scenarios when shortcuts take a different direction from familiar routes (FR), OAs show a significant bias away from the FR preference of young adults in such circumstances. This context-dependent preference for wayfinding in OAs may be accounted for by indicators that nearly every OA found remembering the FR more difficult than YAs. Findings suggest that route familiarity and directional conflict may be important moderators of past evidence that aging otherwise decreases flexibility and increases route-based navigation. YA fMRI data reveal 1) representational similarity between current and past routes show divergent relationships to navigator performance in different subdivisions of mPFC, and 2) broad agreement between when and how the hippocampus and mPFC are engaged for task stages, represent environments, and track participant differences. OA analyses will help further unpack the impact aging has on how individuals execute navigational strategies and the neural factors at play.

Topic Area: EXECUTIVE PROCESSES: Development &aging

F3 - Modeling biophysically interpretable meso-scale latent dynamics with filtered point processes

Patrick Bloniasz[1] (pblonias@bu.edu), Shohei Oyama[1], Emily Stephen[1]; [1]Boston University

Quantifying low-dimensional latent dynamics of neural systems is a powerful approach for explaining information processing across scales. However, classic unsupervised latent state estimation approaches struggle to identify the underlying network elements generating the dynamics (e.g., different cell or synapse types). We propose a generative modeling framework to complement these methods by modeling relevant network elements as latent stochastic processes. To gain information about latent network elements from data, we exploit an increasingly recognized property of electrophysiological recordings (0–5000 Hz): the time-varying broadband power spectral shape contains rich information about firing rates of different cell type populations and synaptic activity in the tissue. For example, different cell types predictably affect power in the spike-frequency range (>2000 Hz) based on their extracellular waveform shapes, and excitatory/inhibitory synaptic dynamics affect the local field potential (LFP) frequency range (<200 Hz). Building on prior "kernel" methods modeling recordings as sums of filtered point processes (FPPs), our framework assigns a latent subprocess to each event type and links their dynamics to the (cross-)spectrogram of the recordings. We can use these models in both forward (testing whether proposed subprocesses explain spectral effects) and inverse directions (fitting latent subprocess dynamics from an observed spectrogram). We demonstrate the FPP model's value by their ability to capture spectral effects across timescales (e.g., sub-second cross-frequency coupling), interface with existing forward models (e.g., biophysical models), and provide interpretable estimation of latent states (e.g., generalized linear models; GLMs).

Topic Area: METHODS: Electrophysiology

F4 - Human sleep spindles are directed by excitatory non-invasive brain stimulation

Jude Thom[1] (jude.thom@linacre.ox.ac.uk), Bernhard Staresina[1]; [1]Department of Experimental Psychology, University of Oxford

Brain activity during sleep is important for consolidating memory. Sleep spindles are bursts of activity linked to memory, intelligence, and neurological disorders. Hippocampal-neocortical synchronization increases around spindles, as do biomarkers of synaptic plasticity. This suggests spindles may play a mechanistic role in memory consolidation during sleep. Recent work shows spindles track cortical regions engaged in a memory task before sleep. Overlap between the task activity and spindle activity predicted memory benefits of sleep. If spindles are indeed guided by endogenous excitability before sleep, can we direct spindles by exogenously exciting regions with localised non-invasive brain stimulation? Moreover, does this influence functionally localised memory consolidation during sleep? We used a within-subject design to test the effect of excitatory transcranial direct current stimulation (tDCS) on spindles. 19 participants learned a one-handed motor task before having excitatory tDCS applied to left or right motor cortex. We then recorded sleep and spindle rates with electroencephalography and compared the spatial distribution of spindles alongside motor skill consolidation between sessions with left excitation and right excitation. Our results show tDCS successfully modulated spindle rates, with more spindles at excited sites. Importantly, stimulation site had no effect on slow oscillations. However, stimulation did not influence motor skill consolidation. These results suggest spindle topographies are neither hard-wired nor random but are influenced by cortical excitability before sleep, which can be modified with external stimulation. This lays the groundwork for tDCS to be used to study the cognitive and physiological role of regional spindles in memory consolidation during sleep.

Topic Area: METHODS: Electrophysiology

F5 - Cortical Signatures of Hippocampal Ripples in Human Sleep

Pin-Chun Chen[1] (pcchen.sleep@gmail.com), Jenny Stritzelberger[2], Katrin Walther[2], Hajo Hamer[2], Bernhard Staresina[1]; [1]University of Oxford, [2]Universitatsklinikum Erlangen

High-frequency bursts in the hippocampus, known as ripples, are thought to support memory consolidation during "offline" states, such as sleep. Recently, human hippocampal ripples have also been observed during "online" memory tasks. However, ripple attributes and their functional significance across states remain unclear. We investigated ripple characteristics across brain states using intracranial EEG from the hippocampus of nineteen participants undergoing invasive monitoring for epilepsy surgery. We quantified four ripple attributes: (1) density, (2) duration, (3) amplitude, and (4) peak frequency. We detected ripples across 5 sleep stages and 3 awake states, all recorded on the same day: (i) slow-wave sleep (SWS), (ii) stage 2 sleep, (iii) stage 1 sleep, (iv) rapid-eye-movement (REM) sleep (v) wake-after-sleep-onset (WASO), (vi) awake resting, (vii) a motor learning task, (viii) an attention task. Linear mixed-effects models with Bonferroni corrections were built, with brain state as a fixed effect, participant and hippocampal contacts as random effects. Results reveal that ripple density is by far highest during SWS and lower during all awake states compared to sleep. Likewise, ripple duration is longest in SWS and shortest during active motor learning. Finally, microwire data reveal strongest ripple-locked increases in neural firing rates during SWS. These findings suggest that ripple characteristics vary across states and reinforce their role as markers of offline neural processing, particularly during deep sleep.

Topic Area: METHODS: Electrophysiology

F6 - Assessing Consciousness and its Cognitive Correlates in Alzheimer's Disease with the TMS-EEG Perturbation Complexity Index

Brenna Hagan[1,2] (haganb@bu.edu), Stephanie S. Buss[3], Peter J. Fried[3], Mouhsin M. Shafi[3], Katherine W. Turk[1,2], Kathy Xie[1,2], Recep A. Ozdemir[3], Andrew E. Budson[1,2]; [1]Center for Translational Cognitive Neuroscience, VA Boston Healthcare System, [2]Alzheimer's Disease Research Center, Boston University School of Medicine, [3]Berenson-Allen Center for Noninvasive Brain Stimulation, Beth Israel Deaconess Medical Center

Introduction: The Memory Theory of Consciousness suggest that consciousness developed as part of the episodic memory system, with all areas of the cerebral cortex contributing to conscious awareness (Budson et al., 2022). Alzheimer's disease (AD) has been postulated as a disorder of consciousness. The Perturbation Complexity Index - State Transitions (PCIST) measures the complexity of the brain's response to transcranial magnetic stimulation (TMS) using electroencephalography (EEG) and is sensitive to consciousness, such as minimally conscious states. We sought to test the hypothesis that PCIST would be reduced in AD compared to healthy aging. Methods: We assessed 28 participants with AD and 28 healthy controls (HC), measuring cognition with the Montreal Cognitive Assessment (MoCA) and disease severity with the Clinical Dementia Rating scale – Sum of Boxes (CDR-SB). Results: Results indicated lower PCIST in the AD group (M = 20.1) compared to controls (M = 28.9). Moreover, PCIST correlated positively with MoCA scores and negatively with CDR-SB scores across the motor cortex (M1) and inferior parietal lobule (IPL) TMS stimulation sites, suggesting that PCIST may reflect conscious cognitive and functional capacity. Conclusion: These findings support the hypothesis that cortical dementias are disorders of consciousness. This research opens the avenue for future studies on the fundamental nature of consciousness and its neuroanatomical correlates, in addition to enhancing our understanding of dementia and possible therapeutic strategies.

Topic Area: METHODS: Electrophysiology

F7 - Comparison of ERP inverse solutions using MRI-informed versus standard forward models

Mark Pflieger[1] (mark.pflieger@gmail.com), Kathryn Toffolo[2], John Foxe[2]; [1]San Diego State University, [2]University of Rochester Medical Center

Any inverse method for estimating the brain current sources of EEG measurements requires a forward model which comprises: (i) a source domain model that specifies feasible locations, orientations, and prior probabilities of primary currents; (ii) a conductivity geometry model based on segmented head tissues with assigned conductivities; (iii) a numerical solver of Poisson's equation that calculates how any given primary current generates electric potentials on the head surface; and (iv) a sensor configuration that specifies electrode locations and an EEG reference. Individual structural MRIs can inform elements (i), (ii), and (iv). Alternatively, study participants can share a standard forward model derived from average MRI data. We hypothesize that MRI-informed (versus standard) forward models spatially sharpen inverse solutions, thereby increasing both spatial specificity and statistical power for discriminating between experimental conditions. To address these hypotheses, we are using structural MRIs of 20 participants in a 128-channel ERP language study (PMID: 39369943) to construct finite element method (FEM) forward models with 5-tissue (skin, skull, CSF, gray matter, white matter) conductivity geometries, and three different source domains (intracranial lattice, gray-matter volume, cortically constrained) for further comparisons. The standard FEM model is derived from ICBM 2009b data (nonlinear, asymmetric) and the New York Head. For each case we shall construct statistical nonparametric maps of congruent versus incongruent (word ending) sLORETA inverse solutions. Then the negative log p-value maps obtained for MRI-informed versus standard models shall be compared at a second level. The results should assist ERP researchers to assess MRI benefits versus costs.

Topic Area: METHODS: Electrophysiology

F8 - Improving the robustness of oscillation detection

Kieran Pawluk[1] (kpawluk@ualberta.ca), Tamari Shalamberidze[1], Jeremy Caplan[1]; [1]University of Alberta

Neural oscillations at various frequencies are associated with many brain functions. To quantify them, it is important to distinguish oscillatory from non-oscillatory 1/f background activity. The BOSC method (Better OSCillation detection; Caplan et al., 2001) does this by estimating the background power spectrum and deriving detection thresholds from that estimate in order to disregard most background signal. When successful, this produces detection criteria that are fairly calibrated across frequencies. But if the background estimate is inaccurate, this can backfire and potentially introduce a bias across frequency. We used both real and synthetic signals to estimate the severity of these problems as they arose, focusing on shorter time windows and when substantial power existed at one end of the measured spectrum. With the goal of improving robustness in these conditions, we then compared various improvements to the background estimate. The combination that produced the best results involved removing high-power values across frequencies, using median rather than mean power values, and replacing ordinary least-squares regression with robust regression. When comparing the optimized BOSC method to the standard method, the standard method fared reasonably well aside from some extreme edge cases. Outcomes suggested that at very short time windows or when artifacts or lopsided power spectra are a concern, the combination of modifications in the optimized BOSC method could result in a more selective and thus more accurate fit to the coloured-noise background signal.

Topic Area: METHODS: Electrophysiology

F9 - The effects of adverse childhood experiences on alpha wave reactivity using EEG

Emily Stripling[1] (emily.stripling@bruins.belmont.edu), Kristie Stephens[2], Dara Olopade[3], Aram Akbari, Emma Chacon, Karlie Souder, Liam Fienberg, Smyth Harper, Michael Oliver; [1]Belmont University

Adverse childhood experiences (ACEs) are defined as traumatic events occurring before the age of 18. Previous research suggests that ACEs are associated with cognitive issues and long-term brain alterations (Boullier & Blair, 2018). As such, it is possible that brain changes associated with ACEs may be detectable by investigating brain activity at rest. For example, alpha reactivity, or the difference in alpha activity from eyes closed to open, has been associated with stress, cognitive impairment (Scally, et al., 2018) and cholinergic system integrity (Schumacher et al., 2020). Therefore, it is hypothesized that individuals reporting ACEs will have reduced alpha reactivity compared to those without ACEs. In this study, 32 individuals (14 with ACEs, 18 without ACEs) between the ages of 18-30, had resting state eyes open and eyes closed brain activity recorded for 5 minutes each with the lights off. Once complete, participants answered demographic information and the ACEs questionnaire through Qualtrics. Results revealed no differences in eyes open alpha power between those with and without ACEs; however, individuals with ACEs displayed higher alpha power (13Hz) compared to individuals without ACEs (9Hz) in eyes closed. Alpha power around 9Hz has been associated with deep relaxation with minimal cognitive load. Although alpha power around 13Hz has also been associated with relaxation, it further reflects an alert, active, and attentionally-ready resting state. As such, it is possible that the presence of ACEs is associated with experiential neuroplastic changes in the brain that can be detected using resting state EEG.

Topic Area: METHODS: Electrophysiology

F10 - Assessing reliability of resting-state EEG metrics in school-age children using a naturalistic paradigm

Madhumita Nambiar[1], Devin Kearns[2], Fumiko Hoeft[1], Silvia Siu-Yin Clement-Lam[1]; [1]University of Connecticut, [2]North Caroline State University

Resting-state EEG (rsEEG) provides valuable insights into neural dynamics, with power spectral densities showing potential for identifying atypical neurophysiological patterns in neurodevelopmental disorders. However, the reliability of these metrics, particularly in children, remains underexplored. This study leverages longitudinal rsEEG recordings across four time points over a month in 29 school-age children (7–10 years) attending summer research camps. EEG data were recorded using a Brain Vision 32-Channel ActiChamp system while children watched a naturalistic video (Inscapes). These repeated measures provide a more robust evaluation of the reliability and variability of rsEEG metrics, specifically delta (0.5–3.5 Hz), theta (4–8 Hz), alpha (8–12 Hz), beta (12–30 Hz), and gamma (>30 Hz) frequency bands. Currently, data preprocessing is underway using EEGLAB in Matlab. Steps include 1-Hz high-pass filter, noisy data removal, interpolation, average referencing, independent component analysis for artifact rejection, and segmentation into 2-second epochs. Power spectral analysis using Fast Fourier Transform will compute absolute and relative power for frontal, central, parietal, and occipital regions . Test-retest reliability will be assessed through Intraclass Correlation Coefficients for each frequency band and electrode cluster across the four time points. Growth curve modeling will examine individual and group-level trajectories of EEG power over time. Discussions will focus on the reliability and variability of power spectral densities across frequency bands and scalp regions. Additionally, we will discuss how naturalistic paradigms and frequent recordings contribute to methodological advancements in pediatric EEG research, guiding the application of rsEEG metrics in developmental studies.

Topic Area: METHODS: Electrophysiology

F11 - Concurrent multimodal imaging reveals that EEG measures of excitation/inhibition balance are compatible with MRS-based measures

Aaron Cochrane[1] (aaron_cochrane@brown.edu), Luke Rosedahl[1], Takeo Watanabe[1], Yuka Sasaki[1]; [1]Brown University

A fundamental feature of the human nervous system is the dynamic interaction between excitation and inhibition. The relative degree of these factors, expressed as excitation/inhibition (E/I) balance, has been used to study a wide range of processes including neuroplasticity, cognition, and disordered neural functioning. While magnetic resonance spectroscopy (MRS) has been effective in quantifying concentrations of excitatory and inhibitory neurotransmitters, and by extension their ratio, MRS methods are greatly limited in their spatial and temporal resolution while also carrying high expenses. Alternative EEG-based measures of E/I balance, such as those derived from criticality theory, have been proposed and validated in several domains, yet these measures have not been directly compared to MRS-based E/I balance. Here, we used concurrent electroencephalography (EEG) and MRS in humans during a 90-minute post-learning nap and tested whether occipital EEG-based E/I balance and MRS-based E/I balances were reliably associated. We found that EEG-based estimates of E/I balance, derived from criticality theory, were positively and reliably associated with MRS-based estimates of E/I balance. These associations were especially strong when examining E/I balance estimated from alpha band. The two methods of assessing E/I balance were reliably linked when examining both within-subjects correlations (i.e., controlling for between-subject variations) and between-subjects correlations (i.e., controlling for within-subject variations). As expected, between-subjects correlations showed stronger associations. These results provide a critical validation for the use of low-cost EEG-based and criticality-informed E/I balance to measure the underlying ratio of excitatory and inhibitory transmitters at multiple brain locations and with high temporal precision.

Topic Area: METHODS: Electrophysiology

F12 - Investigating electrophysiological brain network dynamics and mechanisms underlying executive deployment during novel learning

Julia K Dabrowska[1] (julia.dabrowska@univ.ox.ac.uk), Alexander Fraser[1], Bethan Grimes[1], Mats WJ van Es[1], Mark W Woolrich[1], Gaia Scerif[1]; [1]University of Oxford

Existing research has found that the efficiency of novel learning is heavily dependent on cognitive control and executive function (EF). Consequently, increased ability to cope with cognitive demands is a consistent predictor of learning ability across various tasks and populations. However, the roles of particular brain networks in this interplay remain to be understood. As cognitive control and learning performance have been linked to differential network composition and dynamic reconfigurations, our preliminary hypotheses focus on establishing networks present during a novel learning task over time, differences between attentional demands on a group level, and linking this to individual performance. Here, we use an artificial symbol learning paradigm with concurrent 32-channel EEG recording in 25 adult participants: first, teaching them an ordinal sequence of symbols, followed by a magnitude comparison task to test successful learning. Dynamic network modelling, previously applied to MEG data, is then used to identify networks of oscillatory activity involved with the tasks. Further planned work will investigate similar hypotheses applied to EF task data and the interplay between network characteristics and performance between learning and EF. Besides uncovering cognitive mechanisms, such findings can facilitate effective learning in educational contexts, as recognising general patterns may be beneficial for individuals affected by learning or neurodevelopmental disorders impacting their ability to learn new information. Additionally, this project is crucial for validating the efficacy of novel machine learning methods for the analysis of lower-density EEG data, subsequently opening possibilities for cost-effective and simple experimental procedures to investigate brain network dynamics.

Topic Area: METHODS: Electrophysiology

F13 - The Connectivity Crisis

Ole Jensen[1] (ole.jensen@psych.ox.ac.uk), Hyojin Park[2], Oscar Ferrante[2]; [1]Department of Experimental Psychology, Department of Psychiatry, University of Oxford, [2]Centre for Human Brain Health, University of Birmingham

The case is often made that the brain should be investigated as a network rather than studying individual brain regions in isolation. It has been proposed that interregional functional connectivity identified from electrophysiological data is reflected by phase-synchronization in the gamma band and that the degree of synchronisation is task-dependent thus reflecting communication. Other ‘non-oscillatory’ methodologies have also been tested e.g. information theoretical measures, Granger causality and dynamical causal modelling. Nevertheless, the field of cognitive neuroscience has after more than three decades not converged on a commonly accepted measure of task-related functional brain connectivity estimated from electrophysiological data. We suggest that the lack of convergence is anchored in the observation that few findings on task-modulated connectivity are reproduced across laboratories. We challenge the community to prove us wrong by pointing to a MEG dataset collected by the Cogitate consortium (https://www.arc-cogitate.com/). This dataset allows for testing and verifying measures of functional connectivity associated with visual perception. In contrast to measures of interregional connectivity, the application of multivariate approaches relying on spatially distributed activity patterns has proven very powerful for identifying representational and task-specific neuronal activity. These multivariate patterns are highly distributed and reflect network interactions across the brain. We argue that theories based on circuit diagrams relying on estimating functional connectivity between a handful of regions should be abandoned in favour of testable models embracing neuronal computations distributed across the brain.

Topic Area: METHODS: Electrophysiology

F14 - Developmental trajectories of EEG rhythmic oscillatory activity in children 2-44 months of age

Haerin Chung[1,2] (haerin.chung@childrens.harvard.edu), Winko W. An[1,2], Charles A. Nelson[1,2,3], Carol L. Wilkinson[1,2]; [1]Boston Children's Hospital, [2]Harvard Medical School, [3]Harvard Graduate School of Education

Introduction: Transient changes in spectral power within the theta/alpha range (4–12 Hz) are observed in early childhood, with studies reporting a gradual shift in peak frequency between 5-to-10Hz. Recent findings report transient double peaks (5.5-and-9.5Hz) at 2–4 months, with the higher 9.5Hz peak disappearing by 6 months. Peaks observed in the power spectra are thought to reflect neural oscillatory activity; however, peaks may arise from either irregular (bursty) or sustained (rhythmic) activity. Thus, transition from double to single peak may signal maturational changes of irregular and sustained oscillatory activity. This study aims to characterize developmental changes in rhythmic properties over time and clarify whether transient double peaks in spectral power derive from bursty or rhythmic activity in the first months of life. Methods & Preliminary results: We will analyze resting-state EEG data from 600 participants tracked longitudinally from 2-to-44 months across four studies. Lagged coherence (LC) will be computed to explore the rhythmicity of the signal across 2-40Hz, in 0.2Hz steps from 1-to-3 lags. Preliminary analyses suggest that rhythmic posterior alpha begins to emerge around 5–6 months, with peak frequency and magnitude of LC increasing with age. Distinct peaks at 5-and-10Hz were observed between 2-to-5 months but were decreased by 12-months as the sustained oscillatory alpha stabilized between 6-9Hz. This implies the possibility of two independent transient oscillations with distinct rhythmic properties present early in development, which decrease with maturation as the mature rhythmic alpha emerges. Generalized additive mixed models will be used to assess changes within-subjects over time.

Topic Area: METHODS: Electrophysiology

F15 - Protecting memory from misinformation: Using EEG to explore encoding-related neural responses during exposure to misinformation

Sophia Grekin[1,2] (sgreki01@tufts.edu), Himanshu Chaudhary[1,2], Wuhib Solomon[2], David Distefano[2], Ayanna Thomas[1], Elizabeth Race[2]; [1]meta-Cognition and Applied Memory Lab, Tufts University, [2]Integrative Cognitive Neuroscience Lab, Tufts University

The accuracy of eyewitness memory can be unreliable. For example, exposure to misleading information after an event can impair memory for the event, a memory distortion known as the misinformation effect. Prior research has shown that warning individuals about the unreliability of post-event information (PEI) can significantly reduce misinformation susceptibility. However, the precise mechanisms underlying these effects remain unclear. The current study investigated whether this effect of warning is related to enhanced conflict detection and source encoding, particularly when post-event information differs from one's memory for an original event (Karanian et al., 2024). To test this hypothesis, we first developed a novel misinformation paradigm in which participants witnessed an event and then were presented with PEI in the form of a narrative that was displayed word-by-word before taking a final memory test about the original event. Results from this behavioral study confirmed the presence of the misinformation effect when PEI is presented in a word-by-word format. Currently, we are running the same study while EEG data is being collected in order to measure neural responses (ERPs) to the individual words presented during the PEI and to investigate whether warnings influence these responses. Data collection is ongoing (current n = 15) to further power our analysis. We predict that warnings will influence ERPs related to both conflict detection and memory encoding (e.g., N400, P3b, Late Positive Component) and that the amplitude of these ERPs will be related to later memory accuracy and susceptibility to misinformation.

Topic Area: METHODS: Electrophysiology

F16 - Functional Characterizations of CACNA1G variants Associated with Genetic Generalized Epilepsy

Athar sharifi[1,2] (athr.sharifi@gmail.com), Hang Lyu[1], Epi25 collaborative, Holger Lerche[1], Yuanyuan Liu[1]; [1]Dept. of Neurology and Epileptology, Hertie Institute for Clinical Brain Research, University of Tubingen, Germany, [2]Dept. of Molecular Medicine, University of Padua, Padua, Italy

Background:There is a large body of evidence highlighting the fundamental role of voltage-gated calcium channels (CaVs) in neuronal function. Variants causing dysfunction of CaVs have been implicated in a variety of neurodevelopmental, neurological, and psychiatric disorders. CaV3.1 encoded by the CACNA1G gene, is a subtype of low-voltage activated T-type calcium channel. Variants in CACNA1G have been associated with epilepsy and ataxia. This study aims to elucidate the functional consequences of two CACNA1G variants, R198C and N1745S, which were identified in patients with genetic generalized epilepsy (GGE). Methods:The C592>T or A5111>G mutation was engineered into the human CaV3.1 channel cDNA by site-directed mutagenesis to generate the R198C or N1745S variant construct, respectively. Whole-cell patch clamp experiments were performed in transfected HEK293 cells to characterize the biophysical properties of the R198C and N1745S mutant and wild-type (WT) CaV3.1 channel. Results:The results showed that R198C significantly reduced the peak current density, while N1745S showed a trend towards lower peak current density compared to WT. Although both R198C and N1745S variants did not affect either the V1/2 or the time course of voltage-dependent activation and inactivation, they accelerated the deactivation time course at -50mV, -60mV and -70mV. Additionally, R198C increased the slope of the activation curve and slowed the recovery from inactivation. Conclusion:Our findings suggested that both R198C and N1745S variants caused a loss-of-function (LOF) effect, while R198C showed a stronger LOF than N1745S. These findings help to understand the pathophysiological mechanism underlying CACNA1G-related epilepsy(GGE). Keywords: CACNA1G, genetic generalized epilepsy, site-directed mutagenesis, calcium channel

Topic Area: METHODS: Electrophysiology

F17 - Cognitive reserve moderates the relationship between the aperiodic component of EEG signal and cognitive performance in older adults

Julia A. Sinople[1], Elena K. Festa[2], William C. Heindel[2], Laura E. Korthauer[1,3]; [1]Brown University Health, [2]Brown University, [3]Warren Alpert Medical School of Brown University

Introduction: Parameterizing EEG power spectra into aperiodic and periodic (oscillatory) components can reveal important information about the brain's functional state. Features of the aperiodic component (which takes a 1/f-like distribution defined by its slope and offset) may be related to excitation/inhibition (E/I) balance, which may be a neural underpinning of cognitive reserve (CR) and cognitive performance during aging. Our goal was to examine associations between the aperiodic EEG component, cognitive performance, and CR in cognitively unimpaired older adults. Methods: We enrolled N=58 older adults (age 60+, 69% women), who completed 5 minutes of eyes-open 64-channel resting state EEG. Participants completed a comprehensive neuropsychological battery, including the Cognitive Reserve Index Questionnaire. Results: As expected, age was associated with lower aperiodic offset and exponent (p's < .01). After controlling for age, lower aperiodic offset and exponent were associated with higher CR and a better neuropsychological composite score (p's < .05). CR significantly moderated the associations between aperiodic activity and cognitive performance (p's < .01): individuals with low CR had strong negative associations between the aperiodic offset and exponent and neuropsychological performance, while those with high CR showed no significant association. Discussion: Higher CR was associated with a lower aperiodic offset and exponent, which have been linked to a more excitatory E/I balance. However, aperiodic activity was more strongly linked to cognition in low CR individuals, suggesting that a less excitatory/more inhibitory E/I state could be a possible explanation for poorer cognitive performance in this group.

Topic Area: METHODS: Electrophysiology

F18 - Physiological Health vs. Cognitive Function: The Role of Blood Pressure, Heart Rate, and Pulse Oximetry

Sinead Mukolo-Villegas[1], Deya Rassul[1], Emily Stripling[1], Michelle Johnson[1], Ashley Brooks[1], Emma Sells[1], Hannah Johnson[1], Michael D. Oliver, Ph.D.[1]; [1]Belmont University

Investigations into the circulatory system help to better understand cognitive health. For example, both high blood pressure and low oxygen saturation are associated with cognitive impairment in middle and older adults. However, its effects on long-term cognitive decline are less understood in younger populations. As such, this study investigated the electrophysiological correlates of blood pressure and oxygen saturation on cognition in young adults. It was hypothesized that participants with higher blood pressure and/or lower pulse oximetry would demonstrate lower cognitive function, with reduced cortical activation. Blood pressure and pulse oximetry were measured in 50 college students before completing 2 randomized computerized tasks assessing selective attention and working memory, while brain activity was measured simultaneously using electroencephalography (EEG). Results revealed participants with higher systolic blood pressure exhibited prolonged P300 latencies on the working memory task (r=0.515, p=0.006) and diminished cortical responsiveness on the selective attention task (r=-0.495, p=0.003). Participants with higher pulse oximetry exhibited faster button presses during the Stroop Task (incongruent: r= 0.597, p<0.001; congruent: r= 0.418, p=0.012). Findings imply that early restrictions in blood flow and oxygen saturation may be harmful for cognitive performance by impairing the speed and strength of cortical processing and should be monitored throughout the lifespan.

Topic Area: METHODS: Electrophysiology

F19 - The neural dynamics of acute coma recovery after severe traumatic brain injury using invasive electrocorticography

Rajanikant Panda[1] (rajanikant.panda@ucsf.edu), Kevin Bao[1], Narayan Sankaran[2], David Caldwell[1], Matheus Otero[1], Anthony Mefford[1], Roxanne Simmons[1], Britta Lindquist[1], Vishnu Karukonda[1], Anthony DiGiorgio[1], Phiroz Tarapore[1], Lawrence Chyall[1], Edward Chang[1], Claude Hemphill[1], Geoffrey Manley[1], Michael Huang[1], Edilberto Amorim[1]; [1]University of California San Francisco, [2]University of San Francisco

Background: Coma and other disorders of consciousness are common clinical manifestations of severe traumatic brain injury. Recovery of consciousness is often hard to measure at the bedside, and while neurophysiology dynamics may inform recovery assessment, meaningful advancements about its mechanisms have been limited by low-resolution EEG recordings. Method: We recorded invasive electrocorticography (ECoG) signals from patients who had hemicraniectomy after severe traumatic brain injury (N=10; strip with 8 electrodes). We analyze ECoG data from the first 48h and compared it to 72h from the time of injury. The following features were acquired: relative power spectral analysis and Brain-Continuity-

Index (BCI). Good outcome (GO) was defined as the ability to follow commands prior to discharge, and poor outcome (PO) as normal flexion or worse on the Glasgow Coma Score motor exam. We performed a two-sample t-test between outcome groups. Results: We identified 5 patients in each outcome group. The GO-group had higher alpha [GO= 0.14±0.09, PO=0.07±0.03, p=0.08] and beta [GO= 0.13±0.08, PO=0.05±0.13, p=0.03] power and BCI [GO= 0.90±0.10, PO= 0.61±0.21, p=0.01]. The PO group had a higher burst suppression ratio and delta power [GO= 0.59±0.21, PO= 0.74±0.09, p=0.09]. When examining brain dynamics across time, burst suppression increased over time (data recorded within 48 hours vs 72hrs) in the PO-group, while alpha power increased in the GO group. Conclusion: Improvement in oscillatory frequency and continuity on ECoG precedes recovery from coma based on neurological examination in patients with severe-TBI. Additional studies are needed to validate these findings in larger cohorts with concurrent scalp-EEG.

Topic Area: METHODS: Electrophysiology

F20 - Age-related differences in aperiodic neural activity and its role in listening effort

Sarah J. Woods[1] (sarah.woods@psych.utah.edu), Jack W Silcox[1], Brennan R. Payne[1]; [1]University of Utah

Though previously ignored, aperiodic activity is emerging as an important element of the electroencephalography (EEG) signal. In addition to considering how changes in aperiodic activity may bias oscillatory measurements, both the aperiodic offset and slope have been shown to be dynamic neural measurements that are linked to underlying neurophysiological states (e.g., E/I balance), sensitive to cognitive task demands, and predictive of individual differences in cognitive capacity. In two studies, we show that aperiodic activity can be used as to index listening effort, or the allocation of cognitive resources to accomplish a listening task, during speech comprehension. Both younger (Exp1; N = 31) and older adults (Exp2; N = 48) listened to sentences in quiet or in speech-shaped background noise while EEG was recorded. Changes in aperiodic neural activity were sensitive to the addition of background noise during a listening task in both younger and older adults. Furthermore, noise induced changes in aperiodic activity were greater for older adults and for those with poorer hearing acuity. For younger adults, parietal alpha activity was additionally sensitive to background noise, but this was not true for older adults. These findings highlight the importance of considering aperiodic EEG activity in assessing listening effort in speech comprehension specifically and in challenging cognitive tasks more generally.

Topic Area: METHODS: Electrophysiology

F21 - Examining the extent of neural population overlap for music and speech using noise as a reference stimulus

Alejandra E Santoyo[1], Kristina C Backer[1], Antoine J Shahin[1]; [1]University of California, Merced

There is evidence that music and speech are processed in overlapping neural networks. To further investigate the extent of this overlap, we used an auditory habituation paradigm to examine the N1-P2 auditory-evoked potential (AEP) of speech and music in reference to noise. Previous studies reveal that noise is primarily processed in the primary auditory cortex (AC) while music, and especially speech, further recruit networks in non-primary (higher-level) auditory cortices. Importantly, the amplitude of the N1-P2 AEP reflects the degree of temporal locking of a neural population to sound features. Here, EEG was recorded from eight participants passively listening to four bursts of pink noise, followed by a target sound that was either speech (n-n-n-n-s) or music (n-n-n-n-m); a control condition that consisted of five noise bursts (n-n-n-n-n) was included. We propose that a reduction of the target sound's N1-P2 amplitude would suggest a greater neural overlap with noise, thus resulting in a weakened onset response to the last sound in the stream. When contrasting the AEPs for the music versus noise (control) target sounds, no significant AEP differences were observed. However, the contrast between the speech and noise (control) target sounds revealed a significant difference in the N1 AEP in frontocentral channels following the target sound's onset. These preliminary findings suggest that the neural population of speech (high-level AC), as opposed to music, overlaps less with the neural population of noise (low-level AC), highlighting a hierarchical organization of sound processing mediating noise, music, and speech perception.

Topic Area: METHODS: Electrophysiology

F22 - Novel approach for detection of topographic outliers for spatiotemporal EEG analyses

Jiong Yan Yap[1] (jiongyan@usc.edu), Delara Aryan[1], Sahana Nagabhushan Kalburgi[2]; [1]University of Southern California, [2]Children's Hospital Los Angeles

Electroencephalography (EEG) microstates are increasingly being used to quantify millisecond-level spatiotemporal dynamics on the scalp. Outliers in individual microstates can affect group-level mean microstate maps and subsequently affect computed temporal dynamics of microstates. However, topographical outlier detection on individual-level microstate maps has yet to be explored, and only one microstate analysis toolbox provides outlier detection as a built-in feature. In this study, we propose a novel outlier detection method for microstates. Our method computes the topographic similarity between individual microstate maps and published normative maps to identify outlier topographies. We validated our novel algorithm against a publicly available dataset, in which outliers were identified by manual visual inspection, and then compared the results against an existing outlier detection method which utilized multidimensional scaling (MDS). Our method exhibited good sensitivity (mean = 67.7%) and specificity (mean = 92.5%)

to outliers across all microstate classes. Our method also outperformed the traditional MDS method in sensitivity (mean = 2.4%) across all microstate classes except for class C. The findings suggest that our novel method is capable of identifying outlier microstates with good accuracy and is an improvement over existing methods. Further investigation into determining the optimal topographic similarity cutoff for each microstate class may further increase the specificity of our method. Overall, our study highlights the importance of outlier detection for improving reproducibility in EEG microstate studies.

Topic Area: METHODS: Electrophysiology

F23 - Removing neural signal artifacts with autoencoder-targeted adversarial transformers (AT-AT)

Benjamin Choi[1] (benchoi@college.harvard.edu); [1]Harvard University

Electromyogenic (EMG) noise is a major contamination source in EEG data that can impede accurate analysis of brain-specific neural activity. Recent literature on EMG artifact removal has moved beyond traditional linear algorithms in favor of machine learning-based systems. However, existing deep learning-based filtration methods often have large compute footprints and prohibitively long training times. In this study, we present a new machine learning-based system for filtering EMG interference from EEG data using an autoencoder-targeted adversarial transformer (AT-AT). By leveraging the lightweight expressivity of an autoencoder to determine optimal time-series transformer application sites, our AT-AT architecture achieves a >90% model size reduction compared to published artifact removal models. The addition of adversarial training ensures that filtered signals adhere to the fundamental characteristics of EEG data. We trained AT-AT using published neural data from 67 subjects and found that the system was able to achieve comparable test performance to larger models; AT-AT posted a mean reconstructive correlation coefficient above 0.95 at an initial signal-to-noise ratio (SNR) of 2 dB and 0.70 at -7 dB SNR. We then further tested our system by deploying AT-AT in conjunction with a downstream classifier on a notable inferential use case: distinguishing imagined digits and non-digits from EEG data. We found that AT-AT filtration helped reduce classification error by over 40% and increased latent space separability of neural signal classes. Our results demonstrate the potential of AT-AT for streamlined artifact removal; further research generalizing these results to broader sample sizes and additional use cases will be crucial.

Topic Area: METHODS: Electrophysiology

F24 - Observable differences in electrophysiological markers of respiratory vagal nerve stimulation in deep breathing mindfulness training.

Dr Alexandra Roach[1] (alexandraro@usca.edu), Rayne Szilveszter[1], Jordyn Kellogg[1], Malia Patten[1], Star Boyd[1]; [1]Univ of South Carolina Aiken

Deep breathing exercises, a core component of mindfulness practices, stimulate the vagus nerve. Because the vagus nerve innervates the majority of nerves in the Parasympathetic Nervous System, stimulation of this nerve pair can influence widespread processes including heart rate variability, blood pressure, respiration, and pain perception. Therefore, the vagus nerve has been the target of therapies for mood, pain, immune system, digestion, and other homeostatic processes. In this study, we used Biopac Bionomadix wireless transmitters to collect physiological data including electrocardiogram (ECG), electrodermal activity (EDA), electromyography (EMG), respiration, and pulse during a stress test. These physiological measures can be used to evaluate levels of stress placed on the nervous system. In this between-subjects design, we used a dolorimeter to introduce stress (pain) to establish pain threshold and tolerance. Perceived pain was measured using the Visual Analog Scale at baseline, during vagal nerve stimulation (or control), and post. Vagal nerve stimulation was achieved through deep breathing mindfulness training, using a square breathing technique. The control group spent comparable time in undirected quiet. Physiological data were recorded continuously and processed using AcqKnowledge Data Acquisition and Analysis Software (Biopac). For heart rate variability, we used the NN interval derived from ECG. For EMG data, we used the trapezius muscle electrode placement. Preliminary data show that physiological measures are correlated with perceived pain ratings. Further analysis shows that the physiological difference between baseline and deep breathing, compared to baseline and undirected quiet, was greater, indicating that perceived pain was attenuated by the square breathing.

Topic Area: METHODS: Electrophysiology

F25 - Dynamic Formation of a Posterior-to-Anterior Peak-Alpha-Frequency Gradient Driven by Two Distinct Processes

Marcia Grabowecky[1] (grabowecky@northwestern.edu), Max Kailler Smith[1], Satoru Suzuki[1]; [1]Northwestern University

Peak-alpha frequency varies across individuals and mental states, but it also forms a negative gradient from posterior to anterior regions in association with increases in cortical thickness and connectivity, reflecting a cortical hierarchy in temporal integration. Tracking the spatial standard deviation of peak- alpha frequency in scalp EEG, we observed that a posterior-to-anterior gradient dynamically formed and dissolved. Periods of high spatial standard deviation yielded a robustly negative posterior-to-anterior gradients— a “gradient state”—while periods of low spatial standard deviation yielded a globally converged peak-alpha frequency— a “uniform state.” The state variations were characterized by a combination of slow (0.3–0.5 Hz) oscillations and random-walk-like fluctuations. They were relatively independently correlated with peak-alpha frequency variations in anterior regions and peak-alpha power variations in central regions driven by posterior regions (together accounting for ∼50% of the state variations), suggesting that two distinct mechanisms modulate the state variations: an anterior mechanism that directly adjusts peak-alpha frequencies and a posterior–central mechanism that indirectly adjusts them by influencing synchronization. The state variations likely reflect general operations as their spatiotemporal characteristics remained unchanged while participants engaged in different tasks (breath focus, vigilance, working memory, mental arithmetic, and generative thinking) with their eyes closed, or watched a silent nature video. The ongoing state variations may dynamically balance two global processing modes, one that facilitates greater temporal integration (and potentially also information influx) toward anterior regions in the gradient state and the other that facilitates flexible global communication (via phase locking) in the uniform state.

Topic Area: METHODS: Electrophysiology

F27 - Longitudinal study of concussion-related diffusion MRI changes in college athletes: modeling tracts via hierarchical generalized additive models

Nathan Muncy[1] (nmuncy2@unl.edu), Aron Barbey[1]; [1]University of Nebraska-Lincoln

Sports-related traumatic brain injuries affect 1.6-3.8 million individuals in the US each year, and diffusion weighted imaging can measure the complex timeline of resulting axolemmal changes. Such longitudinal data is difficult to model statistically, however, given the high-dimensionality, semi-parametric and interdependent scalar values, and non-linear spatial (within-tract) and temporal (across visit) properties. Proposal: hierarchical generalized additive models (HGAMs) are well-suited to fit such data with the requisite flexibility and sensitivity to investigate (a) the spatial and temporal changes of white matter tracts, and (b) how such changes relate to diagnostic assessments. Methods: we utilized MRI and IMPACT data collected from 67 college athletes (9 female, age=19.43[1.68]) at three visits: start-of-season, post-concussion, and return-to-play. Diffusion tensors were modeled via constrained spherical deconvolution and probabilistic tractography from pyAFQ yielded 100 scalar values per white matter bundle. Results: By fitting the scalar profiles with longitudinal HGAMs we detected within-tract changes as a function of visit, revealing distinct patterns of post-injury disruption and recovery. Critically, it is unlikely that such changes would have been detected with standard techniques given their linear assumptions and limited dimensionality. Further, we examined whether these evolving diffusion metrics correlated with cognitive outcomes using HGAM tensor product interaction smooths and found moderate evidence linking white matter alterations to IMPACT composite scores. Merit: HGAMs offer a powerful framework to capture the complex progression of brain injury. Our findings suggest that HGAMs enhance our understanding of the spatiotemporal dynamics of brain injury and may enable more accurate tracking of injury and recovery.

Topic Area: METHODS: Neuroimaging

F28 - Cross-Modal Transformation of Structural Similarity Networks into Functional Connectomes for Behavioral Prediction

Yae Ji Kim[1], Minchul Kim[2], Marvin M. Chun[3], Kwangsun Yoo[1,4]; [1]Sungkyunkwan University, [2]Kangbuk Samsung Hospital, [3]Yale University, [4]Samsung Medical Center

Previous studies have demonstrated structural similarity networks (SSNs) derived from T1-weighted MRI reflect individual's structural brain networks, but their ability to infer functional connectivity and predict behavior remains underexplored. This study examines whether SSNs encode functionally relevant information for predicting functional connectomes (FCs) and cognitive performance through cross-modal connectome transformation models. We used task-free and attention-task fMRI data from 92 participants from Yoo et al., 2022a. SSNs were constructed using structural similarity metrics between volumetric regions parcellated by the Shen atlas (Oskar et al., 2019; Shen et al., 2013). To predict task-free FCs from SSNs, we created cross-modal connectome transformation models by adapting connectome-to-connectome transformation modeling framework (Yoo et al., 2022b). Predicted FCs were evaluated for their similarity to empirical FCs and their ability to predict individual attention functions using connectome-based predictive modeling (CPM). Predicted FCs exhibited high spatial correlation with empirical FCs ($r = 0.70$; $q^2 = 0.49$). Furthermore, predicted FCs demonstrated high state specificity (task-free vs. task-related states). Behavioral predictions based on the predicted FCs ($r = 0.22$, $p = 0.04$, $q2 = 0.05$) outperformed those using SSNs alone ($r = 0.06$, $p = 0.56$, $q2 = -0.13$), indicating that SSNs encode meaningful functional-information relevant to attentional behaviors. Notably, predicted FCs exhibited behavior prediction performance comparable to empirical FCs ($r = 0.38$ $p < 0.01$, $q2 = 0.12$). This study highlights feasibility of leveraging SSNs and cross-modal transformation models to infer the brain's functional architecture and predict behavior, suggesting a practical tool when direct functional data are unavailable.

Topic Area: METHODS: Neuroimaging

F29 - Novel Optical Parallelized Diffuse Correlation Spectroscopy Distinguishes Subtle Task-Specific Prefrontal Cortical Activity

Akhilesh Chegu[1] (akhilesh.chegu@duke.edu), Lucas Kreiss[1], Paul McKee[1], Melissa Wu[1], Roarke Horstmeyer[1], Scott Huettel[1]; [1]Duke University

Non-invasive optical imaging measures physiological markers of brain activity at high temporal resolution, with fewer restrictions, and at a lower cost than traditional neuroimaging techniques. Here we explore the potential of a new technique, Parallelized Diffuse Correlation Spectroscopy (PDCS), which measures the scattering of near-infrared light using a single-photon avalanche diode (SPAD) array. Fluctuations in the resulting speckle patterns create a calculated blood flow index (BFI) that provides insights into capillary perfusion, often underestimated by traditional absorbance-based techniques. Building on prior work distinguishing prefrontal cortex (PFC) blood flow in resting vs. task-activated states, this study evaluates PDCS' ability to differentiate PFC activation across executive functioning tasks. Participants completed a Go-No-Go task (targeting the right inferior frontal cortex [RIFC]) and a Verbal Fluency Task (VFT; targeting the left inferior frontal cortex [LIFC]) while PDCS measured regional blood flow. Results were compared to functional near-infrared spectroscopy (fNIRS), a well-established technique that tracks cortical blood oxygenation via light absorption. PDCS data revealed distinct task-specific activation: Go-No-Go increased RIFC activation relative to LIFC and VFT, while VFT increased LIFC activation relative to RIFC and Go-No-Go. These findings demonstrate PDCS' sensitivity to subtle, region-specific neural activity, supporting its potential as an effective tool for optical blood-flow neuroimaging.

Topic Area: METHODS: Neuroimaging

F30 - Characterizing neural and behavioral signatures of normal cognition using TD-fNIRS Across the Adult Lifespan

Julien Dubois[1], Ryan M. Field[1], Erin M. Koch[1], Zahra M. Aghajan[1], Naomi Miller[1], Katherine L. Perdue[1], Moriah Taylor[1]; [1]Kernel, Culver City, CA, USA

Probing different domains of cognition from a neural and behavioral perspective is of interest to both scientific and clinical communities: from unravelling mechanisms underlying cognitive function and dysfunction to using this understanding to inform and enhance clinical assessment and intervention. Using a portable time domain functional near infrared spectroscopy (TD-fNIRS) system, the Kernel Flow, we are measuring brain activation and behavior in 200 healthy adults—with an age range of 40 to 80 years old, targeting 50% female— while they perform a set of internally developed tasks adapted from commonly-used cognitive experiments and neuropsychiatric assessments. These tasks include the verbal fluency test, the N-back task, and a resting-state task, as in our previous study aimed at classifying Mild Cognitive Impairment in an older population. We added versions of the Trail Making Test, the Culture Fair Intelligence Test, delayed verbal recall, and visuospatial recall for a more thorough neuropsychological assessment. Each participant is assessed twice at a 1 month interval to evaluate reliability. In the first 50 participants, behavioral performance varied as a function of cognitive load as expected in each task, and as a function of age, validating the battery of tasks we chose and their implementation. Furthermore, brain hemodynamic responses derived from general linear models (GLMs) yielded patterns of activations at the group level that matched the literature as well as our previous work. This work is a stepping stone to a larger, multi-site data collection effort aimed at establishing normative neural and behavioral ranges for cognitive function.

Topic Area: METHODS: Neuroimaging

F31 - Neural synchrony network disruptions in Alzheimer's disease revealed with MEG imaging

Pooja Prabhu[1], Kiwamu Kudo[1,2], Leighton Hinkley[1], Faatimah Syed[3], Anne Findlay[1], Bruce Miller[3], Joel Kramer[3], John Houde[4], Keith Vossel[3,5], Kamalini Ranasinghe[3], Srikantan Nagarajan[1]; [1]Department of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, USA, [2]Medical Imaging Business Center, Ricoh Company Ltd., Kanazawa, Japan, [3]Memory and Aging Center, Department of Neurology, University of California San Francisco, San Francisco, CA, USA, [4]Speech Neuroscience Laboratory, Department of Otolaryngology—Head and Neck Surgery, University of California San Francisco, San Francisco, California 94143, USA, [5]Mary S. Easton Center for Alzheimer's Disease Research, Department of Neurology, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, CA 90095, USA

Changes in brain network function, specifically neural synchrony have been clearly demonstrated in patients with Alzheimer's disease (AD). Previous electrophysiological studies reveal that delta and theta oscillatory activity increases in AD, while alpha and beta activity decreases. These abnormalities are frequency-specific and region-dependent, but their consistency across different local and long-range neural synchrony metrics remains unknown. Here, in a well characterized, AD biomarker positive cohort of 77 AD patients and age-matched controls (n=90), we used magnetoencephalography (MEG) to examine the local and long-range oscillatory abnormalities. Specifically, source-space reconstructed MEG signal for 40 modular level cortical regions (Brainnetome-atlas) was used to compute three different metrics: local synchrony estimated as regional spectral power; long-range synchrony at slow time-scale estimated from amplitude-envelope correlation; and long-range synchrony at fast time-scale estimated from imaginary coherence. Each measure was computed for 2–7 Hz (delta-theta), 8–12 Hz (alpha), and 15–29 Hz (beta) bands. Consistent with previous results, we found that increased delta-theta and reduced alpha and beta oscillatory activity patterns in AD compared to controls. A conjoint analysis, in which we examined the common spatial patterns across different metrics of neural synchrony demonstrated that the frequency-specific patterns have consistent regional dependencies. The dorsal frontal and anterior cingulate cortices showed the highest delta-theta increases, while the inferolateral temporal cortices and posterior temporoparietal regions consistently showed the greatest reductions in alpha band. Our results show that frequency-specific, region-dependent neurophysiological manifestations in AD are conserved across different synchronization paradigms that contribute to the functional architecture of neural networks.

Topic Area: METHODS: Neuroimaging

F32 - BrainPowerX - A New Empirical Algorithm for Power Calculation for fMRI

Fabricio Cravo[1], Stephanie Noble[1,2]; [1]Northeastern University, [2]Yale University

Although fMRI research has transformed our understanding of the human brain, recent studies highlight a critical lack of statistical power (probability of detecting true effects) throughout the field. The high probability of missing true effects limits our ability to learn more about how the brain is functionally organized and poses a major challenge to reproducing results. A proper power analysis enables researchers to mitigate this through sample size estimation and optimization of other elements of analysis for the detection of effects of interest. Existing power calculators rely primarily on parametric methods, which assume prior knowledge about the nature of the underlying probability distribution of the effect. Furthermore, they often exclude more complex inferential procedures often used in neuroimaging, limiting their applicability. To address these limitations, we propose BrainPowerX, a web-based, non-parametric power calculator tailored to typical fMRI studies. It will use data from large, publicly available datasets to estimate true effects and simulate experimental conditions through repeated subsampling. Power will be calculated by measuring the proportion of repetitions where effects are successfully detected in comparison with "ground truth" effects identified from the whole dataset. Preliminary results provide initial power estimates for various inferential methods. Current efforts focus on expanding the flexibility of a Matlab toolbox to accommodate power estimates from more diverse experimental designs. Ultimately, we aim for this toolbox to be an easily-accessible and user-friendly web app that empowers researchers to assess whether their experimental parameters provide sufficient sensitivity to detect their desired effects and adjust experiments accordingly.

Topic Area: METHODS: Neuroimaging

F33 - Dynamic Volitional Respiratory Modulation Increases Large-Scale Brain Network Integration

Jude Hammoud[1] (jhammoud@mgh.harvard.edu), Suk-tak Chan[2], Kenneth K. Kwong[3], Clemens C. Bauer[1,4,5,6], David Magone[7], Susan Whitfield-Gabrieli[6], Karestan Koenen[8]; [1]Center for Precision Psychiatry, Massachusetts General Hospital, [2]Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, [3]Department of Radiology, Massachusetts General Hospital, Harvard Medical School, [4]Department of Psychology, Northeastern University, [5]Department of Brain and Cognitive Sciences and McGovern Institute for Brain Research, Massachusetts Institute of Technology, [6]Department of Psychiatry, Harvard Medical School, [7]Down Under School of Yoga, Boston, MA, [8]Department of Epidemiology, Harvard T.H. Chan School of Public Health, Harvard University

Volitional breath control modulates nervous system activity, promoting emotional regulation and psychological flexibility—similar to effects seen with psychedelics and meditation. Its neurophysiological mechanisms, particularly the interplay between the Default Mode Network (DMN) and Frontoparietal Control Network (FPCN)—key systems in self-referential processing and cognitive control, remain underexplored. We developed the Dynamic Volitional Respiratory Modulation (DVRM) paradigm, incorporating brief hyperventilation and breath retention, to investigate its effects on resting-state connectivity. Five participants experienced in DVRM completed three rounds of hyperventilation (10, 6, and 6 minutes), each followed by a 1-minute breath-hold, with the final round including up to a 3-minute breath-hold. Resting-state fMRI scans were acquired pre- and post-paradigm. Functional connectivity analyses targeted resting-state networks using masks from Yeo et al. (2011) and Choi et al. (2012). Multiple comparisons were corrected using false discovery rate (FDR). For all participants, post-task DMN-FPCN connectivity increased, with r values ranging from 0.665 to 0.959 (p less than 0.0001), reflecting 28.7 to 618.4 percent increases from baseline. Post-task Somatomotor Network (SMN)-DMN connectivity increased, with r values from 0.360 to 0.904 (p less than 0.0001), corresponding to 19.8 to 381.1 percent increases from baseline. Pre-task SMN-DMN connectivity was non-significant for one participant (p equal to 0.065). Results reflect large-scale network integration, a pattern observed in psychedelic and meditative states. In post-task interviews, participants reported altered self-perception, emotional catharsis, and vivid sensory experiences. DVRM appears to facilitate resting-state network integration, consistent with mechanisms underlying these altered states, suggesting its potential as a complementary strategy in mental health interventions.

Topic Area: METHODS: Neuroimaging

F34 - Development of a Diagnostic Model for Mild Cognitive Impairment Using Brain Functional Connectivity

Chisho Takeoka[1] (takeoka.chisho904@mail.kyutech.jp), Tetsushi Yada[1], Toshimasa Yamazaki[2], Yoshiyuki Kuroiwa[3], Kimihro Fujino[3], Toshiaki Hirai[3], Hidehiro Mizusawa[4]; [1]Graduate School of Computer Science and Systems Engineering, Kyushu Institute of Technology, [2]Office for Career Support, School of Computer Science and Systems Engineering, Kyushu Institute of Technology, [3]University Hospital, Mizonokuchi Teikyo University School of Medicine, [4]National Center of Neurology and Psychiatry

Proper diagnosis of mild cognitive impairment (MCI) is important in the early detection of dementia. In this study, we tested the possibility of discriminating between electroencephalography (EEG) data of MCI patients and healthy elderlies by machine learning. 16 regions of EEG data measured for 7 MCI patients and 10 healthy elderlies were separated into 6 frequency bands each, and the functional connectivity between two brain regions were calculated with Synchronization Likelihood (SL) in each frequency band. A discriminator based on 16C2 SL values was constructed for each frequency band, and the discrimination rates between MCI and healthy elderlies were calculated. Leave-one-out, leave-two-out, and leave-three-out cross-validations were performed to evaluate the discriminator, and the SL values used for cross-validation were selected in the range of 1 to 120 using Recursive Feature Elimination (RFE). The results showed that the discrimination rates with random forests using 12 SL values in the lower alpha band were 88%, 75%, and 72% for leave-one-out, leave-two-out, and leave-three-out cross-validation, respectively. The SL values that were frequently selected throughout the series of RFEs represented the functional connectivity of the frontal and left temporal lobes, indicating the robustness of the discriminator with these SL values. These indicate that it is possible to identify MCI using EEG data and that functional connectivity between the frontal and left temporal lobes is associated with cognitive dysfunction in MCI. Details will be presented in a poster presentation.

Topic Area: METHODS: Other

F35 - Spirit in Physics: Structuring and Quantifying Human Spirit Using the Vector Space

Jun Kawasaki[1] (root@junkawasaki.com), Kazuki Tainaka[2], Tomonori Takeuchi[3]; [1]Graduate School of Medical and Dental Sciences, Niigata University, [2]Brain Research Institute, Niigata University, Japan, [3]Department of Biomedicine, Aarhus University, Denmark

Spirit, a concept deeply rooted in human consciousness, has been traditionally unquantifiable in physical sciences. This study introduces the Kawasaki Model, which conceptualizes human spirit as a vector space, allowing for its measurement and structuring analysis through physics empirical methods. The research employs skin potential measurements and emotion analysis to investigate spirit's physics structure and dynamics. Inspired by the Rubber-Hand, Marble-Hand illusions and Traditional Buddhism Mandala Method. Participants are vectorizing conceptual structures using the Mandala method. They are exposed to physical and digital stimuli as they interact with conceptual separations and integrations, observing changes in skin potential and facial expressions. These responses are timestamped and analyzed, revealing the impact of self-expansiveness—spirit's core property—on both physicality and cognition. Results demonstrate that spirit can be quantitatively measured and represented as vectors in an information space. The study finds that self-expansiveness influences individual behavior, societal structures, and even physiological states, acting as energy and mass in physical terms. This novel approach provides a foundation for integrating spirit into physical sciences, with potential applications in understanding mental health, social dynamics, and personal growth. Future work will validate and expand these findings to ensure reproducibility and broader applicability. Keywords: spirit, physics, Kawasaki Model, vector space, self-expansiveness, skin potential, emotion analysis, well-being, methods, embedding, UMAP, information

Topic Area: METHODS: Other

F36 - Effect of Transcranial Photobiomodulation on Clinical Symptoms, Quality of Life, and Brain Connectivity Alterations in Dementia with Lewy Bodies

Anne Botzung[1,2] (abotzung@unistra.fr), Eléna Chabran[1], Malvina Billères[3], Marjorie Dole[3], Antoine Robinet[3], Olivier Bousiges[1], Paulo Loureiro De Sousa[1], John Mitrofanis[3], Blanc Frédéric[1,2]; [1]ICube Laboratory UMR 7357, Université de Strasbourg, CNRS, Strasbourg, France, [2]Centre Mémoire de Ressources et de Recherche (CM2R), Départements de neurologie et gériatrie, Hôpitaux Universitaires de Strasbourg, Strasbourg, France, [3]Université Grenoble Alpes, Fonds de Dotation Clinatec, Grenoble, France

Dementia with Lewy bodies (DLB) is the second most common progressive cognitive disorder after Alzheimer's disease (Aarsland et al. 2008). No treatments currently exist to slow its pathological processes or manage symptoms effectively. Photobiomodulation (PBM), which involves applying red to infrared light (λ=600-1000nm) to body tissues, has shown neuroprotective effects and improved cognitive and motor behavior in animal models of dementia (Adaikkan et al. 2019; Enengl et al. 2020; Tao et al. 2021). Preliminary studies in Alzheimer's and Parkinson's patients have also produced promising results (Saltmarche et al. 2017; Chao 2019; Nizamutdinov et al. 2021). This method has the advantages of being non-invasive, non-pharmacological, inexpensive, and easy to use, but has not been tested in DLB. We aim to assess whether PBM can act on the symptoms and experience of DLB by patients and their caregivers, help rebalance cerebral functional connectivity, and ensure a neuroprotective effect. Due to DLB's unique pathophysiology, this study may have a greater impact than similar trials in Alzheimer's or Parkinson's disease. Our small-scale placebo-controlled clinical trial will include 30 prodromal DLB patients, split into active and placebo groups. PBM will be applied twice daily using the LUCIOLE Cap, an innovative device developed specifically for this study. Participants will undergo evaluations at baseline, 3 months, and 6 months, assessing brain functional connectivity (rs-fMRI), cognitive and motor abilities, patient and caregiver wellbeing, and blood biomarkers (neurofilaments, phosphorylated tau 181, Aβ40/42 ratio). This study will be the first step in assessing PBM as a non-invasive treatment for DLB.

Topic Area: METHODS: Other

F37 - The potential moderating role of estrogen in effects of transcranial direct current stimulation on working memory

Samantha Walsh[1], Alexandra Gaynor[1]; [1]Montclair State University

Effects of anodal transcranial direct current stimulation (tDCS) on cognitive performance are known to be highly variable, and there is growing evidence that individual differences in endogenous brain activity may account for much of the heterogeneity in response to stimulation. Higher estrogen levels in females have been associated with increased cortical excitability, but no research to date has tested whether endogenous estrogen levels moderate the effects of tDCS on cognitive performance. In a within-subjects experiment, 24 healthy female participants, 18-35 years old with normal menstrual cycles, completed an n-back working memory task while high-definition tDCS was applied to the left dorsolateral prefrontal cortex (DLPFC). Across four sessions, participants received 20 min of anodal active (2mA) or sham tDCS during the late luteal (low estrogen) or late follicular (high estrogen) phase of their menstrual cycle. Data collection is ongoing. We hypothesize that tDCS over the DLPFC will have a greater effect on working memory performance during the late follicular phase compared to the late luteal phase, suggesting a moderating role of dynamic estrogen levels in cognitive effects of tDCS. Results will contribute to our understanding of individual differences in cognitive outcomes of tDCS, and inform the development of interventions that optimize potential benefit for female populations, such as tailoring stimulation protocols to align with menstrual cycle phases.

Topic Area: METHODS: Other

F38 - Trial-level representational similarity analysis

Shenyang Huang[1] (shenyang.huang@duke.edu), Cortney M. Howard[1], Ricardo Morales-Torres[1], Matthew Slayton[1], Paul C. Bogdan[1], Roberto Cabeza[1], Simon W. Davis[1]; [1]Duke University

A neural representation refers to the brain activity that stands in for one's cognitive experience, such as seeing an image of a cardinal. In cognitive neuroscience, one major approach to studying neural representation is representational similarity analysis (RSA). The classic RSA (cRSA) method examines the overall quality of representations across a number of instances (e.g., cardinal, broccoli, hammer) by assessing the correspondence between two representational dissimilarity matrices (RDMs): one based on some theoretical model of stimulus similarity and the other based on neural activity data. However, cRSA fails to appropriately account for three levels of statistical variability: participant, stimulus, and trial. Here we formally introduce trial-level RSA (tRSA), an innovative analytical framework that aims to measure the strength of neural representation for a single instance. First, we demonstrated how tRSA works by comparing RDMs at the level of trials, and we validated its numerical correspondence to cRSA in quantifying overall representation strength. Second, we compared the statistical inferences drawn from both frameworks using simulated data that reflected a wide range of scenarios. Modeling tRSA in a multi-level framework was more theoretically appropriate and demonstrated significant enhancements in Type I and Type II error rates compared to cRSA. Third, using a real fMRI dataset, we further demonstrated the issues with cRSA, validated the robustness of tRSA, and presented some novel analyses of neural representation that are not answerable with cRSA but feasible with tRSA. In summary, tRSA proves to be a robust and versatile analytical approach for cognitive neuroscience at large.

Topic Area: METHODS: Other

F39 - Clinical Correlation of Stereopsis to Dementia Diagnosis in a Memory Clinic

Rui Huang[1] (rui.huang@thealzcenter.org), Surya Sunil[2], Viviana Obando[3], Malini Nair[4], Anil K Nair[5]; [1]Alzheimer Disease Center

Background: We attempted to find if depth perception as measured by stereopsis can be used as an early biomarker for preclinical dementia diagnosis. Methods: The study was conducted at the Alzheimer Disease Center, a suburban memory clinic serving the south shore of Boston MA. We collected retrospective data by chart review on patients during the period July 2010 to December 2024. A retrospective database search included subjects with memory impairment with a diagnosis code and stereopsis score. All data analyses were performed using R version 4.3.1. Spearman Correlation was performed for univariate correlations of age and education. Normality analyses determined the use of Kruskal-Wallis Chi Square test for predicting diagnosis codes. Results: We identified 748 subjects with stereopsis and diagnosis code. Mean Stereopsis was 7.01 (SD 4.27), mean age was 70 (SD 14.18), mean education 12.8 years (SD 3.27), 85.11% Caucasians and 58.87% females. Stereopsis negatively correlated with age ($r=-0.207$ p.value<0.0001) and positively with education ($r=0.347$, $p<0.0001$). We found a significant association of stereopsis to the initial diagnosis code in the clinic (Kruskal Wallis Chi=28.9, $p=0.000008$). Conclusion: A pilot study of stereopsis for predicting dementia diagnosis in a memory clinic showed a significant univariate association. Further study including creation of multivariate models is needed.

Topic Area: METHODS: Other

F40 - NITRC's Triad of Services: Software, Data, Compute

Christian Haselgrove[1] (christian.haselgrove@umassmed.edu), Richard Brash[2], Albert Crowley[2], David Kennedy[1], Abby Paulson[3], Nina Preuss[4]; [1]UMass Chan Medical School, [2]Turner Consulting Group, Inc, [3]Alpine 22, [4]Preuss Enterprises, Inc

The NeuroImaging Tools and Resources Collaboratory (NITRC) is a neuroimaging knowledge environment for MR, PET/SPECT, CT, EEG/MEG, optical imaging, clinical neuroinformatics, computational neuroscience, and imaging genomics tools and resources. NITRC's Resource Registry (NITRC-R) catalogs and promotes software, vocabularies, test data, databases, and other resources, thereby extending the impact of previously funded neuroimaging informatics contributions. NITRC-R provides efficient access to research tools and resources, categorizing and organizing resources, facilitating interactions between researchers and developers, and promoting better use through enhanced documentation and tutorials. The NITRC Image Repository (NITRC-IR) hosts freely-downloadable data, offering 22 data projects, over 14,000 subjects, and 21,500 imaging sessions. NITRC-IR recently took over curation of the OASIS dataset and other projects from XNAT Central. The NITRC Computational Environment (NITRC-CE) provides cloud-based configurable computational services via Amazon Web Services and can also be downloaded to local machines. Funded by the NIH since 2006, NITRC continues to identify existing software tools, resources, and data in order to support research, education, and neuroinformatics efforts.

Topic Area: METHODS: Other

F41 - Preliminary Exploratory Analysis of Autistic Camouflaging using Machine Learning

Dan Kingsley[1] (dkingsl2@gmu.edu), Goldie McQuaid[1], Allison Jack[1]; [1]George Mason University

Autistic populations have greater mental health challenges such as anxiety than non-autistic populations. Camouflaging, the attempt to appear "non-autistic" in social situations, has been correlated with higher levels of anxiety. We used data from autistic participants in the GENDAAR cohort (NDA data Collection #2021), exploring variable importance in relation to camouflaging (assessed via the Camouflaging Autistic Traits Questionnaire [CAT-Q]) with a machine learning model. Data from a subset of individuals (N=101; 15-30y; 46 assigned female at birth [AFAB]) were preprocessed and run through ridge, LASSO, and elastic net regression machine learning models in R. Features evaluated (n=23) included domain scores from measures of autistic traits (SRS-2), restricted repetitive behaviors (ADI-R:C), and co-occurring psychiatric and behavioral symptoms/traits (ABCL/CBCL). The best fit models were the LASSO (R2 =.05; RMSE=22.67; MAE=17.59) and the elastic net (R2 =.02; RMSE=23.31; MAE=17.78). The variables of most importance were sex assigned at birth (SAB), anxiety problems, and unusual sensory interests, all of which were correlated with higher predicted levels of camouflaging; and rule-breaking, which was correlated with lower levels. These preliminary findings indicate that being AFAB, higher levels of anxiety, and unusual sensory interests predict greater camouflaging. This suggests that AFAB individuals struggle with anxiety more than AMAB (assigned male at birth) individuals partially because of mental burden associated with camouflaging. Rule-breaking behaviors may indicate lower recognition of social rules, underlying factors which may translate into less awareness or usage of camouflaging. Final models will be run with MRI data to explore the neural correlates of camouflaging.

Topic Area: METHODS: Other

F42 - Reducing Bias in Autism Spectrum Disorder Diagnostic Procedures Through Machine Learning

Georgia Agoritsas[1] (gagoritsas@outlook.com); [1]The Bronx High School of Science

Autism spectrum disorder (ASD) is a developmental disability that causes one to act, think, and communicate differently than what is considered the social norm. Historically, ASD was associated with males, a concept rooted in Asperger's syndrome and its original studies. Recently, more females have been diagnosed, but many still remain undiagnosed. Therefore, this project examined correlations between ASD diagnosis and traits, such as sex, ethnicity, or score on one of ten questions from the AQ-10 autism diagnostic assessment. Using a UCI Adult Autism Screening dataset of around 700 participants, machine learning was incorporated to analyze the dataset using data preprocessing, correlation analysis, and predictive modeling. A correlation map determined a significant relationship between AQ-10 responses and diagnosis (correlation ≥ 0.54) and a negative correlation between gender and diagnosis (-0.12). This suggests that certain autism traits can be focused on more than others when being diagnosed with autism, and gender does not significantly impact an autism diagnosis. Altogether, this supports the idea that anyone can be diagnosed with autism if they exhibit the proper criteria for it and that a bias should not be held when diagnosing a patient with autism. Machine learning could further reduce this bias in autism diagnoses, providing a fairer, more accurate assessment process.

Topic Area: METHODS: Other

F43 - Does scientific research reflect the diversity of mental experience?

Douglas Forrest[1] (douglas.forrest@ubc.ca), Desmond Wood-Anderson[1], Andre Zamani[1], Caitlin Mills[2], Kalina Christoff Hadjiilieva[1]; [1]University of British Columbia, [2]University of Minnesota

Mental experiences range from being closely tied to current sensations to being relatively independent of them. Mental processes tied to current sensations have been studied under the rubrics of exteroception and interoception, whereas processes independent of current sensations have been studied under many names, such as mind-wandering, mental time travel, and autobiographical memory. Here we propose a framework categorizing mental experiences based on their origin, defining exteroception as experiences originating from the outside world (e.g., vision), interoception as experiences originating from within the body (e.g., heart-rate perception), and conceptive experiences as those originating from within the mind (e.g., memories or thoughts). We empirically estimate the degree to which each stream of experience is represented within the scientific literature, including the fields of cognitive neuroscience and psychology. We downloaded and analyzed 4.2 million research article abstracts in neuroscience and psychology from the Scopus database, covering publications dating back to the 1970s. We used a custom-made program to identify words in those abstracts relating to exteroception, interoception, or conception, allowing us to estimate the degree to which these themes are studied over time. Results suggest that exteroception is overrepresented relative to interoceptive and conceptive terms across a variety of fields. The conceptive stream was also underrepresented in research compared to the prevalence that it occupies in daily life. Overall, there is an indication that the percentage of research dedicated to the conceptive stream is increasing over time.

Topic Area: METHODS: Other

F44 - Shared genetic etiologies between type 1 diabetes and neurobiological traits

David Alagpulinsa[1,2], Priscilla Priscilla Saarah[1,2], Zehra Syeda[1,2], Ziang Xu[1,2], Yikai Dong[1,2], Samira Asgari[3,4], Andrew DeWan[5,6]; [1]Yale Center for Molecular and Systems Metabolism, Yale University School of Medicine, New Haven, CT, USA., [2]Department of Comparative Medicine, Yale University School of Medicine, New Haven, CT, USA., [3]Institute for Genomic Health, Icahn School of Medicine at Mount Sinai, New York, NY, USA., [4]Department of Genetics and Genomic Sciences, Icahn School of Medicine at Mount Sinai, New York, NY, USA., [5]Center for Perinatal, Pediatric and Environmental Epidemiology, 60 College Street, Yale School of Public Health, New Haven, CT 06510, United States., [6]Department of Chronic Disease Epidemiology, Yale School of Public Health, 60 College Street, New Haven, CT 06510, United States.

Epidemiological observations have reported accelerated and/or high prevalence of nearly every neuropsychiatric disorder in patients with type 1 diabetes (T1D). The biological mechanisms underlying this association remain unclear. We examined whether shared genetic factors contribute to the clinical overlap between T1D and neurophenotypes using state-of-the-art statistical genetic analyses of large-scale genome-wide association studies (GWAS) summary data for T1D and 24 distinct neuropsychiatric traits, as well as single-blood and brain cell expression quantitative trait loci (eQTL) data. We found that T1D shares significant genome-wide genetic architecture with several neurophenotypes, including multiple sclerosis, myasthenia gravis, migraine, insomnia, autism-spectrum disorder, bipolar disorder, educational attainment, and intelligence. Several T1D risk loci were identified as being jointly associated with these neurophenotypes. Summary-data-based Mendelian randomization and heterogeneity in independent instruments analysis revealed potential causal genes shared by T1D and neurophenotypes, including RPS26, LRRC37A2, ARL17A, CRHR1-IT1, LRRC37A2, DNDP1, PLEKHM1, RP11-25918.3, RP11-707023.3, RP11-259G18.2, KANSL1-AS1 and LRCC37A49. We showed that while genetic liability to T1D is associated with risk of only migraine and myasthenia gravis, several genetically proxied neurophenotypes are associated with risk of T1D, including increased risk in multiple sclerosis, myasthenia gravis, attention deficit/hyperactive disorder, obsessive-compulsive disorder, Parkinson's disease, and short sleep duration, and reduced risk in bipolar disorder, education, and intelligence. These findings highlight shared genetic factors that may contribute to the clinical overlap between T1D and neuropsychiatric traits and informs consideration of neuropsychiatric risk in T1D management.

Topic Area: METHODS: Other

F45 - Slow wave stimulation using a smartwatch improves sleep quality

Nathan W Whitmore[1] (nathanww@media.mit.edu), Wei Ting Samantha Chan[1], Abigail Dulski[1], Anita Podrug[1], Nelson Hidalgo[1], Nnamdi Obi[1], Varun K. Viswanath[2], Viswam Nathan[2], Pattie Maes[1]; [1]MIT, [2]Samsung Research America

Slow electrical waves in the cortex during sleep play a vital role in memory consolidation and restorative functions of sleep. Experiments that use rhythmic sounds to increase slow wave amplitude (closed-loop acoustic stimulation) have shown that increasing slow wave amplitude can improve measures of sleep quality and cognition. However, current systems used for slow wave enhancement are expensive, cumbersome, and fragile, limiting their use outside of research. To improve the usability of slow wave stimulation, we created a smartwatch app to stimulate slow waves using rhythmic vibration and sound. Stimuli are controlled using a machine learning model which uses motion and heart rate data to predict the optimal stimulus timing and intensity. We tested the effects of smartwatch stimulation in 106 participants who used the device at home. Stimulation (especially sound stimulation) increased frontal EEG delta power compared to no stimulation, replicating previous findings on the effects of slow wave stimulation. Continuous 0.8 Hz sound stimulation was more effective than vibration stimulation or intermittent stimulation. Participants with a large delta increase during stimulation showed improvements in self-rated sleep quality and mood and reduced errors on a trail-making task following stimulation. Our results suggest that smartwatch-based slow wave stimulation can replicate the effects of stimulation with more complex lab-based and EEG systems. Smartwatch stimulation could provide a path to wide use of slow wave stimulation for cognitive enhancement.

Topic Area: METHODS: Other

F46 - Beyond Traditional Factor Analysis: Exploring Latent Variable Modeling Strategies to Capture BrainHealth Index Trajectory.

Quentin Coppola[1] (coppola.q@northeastern.edu), Marc Yanguez[1], Jeffrey Spence[2], Lori Cook[2], Mark D'Esposito[3], Sandra Chapman[2], Susanne Jaeggi[1], Aaron Seitz[1]; [1]Northeastern University, [2]University of Texas, Dallas, [3]University of California, Berkeley

Brain health is a multifaceted construct encompassing cognition, mood, physical and mental well-being, and social engagement. Comprehensive batteries capturing these outcomes are crucial for evaluating the efficacy of interventions aimed to improve cognition and overall brain health. Integrating these subdomains in a unified model is challenging. Traditional exploratory and confirmatory factor analysis (EFA; CFA) methods often omit critical cross-loadings that better capture complex structures. Alternative methods leveraging flexible specifications (e.g., cross-loadings) may better capture this complex interplay, providing a more nuanced understanding and measurement of brain health. This study systematically evaluates latent variable modeling techniques to create a unified model of a brain health battery that includes measures of cognition, well-being, social interaction, and daily functioning. Data were collected from 4000 adults aged 18 to 92 (Mean [SD] = 61.4 [13.0]) through The BrainHealth Project led by the Center for BrainHealth (University of Texas, Dallas, USA). We compare traditional techniques, such as EFA and CFA, to alternative approaches, including exploratory structural equation modeling (ESEM), Bayesian confirmatory factor analysis (B-CFA), and latent network analyses (LNA). These methods provide greater flexibility in specifying interrelationships among variables, allowing for more nuanced representations of brain health. Results demonstrate the utility of these alternative models in characterizing underlying latent structures across a battery of over 20 measures while preserving key interactions between domains. Future work will leverage latent factors with complementary outcomes (e.g., brain imaging) to evaluate intervention efficacy and understand brain health across diverse populations, ultimately revealing the multidimensional contributors to brain health improvements.

Topic Area: METHODS: Other

F47 - Familiarity with everyday naturalistic scene categories in adults and children

Sanjivan Loganathan[1] (sanjivan.loganathan@mail.utoronto.ca), Sagana Vijayarajah[1], Margaret Schlichting[1]; [1]University of Toronto

Previous research has reported that participants' familiarity with particular scenes impacts cognition broadly, but whether effects would be similar with more general scene categories is unknown. In this study, we characterized how children and adults differ in self-reported familiarity with everyday scene categories. We predicted that adults would have greater familiarity with most categories. We asked children (n=42, 7-10 years old) and adults (n=42, 24-35 years old) to rate, compared to others their age, (1) how many different exemplars of a given category they had visited in their lifetime (1=only one to 5=many more than most people) and (2) how often they visited a given category exemplar (1=rarely to 5=frequently), from nine indoor and outdoor categories each. As responses to both questions were highly correlated, we created a composite score with both the ratings and compared them to each scene category between age groups. We found that adults were more familiar with grocery stores, city streets, clothing stores, movie theatres, and gyms than children. Children were instead more familiar with beaches, playgrounds, outdoor skating rinks and indoor swimming pools than adults. Surprisingly, we found no developmental differences in scene familiarity in many categories, including classrooms, amusement parks, libraries, zoos, farms, forests, bathrooms, bedrooms, and outdoor construction sites. Understanding the developmental differences in scene familiarity is essential for developing naturalistic scene stimulus sets for developmental research. Future work will leverage fMRI data to ask how individual differences in children's and adults' prior scene category familiarity relate to neural response.

Topic Area: METHODS: Other

F48 - Precision Brain Modeling Reveals a Bifurcation Mechanism and Local Circuitry Underlying Individual Differences

Matthew Singh[1,2], ShiNung Ching[3], Todd Braver[3]; [1]University of Illinois, Urbana-Champaign, [2]The Beckman Institute for Advanced Science and Technology, [3]Washington University in St. Louis

Task-free brain activity affords unique insight into the functional structure of brain network dynamics and has been used to identify neural markers of individual differences. In this work, we present an algorithmic optimization framework that directly inverts and parameterizes brain-wide dynamical-systems models involving hundreds of interacting neural populations, from single-subject M/EEG time-series recordings. This technique provides a powerful neurocomputational tool for interrogating mechanisms underlying individual brain dynamics ("precision brain models") and making quantitative predictions. We extensively validate the models' performance in forecasting future brain activity and predicting individual variability in key M/EEG metrics. We then resolve a dynamical systems mechanisms whereby variation in inhibitory connection strength generate a sudden shift in attractor topology—from equilibria to limit-cycles (stable oscillations). Individuals straddle this bifurcation boundary at resting-state (some with equilibria, some with limit cycles). Surprisingly, this distinction is the strongest predictor of individual differences in alpha and beta power at rest. Interestingly, it even differentiates slight age groups (early 20s vs. early 30s) with accompanying changes in spectral power distribution. We highlight implications for personalized neurostimulation and cognitive-enhancement through simulated optimal-treatments. Together, these findings highlight the potential of precision brain models to inform the neuroscience of individual differences.

Topic Area: METHODS: Other

F49 - Activating the Path to Recovery: TMS-Evoked Functional Connectivity Response Predicts Clinical Changes in Closed-Loop Accelerated rTMS for Depression

Gavin Doyle[1], Jayce Doose[1], Hengda He[2], Spiro P. Pantazatos[2], Xiaoxiao Sun[2], Chichi Chang[2], Sara Hashempour[1], Ruxue Gong[1], Linbi Hong[2], Corbin Ping[1], Jacob Eade[1], Christian Finetto[1], Brendan Murney[1], Abby Williams[1], Mark S. George[1], Robin Goldman[3], Paul Sajda[2], Lisa McTeague[1]; [1]Medical University of South Carolina, [2]Columbia University, [3]University of Wisconsin-Madison

Background: Transcranial Magnetic Stimulation (TMS) is a FDA-approved treatment for depression but it is not effective in half of patients and the underlying mechanisms remain unclear. Our prior work developed a fMRI-EEG-TMS (fET) instrument that acquires fMRI and EEG simultaneously while delivering TMS. This showed TMS-evoked functional connectivity (FC) between the dorsolateral prefrontal cortex (DLPFC) and the subgenual anterior cingulate cortex (sgACC) depended on an individual's EEG phase at stimulation onset. TMS-evoked responses in the cognitive control and limbic networks significantly predicted clinical improvement for patients that received six weeks of once-daily closed-loop EEG-TMS treatment. We are investigating if our prior FC prediction results replicate in an accelerated repetitive TMS (rTMS) paradigm, where all treatment sessions are compressed into 1 week. Methods: Depressed patients undergo a fET session, then receive six closed-loop rTMS treatments a day for five days. fMRI and EEG data are processed to identify FC networks and alpha phase. Depression scores are evaluated over time. Results: Two patients have completed treatment and their fET session, with four more patients completing soon. We expect to see similar results to prior analysis on 22 fET datasets that FC between DLPFC and sgACC is modulated by EEG phase. We also expect to see that clinical improvement is predicted by TMS-evoked responses in the cognitive control and limbic networks, which was shown in prior analysis of 20 fET datasets. Conclusion: This work will demonstrate that FC predicts clinical improvement in a 1-week accelerated rTMS protocol, like our prior 6-week treatment protocol.

Topic Area: METHODS: Other

F50 - Use and efficacy of commercially available tES devices: A systematic review and meta-analysis

Sara Anne Goring[1] (sara.goring@tufts.edu), Marissa Marko Lee[1], Sydni M. Nadler[2], Madelyn Sandone[1], Tad T. Brunyé[3,1]; [1]Center for Applied Brain and Cognitive Sciences, Tufts University, Medford, MA, USA, [2]Department of Psychology, Tufts University, Medford, MA, USA,, [3]U.S. Army DEVCOM Soldier Center, Natick, MA, USA

There is growing demand for cognitive enhancement in healthy, neurotypical individuals using transcranial electrical stimulation (tES) methods. In recent years, commercial, off-the-shelf (COTS) tES devices have become accessible to the public without necessitating the provision of clinicians or medical professionals. Given the increased availability, the efficacy and safety of these devices are important and timely factors to explore. A systematic review and meta-analysis were conducted to identify and aggregate research evaluating the effects of COTS tES devices for the enhancement of cognitive and physical abilities in neurotypical individuals. A total of 60 reports were identified that utilized one of the 27 available COTS devices. Most studies used ActivaDose II Iontophoresis (36) or Halo Sport (9), with many reporting null findings. Meta-analytic procedures evaluated the overall effect of these devices on cognitive and physical outcomes. Across the cognitive domains, COTS tES devices had mostly positive (38.1%) or null (56.6%) effects, with only 5.3% reporting negative outcomes (e.g., poorer recall after stimulation). Similarly, the effect of COTS tES devices on various physical outcomes resulted in positive (30.9%) or null (67.4%) effects, with only 1.7% indicating a negative effect. Follow-up analyses examined additional factors influencing the efficacy and safety of these devices, including electrode placement, current intensity, and stimulation duration. For example, 2mA was found to be the most frequent and effective amount of current for positive outcomes. Overall, COTS tES devices produced inconsistent effects across studies, and these outcomes varied depending on other factors in the study design.

Topic Area: METHODS: Other

F51 - Influence of social context and musical structure in processing musical conversations

Etienne Abassi[1] (etienne.abassi@mcgill.ca), Jesse Chittock[1], Christopher Robert Vaughan Soden[1], Robert Zatorre[1]; [1]McGill

This study explores the cognitive mechanisms underlying auditory scene analysis, focusing on the influence of social context and musical structure in musical conversations. Building on prior research in speech, we hypothesize that music and speech share overlapping features for social communication. To test this idea, we use stimuli consisting of two-instrument exchanges (to mimic conversation) or one-instrument sequences (manipulating social context) arranged in intact or phrase-scrambled order (manipulating musical structure). Each stimulus comprises five musical phrases, with the fifth phrase embedded in multi-instruments babble noise. This fifth phrase is then repeated without noise, with a single note either altered or unchanged. Healthy young adults judged whether the repeated phrase matched or differed from the previous in-noise phrase. This design, adapted from the validated Music-In-Noise task, also mirrors our previous study on social and semantic contexts in speech processing which showed that conversational context boosts speech perception. We hypothesize improved recognition of musical phrases in two-instrument exchanges compared to one-instrument sequences, reflecting the effect of social context. Additionally, better performance is anticipated for intact versus phrase-scrambled sequences, highlighting the role of musical structure. These findings aim to extend the framework of social cognition, demonstrating how music functions not only as an artistic expression but also as a medium for social exchange. By examining parallels between music and speech, this project seeks to uncover domain-general principles of auditory social communication, thus positioning music as a key tool for understanding social and cognitive processes and advancing applications in neuroscience and auditory technologies.

Topic Area: PERCEPTION & ACTION: Audition

F52 - Decoding speech and music from intracranial recordings: evidence for domain-general representations of sound in the human brain

Jérémie Ginzburg[1,2] (jeremie.ginzburg@mcgill.ca), Émilie Cloutier Debaque[2], Arthur Borderie[2], Laurence Martineau[3], Paule Lessard Bonaventure[3], Robert J Zatorre[1], Philippe Albouy[2]; [1]Montreal Neurological Institute, McGill University, Montreal, Canada, [2]CERVO research center, Laval University, Québec, Canada, [3]Centre Hospitalier Universitaire, Laval University, Québec, Canada

Speech and music represent the most complex ways through which humans use sound to convey information. Recent studies increasingly indicate that the human brain is finely tuned to encode the temporal and spectral features of sound that are crucial for processing speech and music, respectively. However, a key debate persists regarding the brain's representation of perceptual objects: does it rely on category-based encoding (domain-specific view) or physical sound features (domain-general view)? To investigate this question, we conducted stereo-electroencephalography recordings in eleven epilepsy patients with electrodes implanted into the auditory cortex as they listened to a natural stimulus (the audio track of a famous movie) containing both speech and music. Using multivariate ridge and logistic regression analyses, we decoded the spectrotemporal features of the sound from the brain activity. These decoded features were then used to predict the speech/music categories of the sound, based on independent behavioral judgments obtained from 19 healthy listeners. Separately, we decoded the spectrotemporal features of the audio signal underlying these perceptual categorizations. Strikingly high ranked correlations ($0.77 < \rho < 0.91$, all corrected p-values $< .001$) were observed between the spectrotemporal features decoded from brain activity that were used to predict perceptual categorization and the spectrotemporal features associated with perceptual categorization. These findings suggest that the categorization of speech and music relies primarily on the spectrotemporal features of sound, providing robust evidence in favor of the domain-general view that higher-order sound representations in the brain are grounded in their physical properties.

Topic Area: PERCEPTION & ACTION: Audition

F53 - Do listeners access abstract morphological representations while processing speech? A representational similarity analysis of event-related potentials

Chiung-Yu Chang[1] (chiungyuchan@umass.edu), Alexandra Jesse[1], Lisa D. Sanders[1]; [1]University of Massachusetts Amherst

The English plural suffix is pronounced as /z/, /s/, or /ɪz/ depending on the phonological context. Classical linguistic analyses posit an abstract representation of the suffix, while episodic theories do not. Neither of these approaches specify the timing of abstraction during speech processing. This study explored the representational geometries predicted by these theories. We recorded event-related potentials (ERPs) elicited by four types of sounds: /z/ as the canonical plural suffix (e.g., hill-/z/), /s/ as an illegal substitute for the plural suffix (e.g., hill-/s/), /z/ as the coda of a noun (e.g., maze), and /s/ as the coda of a noun (e.g., moose). Additionally, we manipulated the suffix predictability by adding a number (e.g., two hill-/z/) or a definite article (e.g., the hill and the hill-/z/). The acoustic-phonetic model supposes no abstract representation of the suffix, predicting that ERPs for /z/ will always differ from those for /s/. In contrast, abstractionist models predict that ERPs for /z/ and /s/ will be more similar when they serve the same syntactic function. Representational dissimilarity matrices (RDMs) based on these predictions were compared to RDMs derived from the observed ERP data in early and late time windows (i.e., 100-200 and 400-500 ms after /s/ or /z/ onset). Results from 25 participants suggest that the acoustic-phonetic model best predicts the observed data, supporting episodic theories. However, an abstractionist model performs equally well for the late time window when the plural suffix is predictable, suggesting an interplay between predictability and allomorph representations during speech processing.

Topic Area: PERCEPTION & ACTION: Audition

F54 - Effects of Theta-Band Amplitude Modulation on Sustained Attention

Corinna Parrish[1], Arun Asthagiri[1], Psyche Loui[1]; [1]Northeastern University

Theta-band activity is linked to attentional sampling as well as to working memory. We investigate whether theta-band acoustic amplitude modulation, tailored to the beat of naturalistic music, can entrain neural oscillations and enhance cognitive performance. Additionally, we test whether individuals with ADHD symptoms (assessed with ADHD self-report scale, ASRS) are differently impacted by amplitude modulation. We added theta-band amplitude modulation to 32 popular songs and used the amplitude-modulated and unmodulated tracks as background music during the sustained attention to response task (SART) in young adults across three studies. Study 1: Results from an online sample of n=258 reveal differences between participants with and without symptoms of ADHD (ASRS+ and ASRS- groups): coefficients of variation for reaction time decreased over songs for the ASRS positive group only when listening to modulated music. Study 2: EEG (n=21) shows increased phase-locking in theta-band (4-8Hz) in the amplitude-modulated condition that differed between ASRS+ and ASRS- groups. Study 3: fMRI (n=40) highlights differences in brain activation between modulated and unmodulated music in the right anterior cingulate/supplementary motor area, right caudate, and left frontal pole areas, particularly in the ASRS+ group, suggesting that effects of amplitude modulation are related to working memory, executive function, and motor planning. Together, findings suggest that amplitude modulation in music can be used to target neural dynamics involved in attention, supporting cognitive function especially in individuals with attentional difficulties.

Topic Area: PERCEPTION & ACTION: Audition

F55 - Reduced habituation to tones in FXS compared to TD and ASD

Winko An[1] (anwenkang@gmail.com), Michael Khela[1], Meagan Tsou[1], Carol Wilkinson[1]; [1]Division of Developmental Medicine, Boston Children's Hospital

Background: Fragile X syndrome (FXS) is a rare genetic disorder often associated with autism spectrum disorder (ASD) and intellectual disability. Prior studies in FMR1 KO mice and adults with FXS report reduced neural habituation to repeated sounds, yet little is known about habituation in children with FXS compared to those with idiopathic ASD or Down syndrome (DS). Objectives: To characterize neural habituation to repeated tones in children with typical development (TD), ASD, FXS, and DS. Methods: Using an auditory paradigm, we presented pure tones (1000 Hz) in trials of three repeated tones, each separated by 500 ms, to 20 children with FXS (27–78 months, 3 females), 28 with ASD (32–83 months, 1 female), 26 with DS (24–68 months, 11 females), and 46 TD children (23–76 months, 9 females). High-density EEG data (≥40 trials per condition) were analyzed to extract P2 (44–188 ms) and N2 (216–384 ms) components. Habituation was calculated as the amplitude difference between First and Third tones (P2: First – Third; N2: Third – First) and assessed via one-sample t-tests. Results: TD ($p=0.009$) and ASD ($p<0.001$) groups showed significant P2 habituation, unlike FXS ($p=0.194$) and DS ($p=0.434$). TD ($p=0.022$) and DS ($p=0.012$) also showed N2 habituation, absent in ASD and FXS. Conclusions: TD children habituate to tones in both P2 and N2 components. Children with FXS lack significant habituation, while those with ASD or DS exhibit partial habituation in one component.

Topic Area: PERCEPTION & ACTION: Audition

F56 - Neural correlates of predictive speech processing in noise

Tugba Lulaci[1] (tugba.lulaci@ling.lu.se), Pelle Söderström[1,2], Mikael Roll[1]; [1]Lund University, [2]The National Acoustic Laboratories, Sydney, Australia

The processes underlying speech perception in the brain are still largely unknown. Rapid perception of speech requires efficient processing, and one of the largest challenges in perception is keeping up with the changing nature of signal, particularly in adverse listening conditions. Prediction is thought to be a mechanism that helps listeners anticipate upcoming acoustic information to cope with noise and ambiguity. This ongoing study investigates how varying levels of noise affect auditory predictions by examining event-related potentials elicited by matched and mismatched Swedish prosodic cues in clear speech and at different speech-shaped noise levels, offering new insights into the interaction between prosody, prediction, and adverse listening conditions. Native Central Swedish speakers between 18-40 years participated in the study. Participants had no neurological disorders and had normal hearing thresholds (250–8000 Hz). They listened to sentences presented in three conditions: no noise, 0 dB SNR and -5 dB SNR. Sentences were presented in matched -correct accent and suffix- and mismatched -cross-spliced accent and suffix- conditions and the participants were asked to choose if the sentence object they have heard was plural or singular. EEG data were collected using a 64-channel system, and ERP analyses focused on components linked to predictive mechanisms. Swedish word accents are known to reliably elicit predictive processing, and mismatched suffixes, increased prediction error. This research will contribute to understanding how noise impacts auditory predictive processing, focusing on the role of sentence and prosodic cues in facilitating speech comprehension. Ongoing analyses are refining the findings and assessing group-level effects.

Topic Area: PERCEPTION & ACTION: Audition

F57 - Across- but Not Within-Category Speech Discrimination Is Associated with Individual Phonological Awareness

Heesu Yun[1] (yun.he@northeastern.edu), Monique Montoute[1], Lauren Voso[1], Brynn Siles[1], Carlie Chukrallah[1], Tess Latham[1], Pradyumna Lanka[1], Frances Earle[2], Zhenghan Qi[1]; [1]Northeastern University, [2]University of Delaware

Phonological awareness, a foundational skill for language development, has been hypothesized to relate to speech-sound discrimination and its neural correlates. This study examines the relationship between electrophysiological markers, behavioral measures of phonological awareness, and speech discrimination performance in native English speakers ($n = 30$). Native English speakers completed the Comprehensive Test of Phonological Processing (CTOPP), which assesses phonological manipulation and synthesis skills through subtests such as Elision and Blending. Then, an auditory oddball task presented English consonant contrasts (/ba/and /ga/) to evaluate across- and within-category discrimination. EEG data were collected during the discrimination task using a 32-channel ActiChamp system. Event-related potentials (ERPs) were analyzed to extract mismatch negativity (MMN; 100–250ms) and late difference negativity (LDN; 300–550ms) components, focusing on group-level differences between native deviants and standard stimuli. Mass univariate analysis (MUA) identified electrodes showing significant ERP differences, controlling for multiple comparisons. Results revealed significant correlations between across-category discrimination and CTOPP scores. Specifically, MMN amplitudes for across-category stimuli correlated with Elision scores ($r = -0.32$), while LDN amplitudes demonstrated even stronger correlations with both Elision ($r = -0.43$) and Blending ($r = -0.32$). Interestingly, across- and within-category MMN were marginally correlated in a negative direction ($r = -0.28$). Within-category ERP components were not significantly associated with CTOPP scores. These findings suggest that phonological awareness is closely tied to neural markers of across-category discrimination, particularly LDN, while within-category discrimination appears less relevant. Greater sensitivity to speech categories may be related to reduced sensitivity to acoustic differences within categories.

Topic Area: PERCEPTION & ACTION: Audition

F58 - Function of the auditory cortex characterized with its intrinsic dynamic coactivation patterns estimated in individuals

Maria Hakonen[1,2] (mhakonen@mgh.harvard.edu), Kaisu Lankinen[1,2], Parker Kotlarz[1,2], Jonathan Polimeni[1,2,3], Tori Turpin[1], Jianxun Ren[4], Danhong Wang[1,2], Hesheng Liu[4,5], Jyrki Ahveninen[1,2]; [1]Athinoula A. Martinos Center for Biomedical Imaging, [2]Massachusetts General Hospital / Harvard Medical School, [3]Harvard-MIT Program in Health Sciences and Technology, [4]Changping Laboratory, [5]Biomedical Pioneering Innovation Center, Peking University

Local functional connectivity in auditory areas of the superior temporal cortex supports the hierarchical processing of sound. Although brain connectivity is now recognized as dynamic, most studies have overlooked smaller local networks, which can be obscured by their individual variability and the dominance of larger networks. Here, we investigated local dynamic functional connectivity, or coactivation patterns, of the networks in the auditory cortex (AC) determined from single frames of 7T fMRI data with a novel individualized network-based algorithm. The template network patterns were created by clustering and averaging the frames across participants. Thereafter, the frames of each participant were assigned to the template with the shortest spatial distance. The eight-cluster solution was selected for closer examination based on its high within-participant reproducibility values, which were 0.86 for the pattern occurrence rates and 0.79 for pattern spatial topographies. In contrast, between-participant correlations were lower, 0.66 for pattern occurrence rates and 0.58 for spatial topographies, indicating greater variability across individuals compared to within the same individual. Thus, dynamic AC patterns also captured interindividual variability. Each coactivation pattern had a corresponding inverse pattern in which the same network was deactivated. The coactivation patterns shared similarities between resting-state and auditory-task data, as indicated by the group-level similarity of 0.84 and individual-level similarity of 0.71 in the spatial topographies. Furthermore, the occurrence rates of AC patterns correlated with specific task contrast regressors. Our results suggest that the AC function can be characterized by recurring coactivation patterns that share similarities during resting state and auditory simulation.

Topic Area: PERCEPTION & ACTION: Audition

F59 - Perceptual similarity predicts item recognition errors but not serial order errors in auditory working memory

Abigail Noyce[1] (anoyce@andrew.cmu.edu), Will Yuhang Li[1,2], Eli Bulger[1], Barbara Shinn-Cunningham[1]; [1]Carnegie Mellon University, [2]University of Wisconsin

One source of memory errors is theorized to be similarity or confusability among stimuli. Perceptual organization of items or features into coherent objects also impacts how effectively working memory can maintain and retrieve those items. Here, we examine the effects of perceptual similarity and perceptual organization in auditory working memory for three classes of stimuli: complex tones at varying pitches (most similar), sampled natural sounds (most dissimilar), and feline vocalizations (in between). To further explore the critical role of temporal grouping in auditory object formation, we tested memory via two tasks with different probe structures (N = 40). In both tasks, the memory set was a sequence of 4 sound items from one category. In item recognition memory, a single probe item was played and listeners reported whether it matched any remembered item. In serial order memory, a probe sequence comprising the same 4 items was presented and listeners reported whether the items' order matched the remembered sequence. Item recognition performance was highest for natural sounds and lowest for complex tones; serial order performance had the reverse effect. All stimuli pairs were independently rated in similarity, allowing us to evaluate whether similarity predicted memory. In item recognition, the similarity between the probe and the memory sequence strongly predicted the probability of "present" responses. In serial order, there was no meaningful relationship. Probe-target perceptual similarity matters when the items must be maintained in memory as individual objects, but does not predict memory for temporal, sequential representations of events.

Topic Area: PERCEPTION & ACTION: Audition

F60 - Examining the relationship between behavioral and neural indices of nonnative speech perception

Meli R. Ayala[1] (aayala@udel.edu), Ali Solbi[1], F. Sayako Earle[1]; [1]University of Delaware

Learning a foreign language often involves learning new speech sounds that are difficult to disambiguate, but learners can distinguish between foreign speech contrasts through speech-perceptual training. The purpose of this study was to examine the relationship between behavioral and neural indices of nonnative speech sound discrimination. Native speakers of English completed two days of training in the Hindi contrast of the dental and retroflex stops. They were assessed throughout the week on their discrimination accuracy and completed a passive oddball electroencephalogram (EEG) experiment at the end of the week. Event-related potentials (ERP) were analyzed to track learning-induced plasticity of the nonnative contrast for both within (dental1 vs. dental2) and between (dental vs. retroflex) category contrasts. A time window of 250-350ms post-stimulus onset was identified through visual inspection of the difference waveform (deviant minus standard) and mean amplitude was calculated during the window. A linear mixed effects model confirmed the presence of significant mismatch negativity (MMN) at central electrodes (Fz,FC1,C3,CP1,CP2,Cz,C4,FC2) for both deviants. We then tested the relationship between neural sensitivity recorded at electrode Cz and discrimination accuracy over time. A significant interaction between the within-category MMN and time suggested that the association between neural sensitivity and behavior grew stronger over the course of the week. The across-category MMN was unassociated with perceptual behavior. In summary, robust, neural sensitivity to nonnative speech was found to emerge with just two days of training. Furthermore, perceptual performance on nonnative speech discrimination may reflect phonetic, rather than category-level, sensitivities.

Topic Area: PERCEPTION & ACTION: Audition

F61 - Complex impact of stimulus envelope on motor synchronization to sound

Yue Sun[1], Georgios Michalareas[2], Oded Ghitza[3], David Poeppel[1,4,5,6]; [1]Ernst Struengmann Institute for Neuroscience, Frankfurt am Main, Germany, [2]Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany, [3]Boston University, [4]New York University, [5]Center for Language, Music, and Emotion (CLaME), New York, USA, [6]Music and Audio Research Laboratory (MARL), New York, USA

The human brain tracks temporal regularities in acoustic signals faithfully. Recent neuroimaging studies have shown complex modulations of synchronized neural activities to the shape of stimulus envelopes. How to connect neural responses to different envelope shapes with listeners' behavioral ability to synchronize to acoustic rhythms requires further characterization. Here we examine participants' motor and sensory synchronization to noise stimuli with periodic amplitude modulations (AM). We used three envelope shapes that varied in the sharpness of amplitude onset. In a synchronous motor finger-tapping task, we show that participants more consistently align their taps to the same phase of stimulus envelope when listening to stimuli with sharp onsets than to those with gradual onsets. This effect is replicated in a sensory synchronization task, suggesting a sensory basis for the facilitated phase alignment to sharp-onset stimuli. Surprisingly, despite less consistent tap alignments to the envelope of gradual-onset stimuli, participants are equally effective in extracting the rate of amplitude modulation from both sharp and gradual-onset stimuli, and they tapped consistently at that rate alongside the acoustic input. This result demonstrates that robust tracking of the rate of acoustic periodicity is achievable without the presence of sharp acoustic edges or consistent phase alignment to stimulus envelope. Our findings are consistent with assuming distinct processes for phase and rate tracking during sensorimotor synchronization. These processes may be underpinned by different neural mechanisms whose relative strengths are modulated by specific temporal dynamics of stimulus envelope characteristics.

Topic Area: PERCEPTION & ACTION: Audition

F62 - Sound Tracking and Localization in Blind Athletics

Hannah Creely[1] (hncreely@live.carlow.edu), Jennifer Roth[1], Clara Cheng[1]; [1]Carlow University

Blind and Visually Impaired (BVI) tennis is played with foam balls containing a mechanical rattle, making sound only during changes in momentum. This study examined the effects head placement and age have on sound localization and tracking in participants. The findings can benefit blind athletics as we learn how to optimize players' sound localization ability, leading to more efficient coaching techniques that can increase success and enjoyment of the sport, as well as retention of new players. Sighted and blind participants aged 18-60 were blindfolded as BVI tennis balls were tossed at them by a researcher standing 20 feet in front of them. The balls were thrown at target points -15°, -7°, 0°, 7°, 15° from where the researcher was standing. In 3 blocks of trials, participants had both ears, left ear, or right ear towards the researcher tossing the balls. The ball bounced three times before reaching the target point. Participants shuffled laterally to make contact with the BVI tennis ball. Another researcher sat behind the participant giving hand signals to communicate which target the balls should be tossed at. Participants were significantly more successful at contacting the ball when both ears faced the ball rather than just one. There was not enough data collected to confirm the effect age has on sound localization and tracking abilities. As blind tennis grows worldwide, coaches of sighted athletes who typically have players turn to hit a ball, will know to coach blind athletes to keep both ears pointed toward the ball.

Topic Area: PERCEPTION & ACTION: Audition

F63 - Sensorimotor Engagement Facilitates Regularity Detection During Auditory Scene Analysis

Berfin Bastug[1] (berfin.bastug@esi-frankfurt.de), Yue Sun[1], Erich Schroeger[3], David Poeppel[1,2]; [1]Ernst Struengmann Institute for Neuroscience, Frankfurt am Main, Germany, [2]Department of Psychology, New York University, [3]Wilhelm-Wundt-Institute of Psychology, Leipzig University, Leipzig, Germany

One challenge the auditory system faces derives from the fact that acoustic input typically lacks clear boundaries. A central goal is therefore to decompose the input and identify perceptually meaningful units, a process known as Auditory Scene Analysis (ASA). A body of research suggests that the detection of temporal regularities in auditory stimuli facilitates ASA. Here, we explored factors that modulate regularity detection using so-called 'tone cloud' stimuli —sequences of randomly generated clusters of 50-ms pure tones, and the possible sensorimotor contribution (requiring detection and concurrent tapping). Temporal regularity was introduced by periodically repeating a proportion of tones within each tone cloud. We manipulated two variables: (i) repetition rate, determined by tone cloud durations (0.4 s, 0.7 s, 1 s), and (ii) the percentage of repeated tones (0% to 100%). This created a gradient from fully repeated to continuous streams, with intermediate conditions involving partially frozen and regenerated tones. The frozen tones formed the signal to detect, while newly generated tones added background noise. Participants completed two psychophysical experiments: detection and tapping. The results reveal sigmoidal, quasi-categorical performance across percentage levels in both experiments. Inflection points shifted with repetition periods. While the performance patterns in both experiments were similar, sensorimotor involvement in fact lowered the threshold for detecting repetition. These findings suggest that the signal required to perceive repetition depends on tone cloud duration and that sensorimotor engagement improves the detection of repeating patterns and the formation of perceptual boundaries.

Topic Area: PERCEPTION & ACTION: Audition

F64 - Joint Connectivity between Sensorimotor and Auditory-Reward Networks During Resting State and Music Listening

Kai Yi (Kaye) Han[1] (han.kaiy@northeastern.edu), Corinna Parrish[1], Jinyu Wang[1], Psyche Loui[1]; [1]Northeastern University

Music listening activates the auditory, motor, and reward networks, and their interactions are crucial to its pleasurable nature. Here, we compared functional connectivity between auditory-reward and motor networks during rest and music listening. N=40 young adults completed working memory (2-Back) and Sustained Attention to Response (SART) tasks while listening to music. ROI-to-ROI connectivity analyses replicated previous findings of significant within- and between-network connectivity in the auditory and reward networks during both rest and task. Additionally, we found significant connectivity within and between the motor and auditory-reward networks during rest and task. We then examined connectivity differences between task and rest and found enhanced functional connectivity within the auditory network and within the motor network, but reduced functional connectivity between the auditory and motor networks during task. Specifically, auditory areas showed lower connectivity towards bilateral precentral gyri, left postcentral gyrus, and bilateral supplementary motor areas during SART, and towards bilateral precentral gyri during the 2-Back task. In contrast, both tasks enhanced functional connectivity between the reward and motor networks. We found higher connectivity from reward areas to bilateral superior frontal gyri (SFG) during the 2-Back task, and to bilateral SFG and left middle frontal gyrus during SART. We also saw greater increased connectivity between the right SFG and insula cortex during both tasks. Ongoing work involves examining effects of individual differences in musical reward sensitivity, musical training, and sustained attention. Results suggest that engaging in cognitive tasks during music listening increases within-network but reduces out-of-network connectivity from auditory areas.

Topic Area: PERCEPTION & ACTION: Audition

F65 - Perceptual Judgments of Auditory Fractal Stimuli

Mahboubeh khoddam[1] (mkhoddam@uoregon.edu), Richard Taylor[2], Margaret Sereno[1]; [1]Integrative Perception Lab, Department of Psychology, University of Oregon, Eugene, OR, United States, [2]Material Science Institute, Department of Physics, University of Oregon, Eugene, OR, United States

Fractals, exhibiting self-similarity across scales, are common in nature and artificial phenomena. In audio, fractal properties are often represented by a power law spectrum (1/f^α). While the impact of fractal complexity on visual perception has been well-documented, its influence on auditory perception remains relatively unexplored. This study investigates how variations in auditory fractal complexity, represented by differing α values, influence subjective auditory judgments, including relaxing, engaging, appealing, naturalness, complexity, interesting, and irritating. A set of auditory stimuli was generated using MATLAB, including color noise and amplitude-modulated color noise with varying α values. Ninety-one participants rated the stimuli on 5 perceptual dimensions using a slider scale in a randomized block design. Data collection and presentation were conducted in PsychoPy3, and precise exclusion criteria ensured high data quality. Results revealed significant interactions among α value, stimulus type, and judgment condition. Ratings for "relaxing," "appealing," and "naturalness" increased with α values, suggesting a preference for moderate fractal complexity, while "irritating" ratings decreased. In contrast, ratings for "complex" remained relatively stable regardless of α value, while "interesting" and "engaging" judgments exhibited steady increases. Stimulus type also influenced judgments, with color noise receiving consistently higher ratings than amplitude-modulated patterns in specific conditions. These findings highlight the important role of fractal complexity in auditory perception, with implications for designing soundscapes, therapeutic environments, and multimedia applications. Understanding how fractal properties influence auditory experiences provides valuable insights into natural and artificial sounds' cognitive and emotional processing, offering potential strategies for enhancing acoustic environments.

Topic Area: PERCEPTION & ACTION: Audition

F66 - Mu-band suppression reveals auditory-motor predictions after short motor training in non-musicians

Oscar Bedford Vilarrubias[1] (oscar.bedford@mail.mcgill.ca), Alberto Ara[1], Jérémie Ginzburg[1,2], Philippe Albouy[2], Robert Zatorre[1], Virginia Penhune[3]; [1]Montreal Neurological Institute, [2]CERVO Research Center, [3]Concordia University

Auditory-motor coupling is an important brain system that supports speech and music. It is now widely accepted that this system is bidirectional and that the motor component routinely streamlines auditory perception. For instance, prior literature has shown the presence of motor activity during passive listening to known melodies, and our lab recently demonstrated with TMS that this activity is anticipatory, occurs in non-musicians, and can be elicited at the single note level after a single motor training session. However, the associated note-by-note oscillatory dynamics remain unclear, especially in non-musicians. Other EEG studies have linked mu suppression to this phenomenon in musicians, but mu suppression has not been reliably observed in non-musicians at the single note level. To this end, we developed an EEG functional localizer using active and resting data to identify channels, frequencies, and timepoints that would be likely to showcase mu suppression during passive listening to a trained melody. We then applied a Generalized Linear Mixed Model to assess differences across passive listening conditions. We found significantly more mu suppression (-400ms to -100ms) preceding each tone during passive listening after motor training than in all other passive conditions. We found no significant effects in other timewindows or frequency bands, including the beta band. These findings show that mu suppression can be observed in non-musicians after a single training session at the individual note level, and align with the literature on the distinct roles of the alpha and beta components of the mu complex.

Topic Area: PERCEPTION & ACTION: Audition

F67 - Effect of Modality on Categorical Speech Perception Task Performance

Lily Yan[1], Frances Earle; [1]University of Delaware

In speech perception research, there has been a marked increase in experimental tasks being conducted remotely, due to several benefits such as greater efficiency in recruitment and administration. With this increase, we wanted to explore the potential difference in performance on a classic perception task (categorical perception) based on administration modality. 53 monolingual English speakers aged 18-34 completed categorization tasks as a part of different larger studies. 25 came in person, and 28 were remote. Three seven-step continua were used: vowel (/a/-/e/), VOT (/d/-/t/), and color (green-blue). Participants identified randomly-presented stimuli from each continuum in a 2AFC task. To investigate categorization behavior differences, we conducted linear mixed effects models on the percentage of responses at one end of each continuum, with the interaction between continuum step and modality, and main effects of modality and step as factors. The vowel continuum included significant effects of steps 4-7, and interactions between modality and steps 4, $p<.001$, and 5, $p=.006$. The VOT continuum found significant effects of steps 3-7, and an interaction between modality and step 3, $p=.01$. The color continuum included significant effects of steps 4-7, with a trending interaction between modality and step 4, $p=.07$. All interactions were driven by a larger percentage of responses by online participants, indicating shallower categorization slopes. This suggests lower precision, which may undermine online use for investigating individual differences. For the conference presentation, we will examine the predictive value of categorization behavior on neurocognitive ability across modalities to substantiate our claims.

Topic Area: PERCEPTION & ACTION: Audition

F68 - PRoMiSS: Psychedelics and the Role of Music in Set and Setting

Riddhima Chandra[1] (rchand23@jh.edu), David Rosen[1], Frederick Barrett[1,2,3]; [1]Center for Psychedelic and Consciousness Research, Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, [2]Department of Psychological and Brain Sciences, Johns Hopkins University, [3]Department of Neuroscience, Johns Hopkins University School of Medicine

Music is pivotal to the “setting” of psychedelic experiences, however, there is an absence of evidence-based music selection protocols. Personally-tuned, autobiographically salient (AS) playlists may evoke stronger emotional responses compared to standardized playlists. This series of studies explores the role of personalized music in psychedelic experiences. In Study 1, a within-subject, non-drug, healthy-participant pilot, subjects experienced four conditions: AS, Johns Hopkins Classic (JHC), and two others. Participants’ EEGs, physiology, and behavioral data were collected, including song emotion ratings using the Geneva Music Emotion Scale. Study 2 is an open-label, high-dose psilocybin study that examines the interaction of music and psilocybin. Using linear mixed-effect models, AS songs significantly influenced a range of emotions: power, sadness, peacefulness, joy, nostalgia, transcendence, and wonder ($p <.001$). JHC elicited more tension*** and transcendence***; however, increases in state-anxiety (STAI) interacted with JHC, reducing transcendence ***. Familiarity increased tension***, sadness**, and nostalgia* and decreased tenderness**. Dispositional positive emotion (DPES) predicted power***, peacefulness***, transcendence*, wonder***, and tenderness**. Joint increases in DPES and AS led to more tenderness**. Positive mood (PANAS) predicted nostalgia* and tenderness*, and negative mood decreased wonder**. DASS-anxiety heightened tension** and sadness***, and it interacted with condition to increase tension** and with familiarity*** to increase sadness. DASS-stress predicted peacefulness and transcendence. Absorption in music (AIMS) and it’s interaction with positive mood increased joy***. Overall, AS music enhanced emotional responses, except for tension. Next steps include analyzing condition-level emotions on acute, subjective and enduring effects, as well as electrophysiological data. ***$p<.001$, **$p<.01$, *$p<.05$

Topic Area: PERCEPTION & ACTION: Audition

F69 - A Spike in Entropy Precedes the Mismatch Negativity; Linking Entropy and Prediction Error

Michael Angyus[1] (michaelangyus@gmail.com), Fernando Rosas[4,1], Pedro Mediano[1,2], Robin Carhart-Harris[3,1]; [1]Imperial College London, [2]University of Cambridge, [3]University of California San Francisco, [4]University of Sussex

Predictive coding suggests that the brain minimizes free energy through the accurate prediction of sensory stimuli. While not mathematically identical, some research has suggested that information content of a brain signal can act as a proxy for free energy. Measures such as Shannon’s entropy and Shannon’s entropy rate may therefore be combined with experimental paradigms of prediction error to statistically examine the relationship in the human brain. Our study combines a recently developed measure of Shannon’s entropy rate with the auditory mismatch negativity (MMN) paradigm to explore relationships between entropy rate and event related potentials from electroencephalography (EEG) signals. Our analyses reveal a significant spike in entropy occurring prior to the onset of the MMN, providing a first direct link between neurocomputational prediction error and neural activity associated with prediction error. Mixed effects regression revealed that the magnitude of this entropy spike was associated with strength of the MMN

(Adjusted R2 = 0.385, β = 0.012, p < 0.001). Mixed effects regression was also used to see if baseline entropy (prior to a given trial) was related to MMN magnitude, finding a significant positive relationship (Adjusted R2 = 0.239, β = 0.023, p < 0.001). These findings provide experimental evidence for the relationship between entropy and prediction error, supporting predictive coding and the free energy principle.

Topic Area: PERCEPTION & ACTION: Audition

F70 - Reduced Mismatch Negativity in Children with Autism Spectrum Disorder

Virginia A. Rosenberger[1,2], Winko W. An[1,2], Brooke E. Keough[1,2], Noah Crane[1,2], Leena Gupta[1,2], April R. Levin[1,2], Charles A. Nelson[1,2,3]; [1]Boston Children's Hospital, [2]Harvard Medical School, [3]Harvard University

Atypical sensory processing is a common feature of autism spectrum disorder (ASD), and has been associated with irregularities in predicting sensory inputs. However, the neural underpinnings of these irregularities, especially during development, remain unclear. In this study, we adopted a Local-Global auditory oddball paradigm with two levels of regularity to assess the neural response to auditory oddballs in ASD. Utilizing high density electroencephalography (EEG) data collected from children (2 – 12 years) with autism spectrum disorder (ASD, n=27) and typical development (TD, n=26), we calculated Mismatch Negativity (MMN) from the difference in event-related potentials between local standard and deviant tones, elicited in response to stimuli deviations in a string of stimuli regularities. We performed ANCOVA to compare MMN magnitude between the ASD and TD groups while accounting for age differences across individuals and observed a reduced MMN in ASD participants compared to TD participants (p = 0.035). We further plan to perform a time frequency analysis on this data comparing responses to standard and deviant tones between children with ASD and TD, and to analyze the P300 component elicited by global deviations in the Local-Global paradigm. These findings suggest altered error prediction in ASD, which may be related to reduced sensory habituation and hypersensitivity to sensory stimuli reported in individuals with autism.

Topic Area: PERCEPTION & ACTION: Audition

F71 - How do harmonic relationships affect grouping of sounds?

Julia M. Leeman[1] (julia.leeman@duke.edu), Cynthia D. King[1], Jennifer M. Groh[1]; [1]Duke University

Perceptually, we group sounds from the same source and segregate sounds from different sources. This study characterizes the effects of harmonicity on this process. We used an auditory streaming paradigm in which tones were presented in a repeating fashion: C-AB-C-AB-C-AB etc, with the higher pitch C presented alone and the lower pitches A and B presented simultaneously. Previous work has suggested that the frequency separation between C and B governs whether B groups with A or C (Bregman & Pinker, 1978). Here, we investigated whether the harmonic relationship between A and B affects this grouping by testing two conditions: A and B are an octave apart (consonant), or A and B are a major 7th apart (dissonant). We varied the frequency of C, and participants classified sound patterns as to whether B grouped with A or with C as a function of C's frequency in the consonant and dissonant conditions. We compared the midpoint and slope of the psychometric curves generated. The consonant and dissonant conditions had a similar midpoint, but the dissonant condition had a sharper slope. Therefore, participants were more sensitive to grouping of tones at a dissonant interval. We suggest the fusion of dissonant intervals may be clearer to participants because the perceptual experience of dissonance requires fusion. This result will help design stimuli to investigate the neural patterns underlying auditory grouping and segregation in nonhuman primates. With these stimuli, we can compare neural responses to sounds that differ in their perception as grouped or segregated.

Topic Area: PERCEPTION & ACTION: Audition

F72 - Non-global Absolute Pitch possessors - A specific cognitive process?

Ébano Resende de Souza[1]; [1]Austrian Academy of Sciences

Perfect or absolute pitch (AP) is typically considered to be an asset for any musician, however it is not well understood and may have some drawbacks. From a case study among students from the Musicology and Analysis Department of the Conservatoire National Supérieur de Musique et Danse de Paris - CNSMDP (under direction of Dr. Adrien Mamou-Mani - CNSMDP/IRCAM and Dr. Michèle Castellengo - LAM), we noted important issues raised by the students: 1) confusion and misunderstanding about the AP definition, 2) difficulty among students in identifying whether or not they have AP, 3) the relevance of timbre for AP identification among these students and, 4) students that had partial AP abilities reported difficulties in some musical activities. Among our findings we can highlight: 1) the strong relationship between AP identification and primary instrument; 2) the importance of the piano (pointed as the easiest timbre for recognition) and the voice (which occupies an important place among the hardest timbres for recognition, due, probably, to the overlap between AP label and the lyrics of the song) during AP identification and, 3) the loss of musical pleasure indicated by a considerable number of AP possessors. AP ability involves Brocas's area, Wernicke's area, Arcuate Fasciculus and Planum Temporale. We use MRI and fMRI for mapping these brain areas and verifying their activations . We are therefore currently developing this project to understand to what extent AP perception can hinder RP perception, a cognitive key for musicians and music listeners.

Topic Area: PERCEPTION & ACTION: Audition

F73 - The missing pulse revisited: Comparing dynamic models with expert listeners

Edward Large[1] (edward.large@uconn.edu), Tylor Harlow[1], Mina Golmohammadi[1], Charles Wasserman[1], Heather Read[1]; [1]University of Connecticut

Pulse is the perceptual phenomenon in which an individual perceives a steady beat underlying a complex auditory rhythm, as in music. A number of studies support the hypothesis that synchronization of neural oscillations is the mechanism of pulse perception, however this remains a topic of current debate. This study examines stimulus rhythms that have no spectral energy at the intended pulse frequency, called missing pulse rhythms. Behavioral studies with missing pulse rhythms show that people do perceive the pulse at frequencies predicted by neural synchronization. Further, EEG and MEG steady-state evoked response potentials (SS-ERPs) reveal the predicted frequencies, and have shown that their amplitudes correlate with perception. In this study, w e first trained a neural model consisting of oscillatory auditory and motor networks with complex rhythms, and showed that pulse frequency oscillations arise in the motor planning network. Next we recorded EEG in expert listeners and analyzed only those trials for which perception of the missing pulse frequency was verified. We observed 1) strong pulse-frequency SS-ERPs to missing pulse rhythms, but not to a random control; 2) strong coherence between model-predicted SS-ERPs and brain responses; and 3) differing pulse-frequency localization for missing pulse rhythms versus isochronous controls. Comparison of these results with model predictions support the theory that pulse perception occurs as the result of an emergent population oscillation in motor planning networks that entrains at the pulse frequency.

Topic Area: PERCEPTION & ACTION: Audition

F74 - Evoked Spectral Power in EEG decodes Musical Pitch Imagery in Auditory Cortex in EEG

Miyoung Chung[1] (miyoung.chung@mail.mcgill.ca), Andrea R. Halpern[2], Robert J. Zatorre[1]; [1]Montreal Neurological Institute, [2]Bucknell University

The phenomenon of imagery evokes perceptual-like experience in the absence of external stimuli, reflecting shared neural activity with perception. Musical imagery has become a compelling focus in neuroscience with its relevance to musical abilities and learning. Using EEG, this study examines the neural activity in musical pitch perception and imagery using a familiar melody task. Twenty-three participants listened to the first part of a melody, imagined its continuation, and completed a tone-matching task to determine if a test tone matched the original note of the melody. Decoding analysis using support vector machine was performed to classify each of seven tones based on evoked spectral power in the theta to beta frequency bands, known as representing top-down processing, during both perception and imagery. Decoding results exceeded chance level classification accuracy in imagery for evoked power, representing the phase-locked activity in the brain corresponding to the event (average 28.26%, chance: 20.65%). On the other hand, the decoding results when employing the induced power representing higher cognitive activity demonstrated near chance-level classification accuracy, suggesting the importance of evoked power activity for musical imagery. The same trend was revealed when this decoding algorithm was applied to perception (average 40.62%, chance: 31.66%), indicating shared evoked spectral patterns between perception and imagery. Imagery Mismatch Negativity (iMMN) analysis further identified greater right-hemisphere negativity during the tone-matching task, consistent with MMN findings in music perception. These results emphasize the significance of phase-locked neural activity in the auditory cortex, advancing our understanding of the neural basis of musical imagery.

Topic Area: PERCEPTION & ACTION: Audition

F75 - Auditory masking release indexes human click-based echolocation performance

Haydée G. García Lázaro[1] (haydee@ski.org), Santani Teng[1]; [1]The Smith Kettlewell Eye Research Institute

Echolocation is an active sensing strategy enabling some blind individuals to detect, discriminate, and localize objects in their environment. Trained blind echolocators usually outperform novice blind and sighted individuals in echoacoustic tasks. Although visual experience and expertise often predict echolocation ability, the mechanisms underlying proficiency remain unclear. Previously, blind experts reliably localized virtual click-echo pairs, while sighted controls performed at chance. Because isolated echoes were easily localized by all subjects, the clicks may exert a forward masking effect that is attenuated by experience. To investigate this hypothesis both psychophysically and neurally, we systematically increased the echoacoustic SNR (echo-click amplitude ratio) for sighted controls (Experiment 1) and decreased it for blind experts (Experiment 2). In a 2AFC task, participants localized a spatialized virtual reflecting object 1-m distant at various azimuthal eccentricities across sequences of 2, 5, 8, or 11 click-echoes. Multivariate pattern analysis (MVPA) was applied to EEG responses to decode left vs. right stimulus position. Results showed that increasing echo SNR improved spatial localization parametrically in untrained participants, who reached near-expert performance (~76.6-95.5%). Expert echolocators maintained high accuracy (~92.8%) under unmodified acoustic conditions, with performance dropping to ~85.3% when the echo amplitude decreased by 33% and ~61.2% when decreased by half. Decoding timecourses across the first 2 clicks of each trial tracked spatial location and indexed performance across conditions in both experts and novices. These findings suggest that fine-tuned auditory masking release may underlie echolocation expertise and provide a framework to guide training and assistive technologies to enhance echolocation.

Topic Area: PERCEPTION & ACTION: Audition

F76 - Neural Responses to Disturbances of Musical Phrase in Musicians and Non-Musicians: an ERP Study

Emma Barnard[1] (emmarose1213@gmail.com), Grit Herzmann[1]; [1]The College of Wooster

Music has been shown to have beneficial impacts on neurodevelopment and neurodegenerative diseases. Music perception involves complex cognitive processes necessary to decipher elements of music like pitch and timbre. Musical expertise involves training in these cognitive processes and can be studied to further understand the cognitive and neural processes underlying music cognition. This study investigates the underlying brain processes of disruptions in musical phrases. It examines how disruptions (called deviants) in pitch, timbre, intensity, and slide are processed within complex musical phrases (i.e., melodies) and what impact musical expertise has on these processes of music cognition. Participants were musicians (N = 27) and non-musicians (N = 27). To quantify musical expertise, participants took the Musical Ear Test and Goldsmiths Musical Sophistication Index. Stimuli consisted of single music notes arranged in pseudo-randomized melodies with deviants every eight notes. EEG data was collected to measure the MMN, P3, and N1 ERP components. Data collection is complete and preliminary data will be presented. We expect to find no change in N1 between musicians and non-musicians, but larger differences between standard and deviant melodies in MMN and P3 amplitudes in musicians. The lack of change in N1 amplitudes is hypothesized because of similar levels of surprise, whereas, the MMN and P3 are assumed to show the effects of musical expertise because musicians have stronger higher-order predictions for melodies resulting from prior training. The results of this study will provide insights into the time course of music cognition and the impacts of musical expertise.

Topic Area: PERCEPTION & ACTION: Audition

F77 - Modeling target search in blind echolocators using a Kalman Filter with realistic exploratory behavior simulations

Sofia Krasovskaya[1] (skrasovskaya@ski.org), James M. Coughlan[1], Aarshil Patel[1], Santani Teng[1]; [1]The Smith-Kettlewell Eye Research Institute

Some blind persons aid their mobility with echolocation, a technique in which auditory feedback from a sequence of self-generated tongue clicks guides perception and action. To investigate echoacoustically guided sensorimotor dynamics, we present a model for estimating azimuthal head movements based on target location and a series of noisy click-based measurements. The model simulates realistic head movements using an exploratory behavior phase, adjusting head azimuth towards the target over time, with larger adjustments at the start and progressively smaller ones with more feedback. We simulate echoacoustic feedback using Gaussian noise to reflect uncertainty. A Kalman Filter (KF) then tracks changes in head azimuth by combining prior estimates with new noisy measurements. The system assumes a constant angular head velocity and updates estimates using process and measurement noise covariance. Initially, it makes large adjustments, but with each measurement it estimates target location more precisely. We test the model across multiple simulations of trials and participants per trial against a control condition model simulating a zero-feedback scenario, where system updates are based solely on the prior and process noise. We assess the performance of both models using metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), Mean Error and normalized accuracy. Results demonstrate that KF performance improves with feedback but deteriorates without feedback. This resembles the observed behavior of real-life expert echolocators in click and no-click conditions. The proposed model provides a quantitative framework for understanding ecologically relevant behavior in a poorly understood perceptual mode.

Topic Area: PERCEPTION & ACTION: Audition

F78 - The Effects of Repeated Exposure on Musical Reward

Harley Glassman[1] (hglassman@torontomu.ca), Frank Russo[1]; [1]Toronto Metropolitan University

Music can elicit such a powerful emotional response that people will voluntarily listen to their favourite pieces repeatedly. This study aimed to investigate whether repeated exposure to music influences participants' ratings of liking across their most and least preferred genres while controlling for familiarity. Additionally, we explored individual reward sensitivity, as measured by the extended Barcelona Music Reward Questionnaire (eBMRQ). Participants first selected their most and least preferred musical genres. Then they listened to pieces from those genres over five repetitions and rated them on liking and familiarity. Lastly, they completed the eBMRQ. A linear mixed effects model revealed a significant negative effect of repetition on overall liking ratings ($\beta = -0.28$, $p = <0.001$). Meanwhile, higher liking ratings were found for the most preferred genre compared to the least preferred genre ($\beta = 1.26$, $p < 0.001$). Additionally, familiarity was a significant predictor of liking ($\beta = 0.37$, $p < 0.001$), suggesting that familiar music was rated more favourably. Reward sensitivity did not significantly predict liking ratings ($\beta = -0.006$, $p = 0.44$), indicating that individual differences in reward sensitivity did not directly influence overall liking across conditions and repetition cycles. Random effects were included for each participant. These findings underscore the importance of familiarity and musical preferences on pleasure while suggesting a limited role of reward sensitivity in predicting musical reward. Our future work will explore the neural mechanisms involved in musical reward and familiarity with repeated exposure.

Topic Area: PERCEPTION & ACTION: Audition

F79 - Exploring the relationship between age-related hearing loss and the neural correlates of speech processing

Sara Jani[1,2] (sara.jani@mail.utoronto.ca), Claude Alain[1,2]; [1]University of Toronto, [2]Rotman Research Institute at Baycrest Hospital, Toronto, Ontario, Canada

Age-related hearing loss (ARHL) is the most prevalent sensory impairment in older adults, with a growing body of evidence linking it to cognitive decline. Specifically, older adults with more severe ARHL are theorised to have increased difficulties with auditory and speech processing, which evidence from electrophysiological studies has correlated with hyperactivation in brain regions involved in auditory processing. However, the relationships between ARHL, cognitive decline, and the neural correlates of speech processing are currently not well defined. Auditory evoked responses were measured in 48 participants (mean age = 71.5, 56% female) with bilateral mild-to-moderate ARHL, using 64-channel electroencephalography recording while undertaking an auditory oddball target detection task. Participants were presented with the English consonant-vowel phonemes /ba/, /pa/, and /ta/, and asked to respond with a button press upon hearing the syllable /ta/. We measured auditory evoked responses related to sensory encoding, discrimination, and decision making using the P100, mismatch negativity (MMN), and P3b waves respectively. While this work is ongoing, our preliminary results suggest a negative correlation between ARHL and speech processing, such that individuals with more severe ARHL display greater deficits in differentiating speech tokens. These findings are reflected in a reduced MMN response in individuals with greater ARHL. As the MMN response reflects automatic detection of unexpected sensory input, reduction in this response may indicate increased difficulty in discriminating speech stimuli. As participants also performed a neuropsychological test battery during each testing session, future analyses will aim to identify the relationship between neural responses, ARHL, and cognitive status.

Topic Area: PERCEPTION & ACTION: Audition

F80 - Metric expectations drive auditory-motor connectivity: a combined TMS-EEG study

Giorgio Lazzari[1] (giorgio.lazzari01@universitadipavia.it), Connor Spiech[2], Oscar Bedford[3,4,5], Marcel Farrés-Franch[3,4,5], Virginia Penhune[2,4,5], Carlotta Lega[1]; [1]University of Pavia, Pavia, Italy, [2]Concordia University, Montreal, Canada, [3]Montreal Neurological Institute, McGill University, Montreal, Canada, [4]Montreal Laboratory for Brain, Music and Sound (BRAMS), [5]Centre for Research in Brain, Language and Music (CRBLM)

Motor and premotor regions are theorized to generate timing predictions which auditory regions use to effectively perceive or imagine a beat. This strong auditory-motor coupling is bidirectional and involves β-band oscillations, as shown in prior electroencephalography (EEG) studies. Previous transcranial magnetic stimulation (TMS) research by our lab found that the right dorsal premotor cortex (dPMC) is critically involved in this process. In this study, we combined TMS stimulation and EEG recording to investigate the cortical excitability under different states of beat-based timing perception and prediction. Participants listened to or imagined accents during the presentation of an auditory tone sequence that created a march (binary) or a waltz (ternary) metric structure. EEG was recorded throughout the experiment, as single TMS pulses were delivered 50ms before either accented or unaccented events on the right dPMC. We measured neural excitability changes via TMS-evoked potential (TEP) amplitudes, and we investigated directed functional connectivity between dPMC and auditory regions. Preliminary results found increased TEP amplitudes for accented compared to unaccented events, in both the physical and imagined conditions, indicating greater dPMC reactivity when metric expectations are stronger. Additionally, if dPMC encodes metrical expectations, dPMC-to-auditory connectivity should be stronger than auditory-to-dPMC connectivity. Specifically, we predict this effect to occur in delta and in beta frequency bands, given the importance of these frequencies in motor processes. Together these results would clarify the causal relationships between premotor and auditory regions, highlighting the predictive role of the premotor cortex in metric processing.

Topic Area: PERCEPTION & ACTION: Audition

F81 - Speeding up cognitive development: metacontrol instructions foster adult-like event segmentation in adolescents

Xianzhen Zhou[1] (xianzhen.zhou@ukdd.de), Foroogh Ghorbani[1], Astrid Prochnow[1], Christian Beste[1,2,3]; [1]TU Dresden, Germany, [2]German Center for Child and Adolescent Health (DZKJ), Germany, [3]Shandong Normal University, China

Event segmentation, which involves dividing continuous information into meaningful units, changes as children develop into adolescents. Adolescents tend to segment events more coarsely than adults. This study explored whether metacontrol-related instructions could encourage adolescents to segment events more like adults. We compared event segmentation in two adolescent groups and one adult group, while simultaneously recording EEG data. One adolescent group was instructed to perform segmentation as finely as possible, whereas the other adolescent group and adults received no specific instructions on segmentation granularity. EEG data were analyzed using multivariate pattern analysis and source reconstruction. The findings revealed that adolescents given fine-grained instructions adjusted their segmentation probability closer to adult levels, although they did not fully match adults in processing multiple simultaneous changes. Neurophysiological results showed that adolescents with fine-grained instructions exhibited neural patterns more similar to adults. Increased activity in the inferior frontal gyrus in these adolescents compared to adults related to this. The results suggest that adolescents with fine-grained instructions demonstrated more persistent cognitive control and enhanced top-down attention compared to their peers and adults. The study shows that cognitive processes in adolescents can be shifted toward adult-like performance through instructions.

Topic Area: PERCEPTION & ACTION: Development & aging

F82 - Changes of brain activity across development during implicit learning of temporal regularity

Wei Tang[1] (wt1@iu.edu), Pradyumna Lanka[2], Zhenghan Qi[2]; [1]Indiana University Bloomington, [2]Northeastern University

Statistical regularities in the environment can shape brain activity to facilitate perception without explicit feedback. Such neural plasticity enables individuals, even as infants, to acquire perceptual, cognitive and linguistic knowledge and adapt to their surroundings. In this poster we present a study that investigates how statistical learning facilitates visual perception in young adults and children. We asked participants in an fMRI experiment to respond to a cued target in each presented sequence of pictorial stimuli by a button press. Unbeknownst to the participants, we embedded triplets in half of the sequences and mixed them with the other half randomly ordered sequences. Using a hidden Markov model to identify multi-voxel brain representations, we analyzed the representational similarity of structured and randomly presented stimuli across brain regions. Our results suggest that multiple brain regions process temporally associated items differently than those presented in random order. In particular, the medial temporal lobe, striatum and primary visual cortex all showed patterns of chunking for processing triplets, regardless of the type of stimuli that composed the triplets. Moreover, activity in the nucleus accumbens and V1 showed changes across development, suggesting potential differences in the learning outcome, such that the children's brain may become more sensitive to lower-level visual features and the adult brain more sensitive to generalized temporal structures. Both effects could facilitate perception but would involve different brain mechanisms.

Topic Area: PERCEPTION & ACTION: Development & aging

F83 - Altered motion inhibition, but not face detection, in preclinical familial Alzheimer's disease

Hannah Vidu[1] (hannahvidu@gmail.com), Kayla Kilmer[1], Alex Badillo-Cabrera[2], Diana Munera[2], Ana Baena[3], Nikole Bonillas Felix[2], David Aguillon[3], Yakeel Quiroz[2], Daniel Norton[1]; [1]Gordon College, [2]Massachusetts General Hospital, [3]University of Antioquia

Developing inexpensive ways to identify Alzheimer's disease (AD) in the preclinical stage is of critical importance in addressing one of the largest medical issues in society. According to the Amyloid Cascade Hypothesis, AD is caused by the accumulation of amyloid-beta proteins, followed by tau buildup. Tau is most closely linked to cell death but is heterogeneous in its spread. The present study examines two psychophysical tests that rely, at least in part, on brain regions where tau often spreads in the early stages of the disease: (1) a face detection task, relying on the fusiform face area, and (2) a motion discrimination task, relying on the middle temporal area. In the latter, we examined baseline motion discrimination accuracy and the difference in accuracy between small and large grating stimuli on a motion discrimination task, which is thought to reflect center surround suppression (CSS), an inhibitory process within the visual system. To explore whether these tasks are sensitive to preclinical Alzheimer's, we tested carriers of the PSEN-1 E280A mutation that leads to autosomal dominant AD (n=16) who were, on average, 10 years ahead of the expected onset of MCI (age 45), and compared their performance to their unaffected relatives (n=14). Preliminary results show that baseline motion performance was normal, but CSS was higher for E280A carriers. Face detection performance did not differ from controls. These findings suggest visual motion inhibition warrants further exploration as a potential early behavioral marker of AD.

Topic Area: PERCEPTION & ACTION: Development & aging

F84 - Running out of time: Timescale changes across neurodevelopment

Olivia Dance[1] (odance@ucsd.edu), Dillan Cellier[1], Bradley Voytek[1,2]; [1]University of California, San Diego, [2]Halıcıoğlu Data Science Institute

Neural timescales capture the stochasticity or relative stability of a neural signal over time, and are thought to reflect the brain's integration of external and internal stimuli. Though neural timescales have been extensively studied in non-human primates, rodents, and adult humans, research on the trajectory of neural timescales across human development is sparse. Existing literature on aperiodic and oscillatory activity supports a strong hypothesis regarding developmental timescale changes: we predict that neural timescales decrease over development, and that this decrease in timescales will correspond to changes in the aperiodic exponent and oscillatory peak frequencies with age. The current study compares oscillatory and aperiodic metrics of EEG data to the traditional method for measuring neural timescales, the autocorrelation function (ACF). Our investigation uses a cross-sectional dataset of eyes-open and eyes-closed resting state EEG data from the Child Mind Institute from thousands of participants aged 5-21 years old. We extract parameters from the EEG data related to peak frequency and power of oscillatory activity, the slope and offset of the aperiodic signal, and the decay rate of the ACF. In a preliminary analysis of participants ages 6-21, we observed a decrease in neural timescales with increasing age. These findings complemented a concurrent flattening in the aperiodic slope and decrease in offset, replicating the findings of prior studies. Our results highlight the ACF as a powerful metric for understanding timescale changes in neurodevelopment, providing new insights into the relationship between neural activity and behavior across development.

Topic Area: PERCEPTION & ACTION: Development & aging

F85 - Age differences in the neural correlates of perspective change may contribute to spatial memory deficits in old age

Sabina Srokova[1] (sabinasrokova@arizona.edu), Carol Barnes[1,2], Arne Ekstrom[1,2]; [1]Psychology Department, University of Arizona, [2]Evelyn F. McKnight Brain Institute, University of Arizona

Spatial memory involves remembering places across different perspectives. Prior research suggests that older adults may experience declines in spatial memory compared to younger adults, but the role of perspective switching in these differences is unclear. In the present study, young and older participants underwent fMRI as they completed a spatial memory task. Participants viewed virtual rooms containing trial-unique sets of five objects placed in random locations. After a 7 second delay, the room was viewed again, either from the same or a rotated perspective, and participants indicated whether one of the five objects had moved to a new location. Neural correlates of perspective change were examined within two a priori ROIs (the parahippocampal cortex [PHC] and hippocampus [HC]), and only during those trials where the objects' locations were unchanged. Relative to the first presentation, repeated presentation of the same perspective resulted in reduced fMRI BOLD signals across both ROIs, while rotated perspectives resulted in lower fMRI BOLD in the HC but not the PHC. According to theories of fMRI repetition adaptation, these results suggest that spatial representations are perspective-independent in the HC but perspective-specific in the PHC. However, age comparisons revealed that hippocampal repetition effects elicited by rotated perspectives were significantly lower in older relative to younger adults. Additionally, generalized linear mixed effects modeling revealed that lower hippocampal repetition effects were associated with lower probability of correct memory judgements. Therefore, the present data point to the possibility that hippocampal perspective-independent representations may be impaired in old age.

Topic Area: PERCEPTION & ACTION: Development & aging

F86 - Reduced Prefrontal EEG Complexity During Speech and Music Listening Reveals Subjective Cognitive Decline

Matthew King-Hang Ma[1] (khmma@polyu.edu.hk), Manson Cheuk-Man Fong[1,2], Yun Feng[1], William Shiyuan Wang[1,2]; [1]Research Centre for Language, Cognition and Neuroscience, Department of Chinese and Bilingual Studies, The Hong Kong Polytechnic University, [2]Research Institute for Smart Ageing, The Hong Kong Polytechnic University

Subjective Cognitive Decline (SCD) describes self-perceived worsening of cognitive abilities despite normal performance on cognitive tests. Existing evidence suggests SCD approximately doubles the risk of progressing to MCI and dementia (Pike et al., 2022). Understanding neural changes at this stage is crucial for early diagnosis and treatment. With this in mind, we adopted passive speech and music listening paradigm and recruited 60 Cantonese-speaking older adults (aged 60-70 years; cognitively normal per HK-MoCA). All of them completed the 14-item Subjective Cognitive Decline Scale (SCDS; Tsai et al., 2021). During EEG recording, participants listened to 16 speech and 16 music segments (one minute each, varying in emotional content rated by an independent rating study) and rated their perceived emotions using the Self-Assessment Manikin scale. Resting-state EEG was also collected. To evaluate brain activity alterations across different mental states, we computed the Lempel-Ziv Complexity (LZC), which has been used clinically as a consciousness marker, for each EEG recording. With SCDS scores being a continuous variable, linear mixed-effect model revealed a significant interaction between electrode location and SCDS scores on LZC ($F[5, 1307.99] = 3.3632$, $p < 0.01$). Higher SCDS scores corresponded with decreased LZC in prefrontal electrodes, specifically during music and speech conditions. Moreover, in the music condition, self-perceived valence decreased LZC while enjoyment increased it, whereas such results were not observed in the speech condition. Our findings suggest prefrontal EEG complexity reflects self-perceived cognitive decline during passive listening, highlighting LZC's potential as an SCD biomarker beyond its role in measuring consciousness level.

Topic Area: PERCEPTION & ACTION: Development & aging

F87 - Developmental differences in the dimensionality of task-related brain activity

Erica Busch[1] (erica.busch@yale.edu), Nicholas Turk-Browne[1]; [1]Yale University

To investigate cognitive processing in the brain, researchers often focus on the location, amplitude, or reliability of fMRI activity. Dimensionality—the degrees of freedom needed to characterize brain signals—is an additional metric that offers unique insights into where neural computations occur and how they change across development. We use manifold learning to estimate the dimensionality of activity in searchlights across the brain in two developmental fMRI datasets. The first dataset includes awake adults (N=11) and infants (N=26) watching silent cartoons, along with resting adults (N=11) and sleeping infants (N=20). Both adults and infants had higher dimensional activity across the brain during rest/sleep than movie-watching. In adults, this dimensionality decrease was specific to brain regions less engaged by the movie, as indexed by intersubject correlation. That is, non-selective regions demonstrated compressed dimensionality during task relative to rest, while selective regions retained high dimensionality during both. In infants, dimensionality decreased uniformly across the brain from sleep to task, suggesting the infant brain cannot yet dynamically allocate processing capacity to task-relevant regions. Age-related changes in dimensionality were further explored in a second, larger dataset (N=155, ages 3—12y) watching silent cartoons. We again quantified dimensionality across the brain within searchlights, then correlated dimensionality at each searchlight with age. This revealed a positive relationship in prefrontal, anterior cingulate, and anterior temporal cortices, with increasing dimensionality across development. In sum, we have identified two principles of dimensionality: cognitive processing is supported by the compression of activity in task-irrelevant regions, and dimensionality in task-relevant regions increases over development.

Topic Area: PERCEPTION & ACTION: Development & aging

F88 - State-dependent effects of multifocal transcranial magnetic stimulation on paired associative plasticity in the motor network.

Taylor A. Finkelstein[1], Joseph A. Deluisi[1], Taraz G. Lee[2], James A. Brissenden[2], Stephen F. Taylor[3], Thad A. Polk[2], Michael Vesia[1]; [1]University of Michigan

Transcranial magnetic stimulation (TMS) can modulate cortical excitability and functional connectivity, but its effects depend on the activation state of the targeted brain network. Our previous work has demonstrated that functional interactions between brain regions derived from dual-site TMS are context-dependent. For example, connectivity between the posterior parietal cortex (PPC) and primary motor cortex (M1) shows increases in excitability during action planning but not during rest. Despite this, the influence of behavioral context on TMS-induced plasticity in action control circuits is still unclear. We propose that specific behavioral states during TMS can engage neurons involved in action control and affect TMS-induced plasticity and motor function. This study will deliver precisely timed dual-coil pulses to the PPC and M1 (cortico-cortical paired associative stimulation, cPAS). In this within-subject, counterbalanced design, 20 healthy participants will undergo three cPAS conditions: (1) cPAS during a grasping task, (2) cPAS during rest, and (3) cPAS targeting a parietal region outside the grasping network while performing the grasping task. Electrophysiological (TMS) and manual dexterity measures will be collected to assess changes in plasticity and associated hand function within one hour of each intervention. We expect that behavioral context will modulate the aftereffects of cPAS on motor cortical excitability and motor performance, with state-dependent stimulation leading to selective or enhanced effects on motor function. Constraining the brain state with a behavioral task during TMS could optimize plasticity induction in motor circuits underlying action control, offering a strategy to enhance targeted brain stimulation therapies in neurological disorders like stroke.

Topic Area: PERCEPTION & ACTION: Motor control

F89 - High-definition transcranial direct current stimulation of the primary motor cortex modulates the planning and execution of movement sequences

Tara D. Erker[1], Jake J. Son[1,2], Thomas W. Ward[1,3], Yasra Arif[1], Peihan J. Huang[1,3], Jason A. John[1], Kellen M. McDonald[1,3], Nathan M. Petro[1], Grant Garrison[1], Hannah J. Okelberry[1], Kennedy A. Kress[1], Giorgia Picci[1,3], Elizabeth Heinrichs-Graham[1,2,3], Tony W. Wilson[1,2,3]; [1]Boys Town National Research Hospital, [2]University of Nebraska Medical Center (UNMC), [3]Creighton University

Motor control is utilized in many aspects of daily life, though many conditions, including aging, psychopathology, and neurological disorders, can impair motor control. It has been widely shown that noninvasive stimulation of the primary motor cortex can modulate network level activity and has significant effects on motor task performance. The mechanisms of noninvasive stimulation are still poorly understood, but determining how noninvasive stimulation impacts the neural networks associated with motor control could lead to breakthroughs in its therapeutic potential in those with neurological conditions affecting the motor system. Thus, we applied high-definition transcranial direct current stimulation (HD-tDCS) to the primary motor cortex and subsequently utilized magnetoencephalography (MEG) to image the spectral, spatial, and temporal effects of the stimulation on neural responses supporting motor control. Sixty-seven participants completed three HD-tDCS visits (anode, cathode, and sham) that consisted of 20 minutes of left primary motor cortex stimulation followed by MEG. Whole-brain statistical analyses of beta oscillatory responses revealed stimulation-by-task interaction effects in the left primary motor cortex, right occipitotemporal, and the right dorsolateral prefrontal cortices during the planning phase. In these regions, stronger beta oscillatory responses during simple movement sequences were observed following anodal stimulation, but there was no effect of stimulation on neural responses in relation to complex motor sequences. Overall, our data suggests that noninvasive stimulation greatly impacts motor planning, and that the polarity of stimulation and difficulty of movement sequence heavily influence how effective stimulation can be in modulating the beta oscillations.

Topic Area: PERCEPTION & ACTION: Motor control

F90 - Who turned the light on? How avatar's embodiment modulates sense of agency in virtual reality.

Marika Mariano[1] (marika.mariano@unimib.it), Giulia Stanco[1], Caterina Negrone[1], Niccolò Raffa[1], Massimo Montanaro[1,2], Emanuele Sapio[1,2], Alessandro Gabbiadini[1,2], Laura Zapparoli[1,3]; [1]Psychology Department and NeuroMi – Milan Centre for Neuroscience, University of Milano-Bicocca, Milan, Italy, [2]Mibtec – Mind and Behavior Technological Center, University of Milano-Bicocca, Milan, Italy, [3]IRCCS Orthopedic Institute Galeazzi, Milan, Italy

Virtual Reality (VR) allows the implementation of innovative rehabilitation, offering greater ecological validity in the context of motor functions. To be effective, these treatments should foster virtual embodiment, the process of becoming rooted in the virtual body, including a sense of agency towards the avatar's movements. Here, we investigated different dimensions of the agency experience in VR (i.e., explicit and implicit), manipulating the avatar's interactive capabilities (i.e., still vs. moving avatar). We tested 70 healthy adult participants in a VR setting while performing active or passive movements for turning on, after a variable delay, a lightbulb. Before the experiment, half of the participants could see their virtual hands move consistently with their real hand movements (group M+), whereas the other half saw their virtual hands stationary on a table (group M-). Explicit and implicit sense of agency was assessed (considering the intentional binding as an implicit index). Our results show that participants experience an explicit sense of agency (i.e., higher agency ratings in active trials), similarly in both VR scenarios (M+ and M-). This phenomenon is similarly experienced at the implicit level (i.e., significant intentional binding effect for temporally contingent outcomes), but only if real movements are mirrored by an avatar's movements (M+ scenario). These results confirm the dissociation between implicit and explicit processing frequently seen in psychology and suggest the importance of being able to represent our movements in a virtual reality environment through the presence of an avatar whose movements simulate exactly the participants' ones.

Topic Area: PERCEPTION & ACTION: Motor control

F91 - Task-dependent reaction time impairments under cognitive fatigue

Kathleen J. Peters[1], Anthony N. Carlsen[1]; [1]University of Ottawa

Cognitive fatigue (CF) is a psychobiological state of subjective exhaustion resulting from sustained mental effort. Although CF is known to increase simple reaction time (RT) latency, the magnitude of this effect varies, possibly due to differences in the cognitive tasks used to induce CF. It is also unclear whether CF might impact RT differently as processing demands of the RT test increase beyond those of a simple RT task. Thus, this study investigated the effects of three cognitively fatiguing tasks on subjective CF ratings and simple, choice, and go/no-go RT. Participants (n=391) were randomly assigned to a one-hour cognitively fatiguing intervention (math/memory, modified Stroop, or dual-back task) or a control intervention (documentary film). Subjective CF and RT were assessed both pre- and post-intervention. All cognitively fatiguing tasks resulted in significant increases in subjective CF and RT compared to control ($p<.05$), with greater pre-to-post increases observed in simple RT (24.9ms) compared to go/no-go (14.4ms) and choice RT (12.6ms; $p<.01$). The type of cognitively fatiguing task impacted only choice RT, which was significantly slower following the Stroop task compared to the dual-back and math/memory tasks ($p<.05$). Overall, these findings suggest that the ability to induce subjective CF and associated increases in simple and go/no-go RT is largely independent of cognitively fatiguing task type. However, choice RT may be uniquely impacted by certain cognitive demands of the Stroop task, such as repeated response selection. Additionally, although all RT measures were affected by CF, simple RT may be the most sensitive to its effects.

Topic Area: PERCEPTION & ACTION: Motor control

F92 - Ketamine reduces variability in firing frequency and modulates firing rate in the motor thalamus

Yana M. Surtchev[1] (yana.mms@gmail.com), Gabe Holguin, Audrey White, Krystina Jorgensen, Andrew K. Tapia, Zoe H. Huestis, Sydney H. Marean, Katelyn Boone, Carol A. Barnes, Torsten Falk, Stephen L. Cowen; [1]University of Arizona

Ketamine is a powerful general anesthetic that has received renewed interest as a treatment for depression, post-traumatic stress disorder (PTSD), and Parkinson's dyskinesia. Little is known about how ketamine exerts its powerful effects on mood, disease, and perception. Given that the thalamus is a hub connecting nearly all neural systems involved in sensation, perception, and pro-locomotor effect in rodents, we hypothesized that individual neurons in the thalamus would show strong changes in firing rates for at least 1 hour following ketamine injection. Naïve male and female Sprague-Dawley rats (N=4) were implanted with Neuropixels probes (AP: -3.35 ML: +2.8 DV:-5.05-6.7), and recordings were acquired from the thalamic ventral posteromedial nucleus (VPM) while rats were freely traversing an open field. Rats were subsequently injected with two doses of ketamine (20 mg/kg) in two-hour intervals. Preliminary analysis of >250 neurons in 1 rat revealed strong but varying responses over the 25-minute post injection period, such that ketamine reduced 'burst-like' responses as indicated by a reduced short-latency peak in an autocorrelogram. Additionally, the firing rate both increased and decreased across cells during the 5-25 minute post-injection period, suggesting that ketamine has differential effects on various cell types across the VPM axis. This reduction in firing variability and fluctuations in firing rate may be due to ketamine's action as a glutamatergic N-methyl-D-aspartate (NMDA) receptor antagonist that may down-regulate neurons supporting the therapeutic effects of ketamine in depression, PTSD, and PD.

Topic Area: PERCEPTION & ACTION: Motor control

F93 - Using Motor Performance of the SISL Task to Identify Psychosis-Related Clinical Risk

Ziyan Y. Han[1] (ziyanhan2026@u.northwestern.edu), Y. Catherine Han[1], Katherine S. F. Damme[2], Vijay A. Mittal[1], Paul J. Reber[1]; [1]Northwestern University, [2]The University of Texas at Dallas

Motor disturbances have been observed in disorders like psychosis and depression, and are hypothesized to be symptoms predictive of clinical risk. Using an online perceptual-motor learning protocol, the Serial Interception Sequence Learning (SISL) task, we show that motor precision and processing speed measurements can be assessed during a paradigm resembling rhythm-based video games. Within this task, participants attempt to make a series of precisely-timed motor responses to cues moving towards a target location. Throughout the protocol, speed of moving cues is individually adaptively adjusted to maintain a constant overall accuracy rate. In Experiment 1, response precision to the moving cues was compared for patients identified as Clinically High Risk (CHR) for psychosis and healthy controls. CHR patients exhibited poorer initial response precision ($d = 0.91$), consistent with the hypothesis that motor control may act as a biomarker for psychosis risk. Impaired precision improvement was furthermore linked to greater positive symptom severity within this group ($p = 0.036$). In Experiment 2, SISL performance measures were obtained from a large community sample of participants who also completed the Community Assessment of Psychotic Experiences (CAPE). Within this sample, participants scoring higher on a subscale related to depressive symptoms exhibited a tendency towards requiring slower overall cue speed to maintain performance accuracy, suggesting that motor slowing associated with depressive symptoms may also be detectable within this protocol. By evaluating multiple aspects of motor performance, the SISL task can potentially be utilized for identifying risk markers and uncovering motor related mechanisms related to clinical risk.

Topic Area: PERCEPTION & ACTION: Motor control

F94 - Me or Us? Mine or Yours? Here or There? Neural and behavioral responses of prediction in Joint Action

Rosari Naveena Selvan[1,2], Minghao Cheng[2], Anoushiravan Zahedi[1], Florentin Wörgötter[2], Ricarda I. Schubotz[1]; [1]University of Münster, [2]University of Göttingen

Everyday life is filled with instances of joint action, including cooking together, unloading groceries from the car, or playing games. Research suggests that our brains employ a dual hierarchical predictive model to anticipate our own and our partner's actions simultaneously. This hierarchical model has been suggested to have three layers: a sensorimotor layer, a sequence/subgoal layer, and a schema/common goal layer. This study aims to investigate the interplay between shared intention, sub-goal coordination, and movement coordination. We hypothesized that these levels could be modeled as a flexibly coupled dual predictive hierarchy with varying degrees of coupling strength. To test this hypothesis, we employed a two-by-two-by-two factorial design, manipulating the presence/absence of shared common goal, sub-goal coordination, and movement coordination. N=70 participants engage in teams of two players in a novel card game simulating naturalistic joint action scenario. Hand and eye movements are recorded from both players, and EEG is recorded from one of the players. Computer vision is used to map game actions to players' eye movements to analyze successful predictions and errors. Neural (EEG) responses to different levels of coordination – goal, sub-goal, and movement - are analyzed using Hidden Markov Models (HMM), while Dynamic Causal Modeling (DCM) will be used to explore the activation of the Action Observation Network (AON) and the Theory of Mind (ToM) network. By investigating these measures, our findings will shed light on the mechanisms underlying joint action coordination and the role of predictive processing in facilitating efficient and adaptable interpersonal interactions.

Topic Area: PERCEPTION & ACTION: Motor control

F95 - HD-tDCS of the left primary motor cortices upregulates alpha power in the motor circuitry during eyes-closed rest

Yasra Arif[1] (yasra027@gmail.com), Maggie Rempe[2], Nathan Petro[3], Hannah Okelberry[4], Jason John[5], Grant Garrison[6], Kennedy Kress[7], Kellen McDonald[8], Giorgia Picci[9], Tony Wilson[10]; [1]Institute for Human Neuroscience, Boys Town National Research Hospital

Noninvasive brain stimulation techniques, including transcranial direct current stimulation (tDCS), have been shown to modulate cortical excitability. While several electroencephalography (EEG) studies have targeted the primary motor cortices to manipulate motor circuitry, inter-individual baseline variability and volume conduction in conventional EEG studies complicate the accurate characterization of tDCS effects on spontaneous neural dynamics. In the current study, we used high-definition tDCS (HD-tDCS) combined with high-density magnetoencephalography (MEG) to overcome these limitations. Sixty-three healthy adults underwent three stimulation visits (i.e., anodal, cathodal, and sham), during which they completed 20 min of 4X1 motor HD-tDCS followed by eyes-closed resting state during MEG. MEG data were source-imaged and whole-brain vertex-wise ANOVAs were conducted on spatially resolved relative power maps to assess stimulation-related differences in the spontaneous neural power across six canonical frequency bands. Our neural findings indicated that both anodal and cathodal HD-tDCS were associated with significantly increased relative alpha power in distributed brain regions, including bilateral posterior superior temporal cortices, paracentral lobules, right inferior parietal regions, right somatosensory cortices, and left parieto-occipital cortices compared to sham. Surprisingly, no polarity-specific effects were observed. Broadly our data align with previous studies documenting both local and widespread effects of tDCS. Further, the observed spontaneous alpha changes in the somatosensory and association cortices are indicative of downstream modulation of motor-related circuits. This highlights the potential of motor HD-tDCS to influence sensory integration and motor processing across the brain even in the absence of active movement, suggesting the need for further exploration in clinical populations.

Topic Area: PERCEPTION & ACTION: Motor control

F96 - Motor Planning in Posterior Parietal Cortex is Critical in Motor Learning

Hidetaka Hibino[1] (h.hibino@northeastern.edu), Anna Akbas[2], Bailey Uitz[1], Jacob Kogan[1], Terrence Murphy[3], Mathew Yarossi[1], Robert Sainburg[3], Eugene Tunik[1]; [1]Northeastern University, [2]Academy of Physical Education in Katowice, [3]Pennsylvania State Univeristy

While posterior parietal cortex (PPC), which is involved in movement planning and online correction, is a critical cortical area in motor learning, the parietal processes that govern motor learning are poorly understood. We causally investigated the PPC involvement in motor adaptation by delivering double-pulse transcranial magnetic stimulation (TMS) to the left PPC at the movement planning and the online correction phases during a visuomotor rotation adaptation (VMRA) task. Right-handed participants (n=42) were randomly assigned to No TMS, Prior-To-Movement (Early) TMS, or Later-In-

Movement (Late) TMS. Participants completed four blocks in which they reached to pseudorandomly presented targets (8 locations) 12cm away from a fixed central point: Left-Arm Baseline, Right-Arm Baseline, Right-Arm VMRA, and Left-Arm Interlimb Transfer (Transfer). The visually displayed and actual hand motion were matched during the Baselines, whereas the visual feedback of the hand deviated from the actual movement direction of the hand by 30 degrees during the VMRA and Transfer. During the Right-Arm Baseline and Right-Arm VMRA, Early TMS and Late TMS received TMS 50ms after target visualization and when the hand was 8cm away from the starting point, respectively. During the Baselines, the reaching accuracy was comparable between groups. During the early stage of VMRA, the magnitude of reaching errors was lower in Early TMS, but not in Late TMS, compared to No TMS groups ($p<0.05$). This study provides supportive evidence for a causal role of the left PPC in planning for motor learning as seen by enhanced correction of reaching accuracy in Early TMS.

Topic Area: PERCEPTION & ACTION: Motor control

F97 - Differences in the timing of action preparation in people who stutter

Irene Echeverria-Altuna[1,2], Birtan Demirel[2], Sage Boettcher[2], Kia Nobre[1,2], Kate Watkins[2]; [1]Yale University, [2]University of Oxford

Stuttering involves interruptions to the smooth flow of speech and is suggested to arise from differences in the internal timing of speech. Consistently, speech fluency can be induced in people who stutter using external cues to time speech production. Recent studies have reliably shown differences in mu/beta (8-30 Hz) frequency M/EEG (magnetoencephalography and electroencephalography) activity patterns prior to speech production in people who stutter. However, whether this reflects a speech-specific alteration or a more general anomaly in motor control remains unknown. Also uncharted is the extent to which the temporal coordination of action preparation is affected in people who stutter. Here, we developed a working-memory task in which participants shifted between hand-action plans as a function of internally driven temporal expectations. In this task, the dynamic prioritisation of action plans was mirrored by an action-specific and temporally tuned modulation of mu/beta (8-30 Hz) frequency activity as measured with MEG in both people who stutter ($n = 20$) and typically fluent speakers ($n = 20$). Intriguingly, despite showing identical performance in the task, people who stutter differed from typically fluent speakers in the temporal pattern of mu/beta activity modulation when shifting between internal action plans. These findings suggest that stuttering may be linked to more general differences in the timing of action preparation.

Topic Area: PERCEPTION & ACTION: Motor control

F98 - Motor Prediction Sharpens Early Visual Representations of Action Outcomes Independent of Prior Expectations

EDWARD ODY[1], Tilo Kircher[1], Benjamin Straube[1], Yifei He[1]; [1]University of Marburg

According to forward model theories of motor control, sensory consequences of actions are predicted based on an efference copy of the motor command. Correct predictions result in the modulation of action feedback while incorrect predictions result in prediction errors. An alternative view, based on Bayesian models, suggests that incoming sensory feedback is predicted based on the accumulation of prior evidence. Here, in an EEG study ($N = 24$), we examined whether motor prediction sharpens the neural representation of action outcomes independently of prior expectations. In separate blocks, participants either actively triggered Gabor patches with a button press or passively observed them. The patches had 50% probability of having left or right orientation and the order was randomised. To retain attention, participants were asked to respond to vertical catch trials (4/60 per block). We ran a time-resolved decoding analysis by training a classifier (SVM, 5-fold) at each time point to decode the orientation separately for the active and passive conditions. Both conditions showed above-chance decoding shortly after (~100 ms) the onset of the Gabor patch. However, active showed significantly higher decoding than passive, suggesting a sharper representation of the grating orientation in early visual processing. This result demonstrates that forward model motor prediction contributes to sharpening the representation of action outcomes, even when those outcomes can not be predicted based on the accumulation of prior knowledge.

Topic Area: PERCEPTION & ACTION: Motor control

F99 - The influence of auditory pitch contour on timing manual interception of moving targets

Haleh Mahmoudi[1] (haleh.mahmoudi@uga.edu), Deborah A. Barany[1]; [1]University of Georgia

Manual interception of a moving target requires continuous integration of spatial and temporal information across sensory modalities to determine when and where to move. While previous research has primarily focused on visual motion processing, auditory signals may also enhance interception performance. The proposed studies will leverage crossmodal correspondences - systematic associations between stimulus attributes from different modalities - to examine how audiovisual information is integrated for goal-directed action. For example, ascending (descending) pitch changes are typically linked to faster (slower) visual target speeds. Further, our preliminary findings ($N = 11$) indicate that participants judge pitch direction more quickly for faster tempos, especially when paired with matching visual motion directions (up/down). Building on this, we will investigate how audiovisual congruency affects interception initiation and timing. Participants will control a cursor to move toward a fixed interception zone based on visual target speed (fast/slow), with targets presented alone or paired with either a congruent (e.g., fast visual with ascending pitch) or incongruent (e.g., fast visual with descending pitch) auditory stimulus. We hypothesize that movements will be initiated earlier for faster visual targets and when paired with ascending pitch. Additionally, we predict that incongruent auditory stimuli will impair interception timing accuracy. These findings would provide initial evidence that crossmodal correspondences facilitate goal-directed actions. Future work will adapt this paradigm for fMRI, using representational similarity analysis to examine how crossmodal correspondences modulate cortical representations involved in motor planning.

Topic Area: PERCEPTION & ACTION: Motor control

F100 - 4 trials is not enough: More but not less audio-visual experience strengthens audio-tactile correspondences in children

Shibo Cao[1] (shibo.cao001@umb.edu), Rong Tan[1], Vivian M Ciaramitaro[1]; [1]University of Massachusetts Boston

How do we know what sensory information goes together? Besides spatial co-localization and temporal synchrony, we rely on crossmodal correspondences: how features are shared across the senses. For example, nonsense words, such as "bouba", are associated with round abstract shapes and "kiki" with angular shapes. These associations are seen for auditory and visual stimuli (AV), and auditory and tactile stimuli, which are touched but not seen (AT). Visual experience influences AT associations: AT associations are weak in early-blind adults (Fryer et.al, 2014) and in fully-sighted children with naïve visual experience (Chow et.al, 2021), but can be enhanced if fully-sighted children see the shapes first (16 trials of prior AV exposure; Chow et.al., 2021). Here, we examine if the amount of prior exposure matters. Sixty-one 6-8 year-olds had 4 or 8 trials of prior AV exposure, seeing a round and spiky shape on a screen and indicating which shape best matched a nonsense sound. Following AV exposure, children completed 16 AT trials, feeling two tactile shapes inside a box and indicating which shape best matched a nonsense sound. We found that 8, but not 4, trials of prior AV exposure enhanced AT associations while neither 4 nor 8 trials of prior AT exposure enhanced AT associations. Thus, children did not benefit from repeated AT exposure, unlike blind adults where AT associations are enhanced, or blindfolded, fully-sighted adults where AT associations are diminished (Graven et. al., 2018). Future work needs to address mechanisms by which repeated exposure enhances such crossmodal correspondences.

Topic Area: PERCEPTION & ACTION: Multisensory

F101 - Efficacy and mechanisms of virtual reality treatment of phantom leg pain. A clinical trial study.

Elisabetta Ambron[1] (eli.ambron@gmail.com), Rand Williamson[2], Jing-Sheng Li[3], Maxim Karrenbach[3], Erik Rombokas[3], Laurel Buxbaum[2], H. Branch Coslett; [1]University of Pennsylvania, [2]Jefferson Moss Rehabilitation Research Institute, [3]University of Washington

Approximately 90% of individuals with limb amputation experience the persistent sensation of the missing extremity and up to 85% experience debilitating pain in the missing limb, a condition termed phantom limb pain (PLP). We previously demonstrated that Virtual Reality (VR) with active leg movements and vision of a virtual limb significantly reduces phantom limb pain in subjects with below the knee amputations. In this clinical trial, we tested the efficacy and mechanisms of VR treatment of phantom leg pain in thirty-six lower limb amputees with PLP. Participants were randomly assigned to an 8 session VR treatment with Active VR or a commercially available VR pain treatment (REAL i-Series®) and asked to rate their PLP before and after each session. Using ultra-high resolution (7T) functional magnetic resonance imaging, precise somatosensory and motor maps of the limb and connectivity data were obtained at the beginning and at the end of the treatment to test for possible treatment-related changes in cortical representation of the lower limb and connectivity within the pain matrix. Our data show a beneficial effect of VR treatment for PLP, in particular for active treatment, and advance theoretical understanding of the mechanisms and functional neuroanatomy of PLP.

Topic Area: PERCEPTION & ACTION: Multisensory

F102 - Uncovering multimodal narrative integration in the brain using functional connectivity multivariate pattern analysis

Chelsea Ekstrand[1] (chelsea.ekstrand@uleth.ca), Christina Haines[1], Joshua Craig[1], Keva Klamer[1], KiAnna Sullivan[1], Peter Seres[2]; [1]University of Lethbridge, [2]University of Alberta

Narrative coherence is a critical human ability that allows us to process fragmented information and integrate it into unified episodic memories. While previous studies have shown that narrative processing seems to be reliant on the brain's Default Mode Network (DMN), they often confound findings with unrelated cognitive demands, such as increased cognitive load or altered temporal coherence. To address these limitations, we investigated the functional connectivity patterns that support coherent narrative formation under conditions that preserve audiovisual narrative integrity while varying semantic context. Using fMRI, we examined brain connectivity while participants viewed the same foreign-language film under two conditions: (1) a rich context condition, where subtitles provided semantic details of the narrative, and (2) a sparse context condition, where the same film was presented with subtitles in a scrambled order. By maintaining the causal structure of the narrative, we isolated the effects of semantic richness on functional connectivity patterns. Results from functional connectivity multivariate pattern analysis showed that coherent narrative formation is reliant on unique patterns of functional connectivity to the core DMN (ventromedial prefrontal cortex, posterior cingulate cortex; PCC) and frontoparietal network (left inferior frontal gyrus and precentral gyrus, right angular gyrus). Of note, seed-based analyses of these regions identified dissociations among DMN subsystems dependent on contextual richness, where there was decoupling between the PCC and lateral DMN that was greater in the sparse context condition. These findings suggest that narrative coherence relies on specific patterns of functional coupling and decoupling to regions of the DMN and frontoparietal networks.

Topic Area: PERCEPTION & ACTION: Multisensory

F103 - Attention is required for visual modulation of early auditory speech processing

Yun ZOU[1] (yunzou@umass.edu), Lisa D. Sanders[1], Alexandra Jesse[1]; [1]University of Massachusetts Amherst

Most daily conversations occur face-to-face, when listeners hear and see the talker. Visual information from talkers' faces can significantly enhance speech recognition, particularly when auditory signals are degraded. However, whether attentional resources are necessary for visual speech gestures to influence auditory speech processing remains unclear. Some theories posit that these effects are automatic; others allow that, minimally, listeners must attend to speech to observe visual effects on early auditory processing. Using event-related potentials (ERPs), we investigated the role of attention in visual speech effects and whether this influence is modulated by auditory signal ambiguity. Participants heard speech sounds that were either unambiguous ([p] or [t]) or ambiguous (between [p] and [t]), accompanied by unrelated tone sequences. In some trials, participants also saw the speaker's face, while in others, they only heard the speaker. In half of the blocks (attend-speech blocks), participants categorized the speech sounds as /apa/ or /ata/ while ignoring the tones. In the other half (attend-tone blocks), they categorized the tones as high or low while ignoring the speech sounds. ERP results revealed that when participants attended to the speech sounds, seeing visual gestures reduced N1 responses in the audiovisual condition compared to the auditory-only condition for both ambiguous and unambiguous sounds. However, this early audiovisual facilitation disappeared when attention was directed to the tones, regardless of auditory ambiguity. Attention to speech is thus necessary for early audiovisual interaction during speech processing and that attentional effects on visual influence are consistent for both ambiguous and unambiguous auditory signals.

Topic Area: PERCEPTION & ACTION: Multisensory

F104 - Effects of Additional Information, Musical Context and Virtual Reality on the Emotional Affect Induced by Art

Magdalena Nikolova[1] (mnikolov@ramapo.edu), Justin Haskoor[2], Can Ozger[3], Naseem Choudhury[4]; [1]Ramapo College of New Jersey

The subjective experience of art is a universal human phenomenon, yet the mechanisms underlying it remain only partially understood. Two key modes of sensory processing are identified. Bottom-up processing involves the hierarchical construction of perception, starting from raw sensory inputs, such as retinal data, and building toward complex visual representations via primary sensory pathways, particularly the primary visual cortex (V1). In contrast, top-down processing integrates sensory input with prior knowledge, expectations, and contextual factors. This cognitive modulation, mediated by higher-order brain regions like the prefrontal cortex, can significantly influence subjective experiences. For example, a painting or musical piece may evoke different responses depending on cultural background or emotional state. This study explores the interaction between visual art and music, focusing on how top-down processing modulates aesthetic experience. Forty-seven young adults participated in a virtual reality (VR) simulation of Francisco Goya's Black Paintings, randomly assigned to one of four conditions: narration about the artist (N), classical music (M), both (NM), or baseline background noise (B). Affective responses were measured using the Implicit Positive and Negative Affect Test (IPANAT) and the Positive and Negative Affect Schedule (PANAS), administered before and after the experience. Art knowledge and interest were assessed via the Vienna Art Interest and Art Knowledge Questionnaire (VAIAK). We hypothesize that participants in the combined condition (NM) will report the most negative affective state due to enhanced elaboration across sensory and cognitive channels, intensifying the emotional experience. Analyses include one-way ANOVA and paired t-tests to evaluate group differences and affect changes.

Topic Area: PERCEPTION & ACTION: Multisensory

F105 - Examining Learned Associations Between Contextual Cues and Stress-Inducing Experiences

Ella Reinders[1] (ellar2@umbc.edu), Olivia Edoigiawerie[1], Tyler Nguyen[1], Maya Tondravi[1], Se Rin Lee[1], Eden Beyene[1], Tara LeGates[1,2]; [1]University of Maryland, Baltimore County, [2]University of Maryland School of Medicine

The ability to associate stress-inducing stimuli with contextual information is important for survival, but it remains unclear how the brain integrates this information to guide behavior. We used a behavioral paradigm, Conditioned Place Aversion (CPA), where mice learn to associate contextual cues in a two-chamber arena with an ethologically relevant aversive stimuli, restraint. To determine what brain regions may be responsible for mediating this behavior, we used immunohistochemistry to measure cFos expression, allowing us to visualize the brain regions that are activated during various restraint-context pairings. Mice were either placed in the CPA chamber and allowed to roam freely, restrained in the CPA chamber, restrained in their home cage for 30 minutes, or left undisturbed in their home cage prior to collecting brain samples. We focused on the hippocampus CA1 region, medial nucleus accumbens, and basolateral amygdala due to their prominent roles in contextual learning and memory, motivated behaviors, and fear. In the nucleus accumbens and basolateral amygdala, the mice had a significant increase in cFos expression after restraint in the CPA arena. In the ventral hippocampus, mice exposed to the arena with or without restraint showed a significant increase in cFos expression, in line with the hippocampus's role in processing new contextual information in the environment. Overall, these findings suggest that all three hypothesized brain regions play a prominent role in CPA behavior, with the ventral hippocampus facilitating contextual processing. Our findings help to advance understanding of the neurobiological basis of stress with implications for understanding stress-related neuropsychiatric disorders.

Topic Area: PERCEPTION & ACTION: Multisensory

F106 - Integrating Context and Time in Perceptual Decision-Making: Insights from Peripheral Focused Ultrasound Stimulation

Doga Dogan[1] (ddogan6@gatech.edu), Aya Rezeika[2], Audrey Leroux[1], Tansu Çelikel[1]; [1]School of Psychology, Georgia Institute of Technology, [2]Donders Institute for Brain, Cognition and Behavior, Radboud University

Perceptual decision-making is influenced by the interplay between stimulus predictability and temporal uncertainty, as well as global and local stimuli correlations. In this study, we investigated how these factors impact perceptual thresholds for tactile sensitivity using non-invasive focused ultrasound stimulation (FUS). Its high spatial resolution, non-contact nature of force delivery, and spatiotemporal control over sound wave parameters make it an ideal method for quantitatively studying the sense of touch. The study was conducted with human subjects (N = 82, age group: 18-37, all genders) who were instructed to respond if they felt a vibration on their fingertip under varying conditions, assessing the effects of stimulus predictability (priming), temporal uncertainty, and stimulus surprise. Our results show that contextual information (global correlations) and increasing the number of sensory channels (auditory cue) independently improve stimulus detection and reaction times. Temporal uncertainty, however, slows down decision-making and increases sensitivity thresholds independent from local or global correlations. During multi-sensory integration the detection probability is independent from whether stimuli are locally coherent, but reaction times are improved if stimuli are correlated across repetitions (i.e. global correlations). These results suggest that stimulus predictability modulates sensory and motor processes independently. Distributed surface EEG recordings across the two hemispheres revealed a parieto-frontal circuit encoding stimulus predictability in a context- and time-varying manner. These findings suggest that the brain integrates contextual cues and temporal information across sensory modalities through distinct neural circuits to optimize perceptual processes and motor responses.

Topic Area: PERCEPTION & ACTION: Multisensory

F108 - Neural mechanisms of biological motion perception in deaf native signers and hearing non-signers

Carolyn Gershman[1] (cdg60@georgetown.edu), Ted Supalla[1], Anna Seydell-Greenwald[1,2], Barbara Landau[1,3], Elissa L. Newport[1,2]; [1]Center for Brain Plasticity and Recovery, Georgetown University Medical Center, [2]MedStar National Rehabilitation Hospital, [3]Department of Cognitive Science, Johns Hopkins University

Sign language is a visual gestural language that is expressed manually on the hands, face, and body, and mediated by movements through space. Because sign language is processed in left-dominant language networks, lifelong experience with sign language may alter the processing of non-linguistic motion stimuli. For example, some studies suggest stronger left-hemisphere involvement in coherent motion processing in deaf signers, but evidence is still limited. The processing of biological motion, which shares properties inherent to sign language, might show even stronger changes. Here, we investigated differences between 19 deaf native signers and 19 hearing controls in the fMRI activation for biological motion processing (judging the heading direction of a point-light walker) compared to coherent motion processing (judging the heading direction of a coherently random dot pattern). Both groups showed activation in ventral extrastriate cortex, bilateral MT-MST, and right pSTS. ROI analyses in MT-MST and right pSTS showed no differences in strength of activation, but deaf signers showed significantly greater activation in PT and STG regions. Lateralization in MT-MST differed between the groups, with deaf signers showing right-lateralization and hearing participants bilateral activation for biological motion processing, both relative to coherent motion processing and relative to a resting baseline. The overall activation patterns and the relative increase of activation for visual motion processing in early auditory cortex are consistent with previous studies on biological motion processing and cross-modal plasticity. However, the shift towards right-lateralized activation for biological motion processing in deaf native signers contrasts with previous reports and merits further investigation.

Topic Area: PERCEPTION & ACTION: Multisensory

F109 - Effect of place of articulation and phonemic restoration on the Audio-Visual Time Flow Illusion

Achint Sharma[1], Heather Bortfeld[1], Antoine J Shahin[1], Kristina C Backer[1]; [1]University of California, Merced

The Audiovisual Time-Flow Illusion (AVTFI) demonstrates that the auditory domain sets the pace of processing of the corresponding visual speech during AV speech perception. When the auditory speech is temporally altered (i.e., by deleting segments or adding silent pauses), individuals perceive a “skip” or “pause” in the visual signal despite the manipulation being only in the auditory stream. The present study investigated whether the place of articulation (POA) of the temporally altered phoneme results in a change in this illusory perception and whether AVTFI is tied to the phonemic restoration (PR) mechanism. We contrasted AVTFI perception for phonemes with a discernable (e.g., /b/, /p/) versus indiscernible (e.g., /g/, /k/) POA in 30 young adults. Additionally, we investigated the effect of POA on the PR illusion, whereby the same 30 participants were presented with AV speech stimuli in

which phonemes with a discernable or indiscernible POA were removed and replaced with noise. Participants reported whether the speech sounded continuous through the noise. We hypothesized that individuals would experience stronger AVTFI for phonemes with indiscernible versus discernible POA, and AVTFI would be inversely correlated with PR, as stronger phonemes with discernible POA and PR are likely to reduce the perception of a temporal change. First, we observed similar levels of AVTFI perception regardless of POA discernibility. Second, participants showed enhanced PR for phonemes with a discernable POA, but there were no significant across-subject correlations between AVTFI and PR illusory perception, suggesting that these illusions rely on different mechanisms.

Topic Area: PERCEPTION & ACTION: Multisensory

F110 - Tactile word form responses in parietal cortex of proficient blind braille readers

Abby Clements[1] (acleme18@jh.edu), Elizabeth esaccon2@jhu.edu[1], Mengyu Tian[2], Marina Bedny[1]; [1]Johns Hopkins University, [2]Beijing Normal University

Reading recruits specialized neural populations in the ventral visual stream (vOTC), including the so-called 'visual word form area' (VWFA). The VWFA neighbors the fusiform face area and parahippocampal place area but is functionally distinct from these regions. We hypothesized that blind readers would recruit analogous braille-specialized neural populations in posterior parietal cortices, which participate in high-level tactile perception. Congenitally blind braille readers (N = 20) participated in two experiments. In Experiment 1, participants read braille words and consonant strings, touched shapes made from braille dots, and listened to spoken words and backwards speech. In Experiment 2, blind participants touched small 3D models of faces and small maze-like 'places.' Sighted participants (N = 20) performed analogous visual experiments. A leave-one-run-out analysis in blind participants identified voxels in left parietal cortices that respond more to braille words than shapes made of braille dots ($t(19) = 4.6$, $p < 0.001$). These voxels also prefer braille words to spoken words $t(19) = 4.7$, $p < 0.001$). Additionally, braille-preferring voxels did not distinguish between faces and scenes ($t(19) = 0.3$, $p = 0.79$). By contrast, separate neural populations in parietal cortices responded preferentially to tactile faces and tactile places, respectively (p's < 0.001). Face- and place-preferring neural populations responded more to tactile shapes than to braille words ($t(19) = 2.4$, $p = 0.028$), mirroring the selectivity observed in vOTC of sighted readers. These results suggest that proficient blind readers develop braille 'word form' responses in posterior parietal cortex.

Topic Area: PERCEPTION & ACTION: Multisensory

F112 - Evaluating the Neurophysiological Evidence for Cross Modal Expectations using Alpha Oscillations

Soukhin Das[1] (skndas@ucdavis.edu), Mingzhou Ding[2], George (Ron) Mangun[1,3]; [1]Department of Psychology and Center for Mind and Brain, University of California Davis, [2]J Crayton Pruitt Family Department of Biomedical Engineering, University of Florida, [3]Department of Neurology, University of California Davis

Predictive coding is a general model of sensory processing in the brain that forms expectations about the likely causes of sensory input to predict future outcomes. Discrepancies between expectations and sensory inputs are propagated hierarchically as prediction errors to update these expectations. Recent studies suggest that alpha oscillations (8–12 Hz) are a spectral signature of predictive coding in different modalities. However, their distinct patterns during cross-modal sensory processing remain underexplored. Using a 2×2 cross-modal design, auditory (HEAR or SEE) and visual cues (H or S) indicated the target modality (visual/auditory). In 80% of trials, targets were presented in the expected modality, while 20% of trials involved targets in the unexpected modality. Participants distinguished the frequency of visual gratings or the tone of auditory stimuli irrespective of cue validity. Our findings revealed dissociative alpha desynchronization in central and occipital channels, guiding modality-specific expectations. Topographical analysis demonstrated modality-specific cortical activation, with stronger alpha suppression in occipital regions during correct responses compared to incorrect ones. Post-stimulus analysis revealed distinct alpha dynamics for expected versus unexpected targets. Expected targets exhibited sustained occipital alpha desynchronization, while unexpected targets showed transient alpha modulation, reflecting the neural cost of processing errors. Temporal generalization of alpha-power suggested sequential propagation of prediction error signals across cortical regions, highlighting efficient hierarchical updates to internal models. In summary, our study underscores the critical role of alpha oscillations in predictive coding, revealing distinct sensory and cognitive mechanisms underlying expectation and prediction error processing during cross-modal tasks.

Topic Area: PERCEPTION & ACTION: Multisensory

F113 - The Effects of Physical Effort on Time Perception

Li Yang[1] (lyang147@ucr.edu), Rachel Francis[1], Rawan Gabr[1], Brynna Marich[1], Weiwei Zhang[1]; [1]University of California, Riverside

The interaction between time perception and physical effort is essential in activities like sports. This study investigates how isometric handgrip tasks influence time perception through concurrent time reproduction and production tasks. In the time reproduction task, participants exerted grip force at varying intensities while experiencing a time interval (2–4 seconds) and reproduced the perceived duration. In the time production task, they produced a specified duration while exerting grip force. Two hypotheses were tested: the Arousal Hypothesis, suggesting that handgrip-induced physical arousal accelerates time perception, leading to overestimated durations in reproduction tasks and underestimated durations in production tasks; and the Competition Hypothesis, proposing that concurrent handgrip impairs time perception due to competition for shared attentional resources or magnitude-based processes, reversing these effects. Results supported the arousal hypothesis: High effort increased estimated durations in time reproduction tasks (Experiments 1–2) but decreased estimated durations in time production tasks (Experiment 4). Alternative explanations, such as response bias, were ruled out because the handgrip effect disappeared when durations were cued numerically rather than experienced under grip (Experiment 3). These findings suggest physical effort distorts perceived time, potentially due to arousal accelerating temporal processing.

Topic Area: PERCEPTION & ACTION: Other

F114 - Time-resolved EEG decoding of neural text representations during naturalistic braille reading

Pushpita Bhattacharyya[1] (pushpita@ski.org), Ryan Tam, Peter Orsmond, Sadie Hicks, Santani Teng; [1]Smith-Kettlewell Eye Research Institute

Braille is a tactile writing system using raised dots to represent text. Blind and visually impaired people read braille by sweeping their fingers across the page, dynamically assembling dot patterns into meaningful text. Understanding braille sensorimotor dynamics has been limited in part by the difficulty of recording time-resolved neural signals during active braille reading, where stimulus onsets are participant-driven. To address this challenge, we implemented a novel approach integrating electromagnetic finger-tracking with EEG to capture dynamic neural representations during naturalistic braille reading. Blind braille readers read a randomized grid of alphabetic letters with one finger, responding verbally to vowels; sighted participants simply moved their finger along the letters. We estimated letter contact timestamps from the position tracker and synced them to the EEG recording to extract stimulus-onset epochs. These were decoded between letters using SVM classification to produce decoding accuracy curves between -200 ms and 1000 ms of stimulus onset. In the blind group, we found a sustained average decoding signal starting ~200 ms after letter onset, peaking ~400 ms (~59% accuracy), and ~280 ms when excluding vowel response conditions (~56% accuracy). Sighted controls showed a similar, weaker average signal, peaking at ~300 ms (~55% accuracy), suggesting shared low-level sensory representations across groups regardless of braille literacy or visual ability, with stronger decoding signals in braille-literate individuals possibly reflecting additionally encoded graphemic representations. Corroborating recent work decoding statically presented braille letters, these results establish the promise of our approach to capture multiplexed linguistic representations during naturalistic, continuous braille processing.

Topic Area: PERCEPTION & ACTION: Other

F115 - Exploring the Effect of VR-based Social Interaction Tasks on Face Perception

Shengtong Liu[1] (shengtong.liu@manchester.ac.uk), Boris Otkhmezuri[1], Rebecca Elliott[1], Karen Lander[1]; [1]University of Manchester

Introduction: Social anxiety, which affects approximately 13% of the population, is characterised by visual avoidance of eye contact and faces. While VR has been applied across various realms, its potential to influence face perception in behavioural research is underexplored. This study investigates the relationship between social anxiety and face perception and explores the effect of VR-based social interaction tasks on face perception and social anxiety. Methods: In Study 1, participants (N = 144) were recruited. Social anxiety was measured and face perception was assessed. In Study 2, participants (N = 144) were divided into an experimental group and a control group (N = 20 each). The experimental group completed six weekly VR tasks featuring progressively more challenging social scenarios (e.g., ordering at a coffee shop, public speaking), with physiological data (pulse rate, eye movement) recorded as well as social anxiety scales and face perception. The control group completed only the scales and face tests. Results: In Study 1, findings showed a significant negative correlation between face memory and social anxiety. In Study 2, we have established the feasibility of using a VR methodology in this context. Our results show changes in participants' pulse rates and eye movements during the VR-based social interaction tasks and initial analysis suggest changes in social anxiety and face perception across testing sessions in the experimental group. Conclusion: These results suggest social anxiety impairs face memory. Further, we highlight the potential use of VR to improve social and cognitive functioning in socially anxious individuals

Topic Area: PERCEPTION & ACTION: Other

F116 - Neural Correlates of Self-Motion Perception Training in Older Adults

Fred Mast[1] (fred.mast@unibe.ch), Andreas Szukics[1], Matthias Ertl[1,2]; [1]University of Bern, [2]University of Lucerne

Introduction: Perceptual learning (PL) of self-motion discrimination reduces perceptual motion thresholds, enhancing sensitivity to subtle non-visual self-motion cues. We were able to demonstrate that this perceptual improvement also positively influences postural stability and gait in older adults. However, the neural mechanisms underlying PL remain unclear. We investigate the pre- and post-training changes in resting state, neuronal connectivity and EEG associated with PL. Methods: Participants (90, aged 65 and older) are randomly assigned to (1) self-motion training (10 one-hour sessions of roll-rotation PL), (2) Tai Chi training, or (3) a passive control condition. Pre- and post-training assessments include perceptual motion thresholds, vestibular-evoked potentials (VestEPs), rsMRI, posturography, and gait measures. Expected Results: We expect that self-motion training will, as in a previous study, improve perceptual motion thresholds, and we hypothesize that such improvement is absent in the two control groups. We plan to use the behavioral results as predictor for a seed-based (OP2) rsfMRI connectivity analysis. With respect to the EEG data, we expect, based on the literature, that successful PL leads to increased N1 and P2 amplitudes for the trained roll-rotations, but does not alter the amplitudes for other motion directions (no transfer effects). Analyzing neural correlates of PL will provide valuable insights into the mechanisms driving these improvements. Self-motion perceptual training can contribute to fall prevention for older adults.

Topic Area: PERCEPTION & ACTION: Other

F117 - Neural complexity and extended cessations: A source-localized MEG-EEG analysis of the advanced meditative endpoint, nirodha samapatti

Kenneth Shinozuka[1] (kennethshinozuka@gmail.com), Matthew Sacchet[2]; [1]University of Oxford, [2]Harvard Medical School

We are entering a third wave of meditation research focused on advanced meditation, including states and stages of meditation practice that unfold with time and mastery. Nirodha samapatti (NS), sometimes called extended cessation in the scientific literature, is a meditative endpoint described in Theravada Buddhist meditation that corresponds to complete cessation of perception and feeling. In other words, meditators report periods of unconsciousness during NS. Here, we aimed to determine the neural correlates of NS, including their relation to biomarkers of unconsciousness. For example, EEG-based Lempel-Ziv complexity (LZc) has been shown to consistently decrease during anesthesia and disorders of consciousness. Using the first-ever simultaneously-acquired EEG and MEG data from three NS meditators, we measured differences in whole-brain, source localized, normalized LZc between NS and two non-meditative, cognitively engaging control tasks. No significant differences in normalized LZc were identified between NS and the control tasks. These results suggest that NS is a unique brain state from other interventions and conditions that lead to unconsciousness.

Topic Area: PERCEPTION & ACTION: Other

F118 - Stimulus expectations drive conditioned olfactory hallucinations

Lauren Wolters[1], Xiaolin Qiao[1], James Howard[1]; [1]Brandeis University

Olfactory hallucinations represent a significant portion of experienced hallucinations in both clinical and healthy populations. Empirical studies of auditory and visual hallucinations have used Pavlovian conditioning paradigms to demonstrate that false perception is driven by overly robust representations of stimulus expectations. However, no study has established that a similar mechanism underlies olfactory hallucinations in humans. Here we implemented a conditioned olfactory hallucination paradigm in which we first determined the odor detection thresholds of butanol for each participant (n = 55) using an adaptive psychometric algorithm. Participants then completed an odor detection task where on each trial one of two distinct visual cues was paired with either a supra-threshold, threshold, or sub-threshold concentration of butanol, or no odor. In the first three blocks of task trials, one visual stimulus ("strong cue") was paired more frequently with supra-threshold concentrations, and the other visual stimulus ("weak cue") was paired more frequently with sub-threshold concentrations. In the last three blocks both cues were paired most frequently with the no odor condition. We found significantly greater odor detection rates on no odor trials for the strong cue compared to the weak cue ($t54 = 2.08$, $p = 0.043$). Importantly, this finding could not be explained by differences in total number of visual cue presentations or other task variables. We thus demonstrate that false odor perception can be enhanced by the expectation of an olfactory stimulus in a Pavlovian conditioning paradigm. Such findings could yield therapeutic insight into the mechanisms underlying pathological olfactory hallucinations.

Topic Area: PERCEPTION & ACTION: Other

F119 - Neural representations underlying sound-shape associations

Josh Dorsi[1] (jxd5826@psu.edu), Simon Lacey[1,2,3], Lynne Nygaard[4], Krish Sathian[1,2,3]; [1]Penn State Health Milton S. Hershey Medical Center, [2]Penn State College of Medicine, [3]Penn State College of Liberal Arts, [4]Emory University

Sound symbolism is the systematic relationship between speech sounds and meaning (e.g., the pseudowords /kɛke/ and /molo/ sound pointed and rounded, respectively). Prior work showed that representational dissimilarity matrices (RDMs) of shape ratings and spectro-temporal acoustic parameters (the fast Fourier transform [FFT], spectral tilt and speech envelope) are correlated (Lacey et al., Cognitive Science 44:e12883, 2020). Here, we used functional magnetic resonance imaging (fMRI) to investigate the associated neural processes. Participants rated the roundedness/pointedness of 12 auditory pseudowords during and immediately after an fMRI scan. We constructed searchlight RDMs based on the blood oxygenation level-dependent (BOLD) signal within 9 mm spherical regions centered on each voxel in the cerebral cortex. We examined the correlations between these BOLD RDMs and RDMs based on the ratings and spectro-temporal parameters. As shown previously, the ratings RDM was correlated with the RDM of each spectro-temporal parameter. There were significant correlations between the BOLD and ratings RDMs in areas typically associated with visual processing (V4 and superior occipital gyrus), suggesting crossmodal processing of the auditory pseudowords. BOLD RDMs were significantly correlated with RDMs of the FFT and spectral tilt in the inferior frontal gyrus, in pars opercularis and triangularis, respectively, and with the FFT RDM in the left angular gyrus. These regions are known to be engaged in language processing. Our results are consistent with the idea that sound-symbolic shape processing recruits the language and visual systems to establish crossmodal associations between auditory word forms and visual concepts.

Topic Area: PERCEPTION & ACTION: Other

F120 - Task-based fMRI analysis of symbol form areas in 6-8 year-old children

Amelia C. Murray[1] (ameliacmurray@gmail.com), Zoha Arif[1], Emily M. Harriott[1], Sophia Vinci-Booher[1], Laurie E. Cutting[1], Eric D. Wilkey[1]; [1]Vanderbilt University

Separate areas in the inferior temporal lobes are often associated with letter and number processing, known as symbol form areas. The Number Form Area (NFA) shows preference for processing Arabic digits and the Visual Word Form Area (VWFA) shows a preference for words. The present study explored the location and specificity of these symbol form areas in a sample of young children with emerging literacy and numeracy skills (n = 22, 6-8 years old). Children completed two fMRI tasks, a single-digit numerical comparison task (i.e., which of two numbers is greater?) and a lexical one-back task (i.e., was the word repeated?). We modeled blood-oxygen-level dependent signal for each task using a general linear model and then contrasted (1) all task conditions vs. baseline and (2) numbers vs. lexical tasks at the whole brain level. When we compared numbers versus lexical tasks at a threshold of $p < 0.001$ and $k > 10$, activation in the right inferior temporal region was greater for numbers than letters and only during the number comparison task, indicating that the putative NFA area exhibits right-lateralized processing. In contrast, activation in the left inferior temporal region was greater for letters than numbers and only during the lexical task, supporting the presence of a left-lateralized VWFA in this sample. These results will inform future analyses of developing white-matter pathways and provide insight into the neural correlates underlying the math and reading networks of young children with emerging academic skills.

Topic Area: PERCEPTION & ACTION: Other

F121 - Neural bases of the bodily self revealed by electrical brain stimulation in 354 epileptic patients

Zoé Dary[1,5] (zdary@bwh.harvard.edu), Stanilas Lagarde[2,3], Samuel Medina Villalon[2,3], Hugo Dary[4], Elodie Garnier[3], Jacques Léonard[5], Fabrice Bartolomei[2,3], Christophe Lopez[5]; [1]Department of Neurosurgery, Brigham and Women's Hospital, Harvard Medical School, Boston, USA, [2]INS, Institut de Neurosciences des Systèmes, Aix Marseille University, INSERM, Marseille, France, [3]Epileptology and Cerebral Rhythmology Department, APHM, Timone Hospital, Marseille, France, [4]Center for Magnetic Resonance in Biology and Medicine (CRMBM), CEMEREM, CHU, APHM, Timone Hospital, Marseille, France, [5]Aix Marseille Univ, CNRS, Centre de Recherche en Psychologie et Neurosciences (CRPN), Marseille, France

The bodily self, a minimal form of self, is based on bodily experiences like self-location, ownership, agency, and first-person perspective. The network underlining these bodily self experiences has been studied using fMRI during multisensory illusions in healthy participants and through lesion analysis in neurological patients. Intracranial electrical stimulation in patients with epilepsy is another valuable method for brain mapping, linking bodily self changes to specific brain regions. In this study, we analysed clinical manifestations induced by direct electrical stimulation in 354 epilepsy patients undergoing stereo-encephalography (SEEG) for presurgical evaluation (2000–2021). Across 11,004 electrical stimulations, 2,320 clinical responses were recorded. Our analysis focused on bodily self disturbances. We identified 50 patients reporting bodily self disturbances in 78 stimulations (3.3% of all responses). Altered experiences included body image (n=29), depersonalization (n=23), self-location (n=17), and agency (n=15). These disturbances were linked to the anterior and posterior cingulate cortex, insula, supplementary motor area (SMA), precuneus, parietal operculum, and amygdalo-hippocampal complex. The functional connectivity results, across all experiences, showed a decrease in the strength of the inferior parietal lobule and the inferior temporal gyrus, suggesting a disconnection of these nodes in the bodily self network. The analysis of link strength revealed a decrease in functional connectivity between the inferior parietal lobule and the middle temporal gyrus, suggesting a functional decoupling between the bodily self and higher-order self-processing. These findings extend our understanding of the neural basis of the bodily self with another functional mapping technique than fMRI, which links specific areas to bodily precepts.

Topic Area: PERCEPTION & ACTION: Other

F122 - Investigating the role of human mediodorsal thalamus in odor-guided behavior

Jared Newell[1] (jarednewell@brandeis.edu), Lauren Wolters[1], James Howard[1]; [1]Brandeis University

In order to perform critical functions like obtaining food, avoiding prey, and selecting mates, nervous systems must be able to transform olfactory sensation at the periphery into adaptive behaviors. One key region for coordinating this function is the mediodorsal thalamus (MDT), which is densely connected with both olfactory sensory cortex and prefrontal substrates. Recent animal studies demonstrate that MDT both encodes information about specific odorants, and mediates connectivity with sensory and prefrontal cortices to guide behavior. However, the mechanisms by which MDT supports odor-guided behavior in humans remain unknown. Here we designed an experiment in which human participants perform an odor-guided learning task while undergoing fMRI. On each trial of the task, participants receive one of three distinct odors and then make one of two possible responses to receive a monetary reward. Critically, in some trial blocks the rewarded response is the same regardless of odor identity, and in other blocks identity determines the correct response. This experimental design allows us to test the primary hypothesis that ensemble MDT activity preferentially encodes information about odor identity when identity is relevant for making a decision. Preliminary behavioral results (n=15) indicate that participants make highly accurate choices regardless of block type, and that residual differences in odor pleasantness and intensity do not affect performance. Planned analyses of fMRI data will employ multivariate pattern-based techniques to characterize how the balance of olfactory sensory and behavioral task variables are represented in olfactory sensory cortex, MDT, and prefrontal cortex to support learning.

Topic Area: PERCEPTION & ACTION: Other

F123 - The Tool-use Network Supports Actions Independent of the Acting Body Part

Florencia Martinez Addiego[1], Yuqi Liu[1,2], Kyungji Moon[1], Elizabeth Shytle[1], Lénia Amaral[1], Caroline O'Brien[1], Sriparna Sen[1], Maximilian Riesenhuber[1,3], Jody C. Culham[4,5], Ella Striem-Amit[1]; [1]Georgetown University Medical Center, [2]Institute of Neuroscience, Key Laboratory of Primate Neurobiology, CAS Center for Excellence in Brain Sciences and Intelligence Technology, Chinese Academy of Sciences, [3]Center for Neuroengineering, Georgetown University, [4]Department of Psychology, University of Western Ontario, [5]Brain and Mind at Western, Western Interdisciplinary Research Building, University of Western Ontario

The sensorimotor system is broadly organized somatotopically. However, an action-type organization has also been found: a division based on action-type independent of acting body parts was shown for reaching and grasping actions. Does this generalization extend to non-ethological actions? Here, we examined fMRI responses for tool-use actions performed by participants' hands and feet. We additionally tested individuals born without hands to control for hand motor imagery when performing foot actions. We show that the primary sensorimotor cortices have hand and foot selectivity, consistent with a somatotopic organization. In contrast, higher-level motor areas within the tool-use network, such as premotor, supplementary motor area, and superior parietal cortices, showed a shared preference for tool-use independent of the executing body part and sensorimotor experience. Multivariate decoding of action-type in these areas generalized between controls' hand and foot and was successful in individuals born without hands. Finally, the temporal dynamics pattern in primary and association areas carried effector specific and action-type information, respectively. Altogether, we show that the tool-use network in motor association areas represents higher-order action information beyond concrete motor parameters associated with specific effectors, and regardless of hand motor experience. This suggests that an action-type, effector-independent organization extends beyond ethological actions, supporting a hierarchical organization in the action domain.

Topic Area: PERCEPTION & ACTION: Other

F124 - Additive versus Multiplicative Temporal Dilation of Dynamic Visual Stimuli

Kezhen Qi[1] (kezhenqi2028@u.northwestern.edu), Alejandro Cruz[1], Abigail Yiru Liu[1], Marcia Grabowecky[1], Satoru Suzuki[1]; [1]Northwestern University

Temporal dilation, the subjective elongation of perceived duration, has been explained by two competing theories: (1) the sensory-input-intensity theory, which links dilation to increased magnitude coding from dynamic or salient stimuli, and (2) the accumulator theory, which links dilation to the speeding of an internal clock. Our study aimed to reconcile these theories by examining temporal dilation effects in distinct contexts using a duration reproduction paradigm. In Experiment 1, we presented static, expanding, and contracting disks of nine durations (500–2000ms). Importantly, the total size change during each expansion/contraction was constant. Results revealed additive dilation, with the expanding/contracting stimuli lengthening reproduced durations by ~250ms irrespective of their durations. This aligns with the sensory-input-intensity theory as dilation was driven by sensory magnitude (i.e., the fixed total size change). Experiment 2 orthogonally varied stimulus duration and expansion/contraction rate. Results revealed multiplicative dilation, where dilation increased proportional to stimulus duration, with faster expansion/contraction rates yielding greater slope, suggesting that expansion/contraction speeds up temporal pulse accumulation, consistent with the accumulator theory. When we intermixed the trials from Experiments 1 and 2, the results surprisingly replicated, ruling out the hypothesis that the contextual manipulation changed the temporal dilation effect from additive to multiplicative. We noted that Experiment 1 (which yielded only an additive effect) did not include rapidly expanding/contrasting stimuli that lasted for long durations. The overall results suggest that, while the additive mechanism operates by default, the multiplicative mechanism is engaged when fast expansion/contraction persists for longer than a certain threshold duration.

Topic Area: PERCEPTION & ACTION: Other

F125 - Formation of cognitive maps in AI agents through reinforcement learning using visual information: place cells and head-direction cells

Aoto Kidachi[1] (g21230078e@edu.teu.ac.jp), Masayuki Kikuchi[1]; [1]Computer Science Program, Department of Computer and Media Science, Graduate School of Bionics, Tokyo University of Technology

In animals, cognitive maps are formed by neurons in the hippocampus, such as place cells and head direction cells (HD cells). Recent studies show that AI agents in virtual environments can also form cognitive maps like those of animals. They have shown that such a characteristic of the AI agents are formed through a deep learning method called Long Short-Term Memory (which controls memory and forgetting to learn long-term connections).

However, in most of those studies, AI agents have relied on data that real animals cannot directly perceive, such as their own coordinates, direction, and distances to objects. Therefore, the biological plausibility of the cognitive maps formed by these AI agents are questionable. Previously, the authors discovered that place cells emerge using Rainbow (a deep reinforcement learning method) that performs goal-search tasks based solely on visual information. This study shows that the spatial size of the place field (the region where place cells are active) correlated with environment size, and the findings are consistent with animal experiments. We applied the Rayleigh test ($p < 0.05$) to neurons in the visual processing layer (CNN output layer), the state value encoding layer (Value layer), and the action value encoding layer (Advantage layer) within Rainbow, confirming that HD cells were observed in every layer. These results show that the Rainbow model-a biologically plausible approach, trained exclusively on visual data rather than relying on artificial data unavailable to animals-can obtain neural representations of cognitive maps like those observed in animals.

Topic Area: PERCEPTION & ACTION: Other

F126 - Neural correlates of reinforcement learning in the human cerebellum

Juliana E. Trach[1] (juliana.trach@yale.edu), Samuel D. McDougle[1,2]; [1]Yale University, [2]Wu Tsai Institute

In the context of motor learning, the cerebellum is believed to encode a forward model, making predictions about expected outcomes of actions and using discrepancies between predicted and actual outcomes (i.e., prediction errors) to refine behavior. Increasing consensus that the cerebellum is involved in cognitive capacities beyond motor control has prompted questions about how the cerebellum might support prediction-error-based learning in non-motor tasks. Recent evidence in model organisms (mice, monkeys) implicates regions of the cerebellum (primarily Crus I and II) in reinforcement learning (RL; Sendhilnathan et al., 2020; Wagner et al., 2017). Here, we investigated cerebellar involvement in non-motor RL in humans. We used fMRI to scan participants (N = 32) during a RL task where they chose between two images on each trial and received probabilistic reward feedback on their choices (0.8s or 3s after response). Importantly, we randomized the button-presses associated with each image so that reward feedback was not associated with specific motor responses. We found robust neural correlates of RL in the human cerebellum. Specifically, we found activation in Crus I and II related to reward processing. Further, these regions exhibited activity correlated with trial-by-trial reward prediction errors, implicating the cerebellum in prediction error processing beyond motor learning. Finally, we found that the cerebellum preferentially responded to short latency (sub-second) feedback, and was less involved when feedback was delayed, echoing temporal constraints on cerebellar motor learning. Overall, this work implicates the human cerebellum in the processing of cognitive prediction errors during non-motor learning.

Topic Area: PERCEPTION & ACTION: Other

F127 - Using MVPA to disentangle the role of familiarity and predictability in rhythm perception

Jessica Grahn[1,2] (jgrahn@uwo.ca), Joshua Hoddinott[1]; [1]Centre for Brain and Mind, Western University, [2]Department of Psychology, Western University

Listening to rhythmic sounds elicits activity in the basal ganglia, cerebellum, and premotor and supplementary motor areas. Rhythms with a strong beat elicit more SMA and basal ganglia activity relative to non-beat, irregular rhythms. However, most music that people listen to has a clear beat, thus neural responses to strong-beat rhythms may be driven by familiarity rather than beat perception per se. To address this confound, we trained participants on a subset of rhythms that varied in beat strength, and measured BOLD activity to the rhythms before and after familiarity was increased via this training. Participants trained on 12 unique rhythms (4 strong-beat, 4 weak-beat, and 4 non-beat) in finger tapping tasks. In pre- and post-training fMRI sessions, we measured BOLD responses while participants listened to the rhythms during a rhythm discrimination task. Preliminary results reveal no influence of familiarity on the neural representation of beat – strong-beat and non-beat rhythms elicited significantly dissimilar activity patterns in the SMA and putamen both in pre-training and post-training scans. The only effect of training was an increase in dissimilarity between activity patterns in these regions, suggesting that learning the rhythms only made activity more distinct between beat strength conditions. Overall, this suggests the SMA and putamen do not simply encode the familiarity or predictability of rhythms, but are likely involved in beat perception itself.

Topic Area: PERCEPTION & ACTION: Other

F128 - N400 amplitudes are sensitive to image memorability distinct from recognition performance

Will Deng[1] (wuyizhe2@illinois.edu), Kara Federmeier[1]; [1]University of Illinois Urbana-Champaign

Image memorability is an intrinsic property of an image that determines how likely it is to be remembered. Prior work with event-related potentials (ERPs) has shown memorability effects on perceptual and semantic processing: More memorable images evoke facilitated (less negative) responses for both the N300 and N400 components, associated with high-level visual processing and semantic memory access, respectively. However, it is unclear whether the ERP patterns are primarily reflecting differences in episodic encoding success, similar to the subsequent memory effect (SME), or unique properties of image processing separate from episodic encoding. To explore this question, we presented participants with images that varied across a wide range of memorability and recorded their ERPs time-locked to stimulus onset. After two days, participants returned to the lab for a yes/no recognition test that contained images from the previous session with fillers. We examined ERP responses at encoding as a function of both memorability and back-sorted recognition performance (hit or miss). A mixed-effect model revealed a main effect of memorability on N400 amplitudes, but, crucially, no significant main effect of recognition performance or interaction between the two. Our results suggest that N400 amplitudes are sensitive to item-level properties related to memorability but do not directly index episodic encoding effects when observed as part of SMEs. In particular, N400 amplitudes may reflect semantic processing fluency, which is important for memorability but imparts a relatively stochastic effect on subsequent memory rather than serving as a reliable predictor for episodic memory formation.

Topic Area: PERCEPTION & ACTION: Vision

F129 - Predictions do not modulate the perception and time-resolved representation of objects

Phuong Dang[1] (phuong.dang@uqconnect.edu.au), Margaret Moore, Amanda Robinson, Jason Mattingley; [1]The University of Queensland, [2]Queensland Brain Institute, [3]School of Psychology, [4]School of Psychology and Queensland Brain Institute

According to predictive coding accounts of brain function, efficient processing of sensory information is achieved by modelling current and future perceptual states. Previous research has shown that neural representations of low-level visual features, such as orientations, are modulated by predictions. It is unclear, however, whether the same is true for more complex, real-world objects. To address this gap, we recorded brain activity using EEG while participants (N = 40) viewed RSVP sequences containing high-fidelity (intact) and degraded (diffeomorphically warped) object images which were placed in the sequence such that objects were statistically equally likely to occur, expected or unexpected based on a preceding leading image. Participants were asked to report whether target object images were 'intact' or 'warped'. Multivariate pattern analysis was used to quantify the degree of object information represented in neural activity. Decoding accuracy and discrimination task performance were compared across equal-likelihood, expected, and unexpected objects. There were no significant differences in decoding accuracy, discrimination accuracy or discrimination response times amongst the three probability conditions. One potential explanation for these null results is that participants did not have sufficient exposure to the embedded statistical structure; another is that the behavioural task might have interfered with participants' learning of the image statistics. In a follow-up experiment, we explored these possibilities by increasing exposure to the structured sequences, and employing a modified object detection task that was undertaken separately from the neural recordings. We will discuss the implications of these findings for predictive coding theories of visual perception.

Topic Area: PERCEPTION & ACTION: Vision

F130 - Reading words versus seeing font or handwriting style: a study of hemifield processing

Helena Ghorbani[1], Gulcenur Ozturan[1], Andrea Albonico[2], Jason J S Barton[1]; [1]University of British Columbia, Vancouver, Canada, [2]University of the Fraser Valley, Abbotsford, Canada

Tachistoscopic studies have established a right field advantage for the perception of visually presented words, which has been interpreted as reflecting a left hemispheric specialization. However, it is not clear whether this is driven by the linguistic task of word processing, or influenced by stimulus properties such as the style and regularity of text. We had 23 subjects perform a tachistoscopic study while they viewed five-letter words in either computer font or handwriting. The task in one block was to respond if the word in the peripheral field matched a word recently seen in the central field. In a second block with the same stimuli, the task was to respond if the style (handwriting or font) matched. We found a main effect of task: there was a right field advantage for reading the word, but no field advantage for reporting the style of text. There was no effect of stimulus type and no interaction between task and stimulus type. We conclude that the field advantage for processing text is driven by the task, being specific for the processing of the identity of the word and not the perception of the style of the text. We did not find evidence to support prior assertions that the type of text and its regularity influenced the field advantage.

Topic Area: PERCEPTION & ACTION: Vision

F131 - Expectation dynamically modulates the representational time course of objects and locations

Margaret Moore[1] (margaret.moore@uq.edu.au), Amanda Robinson[1], Jason Mattingley[1,2]; [1]University of Queensland, [2]Canadian Institute for Advanced Research

Past work has demonstrated that predictive information modulates how the brain responds to visual stimuli, but it is not yet clear how the brain integrates different types of predictive information to facilitate efficient perception. Here, we aim to explore how different types of predictive information modulate the occurrence and directionality of prediction effects in patterns of evoked brain activity. Participants (n = 40) viewed real-world object images in rapid serial visual presentation (RSVP) streams which were predictable both in terms of object identity and stimulus location. Multivariate pattern analyses of electroencephalography (EEG) data were used to quantify and compare the degree of information represented in neural activity when stimuli were random (unpredictable), expected, or unexpected. Decoding accuracy for expected locations was significantly reduced relative to random locations between 160–238 ms post-onset. However, this effect subsequently reversed with decoding accuracy for expected locations becoming higher than accuracy for random locations between 273-430 ms. This temporally dynamic effect was not replicated within analyses decoding object identity. However, consistent evidence for reduced decoding of unexpected relative to random stimuli in later time windows (>250ms) post-onset was identified across both stimulus types (e.g. objects and locations). These findings extend fundamental understanding of how the brain detects and employs predictive relationships to modulate visual perception.

Topic Area: PERCEPTION & ACTION: Vision

F132 - Chronic cannabis use modulates gamma functional connectivity with V1 during visual entrainment

Lauren K. Webert[1] (lauren.webert@boystown.org), Nathan M. Petro[1], Seth D. Springer[1], Jason A. John[1], Lucy K. Horne[1], Hannah J. Okelberry[1], Ryan Glesinger[1], Maggie P. Rempe[1], Tony W. Wilson[1]; [1]Boys Town National Research Hospital, Omaha, NE

Cannabis is one of the most commonly used illicit substances in the United States, and its chronic use has been linked to deficits across multiple cognitive domains. Mechanistically, cannabis acts upon endocannabinoid receptors, which are densely distributed among GABAergic interneurons throughout the cortex and cerebellum. Such interneuronal networks have been linked to many aspects of visual perception and information processing across the cortex vis-à-vis neural gamma oscillations. However, it remains less understood how chronic cannabis use modulates gamma activity and dynamic functional connectivity (FC) in the gamma range. Herein, 84 cannabis users and 90 nonusers underwent high-density magnetoencephalography during visual entrainment at three separate gamma-band frequencies (32, 40, and 48 Hz). The resulting data were source-imaged in the time-frequency domain and submitted to statistical models to test for effects of hemisphere, frequency, and group. Our results indicated strong entrainment responses across all frequencies in the bilateral primary visual cortices (V1). Across groups, 32 Hz elicited the strongest entrainment response, followed by 40 Hz, and finally 48 Hz stimulation within bilateral V1 ($p<.001$). Additionally, participants exhibited stronger entrainment in the right relative to left V1 across all entrainment conditions ($p=.002$). Group-by-condition interactions in FC ($p<.005$) revealed that cannabis users, compared to nonusers, exhibited elevated V1-right cerebellum FC at 32 Hz, and elevated V1-left inferior frontal gyrus (IFG) FC at 32 and 40 Hz. Our findings suggest that visual entrainment is robust across the gamma spectrum in V1, and that chronic cannabis use modulates V1-cerebellar and V1-IFG connectivity in the gamma range.

Topic Area: PERCEPTION & ACTION: Vision

F133 - Distinct fMRI Pattern Effects of Error- and Uncertainty-Based Event Model Updating

Tan Nguyen[1] (n.tan@wustl.edu), Jo Etzel[1], Matthew Bezdek[2], Jeffrey Zacks[1]; [1]Washington University in St. Louis, [2]Elder Research

The human mind segments continuous sensory input into discrete events. Our study investigated two causal signals for segmentation and the neural mechanisms underlying these processes. Using a Finite Impulse Response (FIR) model to analyze BOLD signals, we observed activity changes around human event boundaries: Areas in the visual, dorsal, and control networks showed an increase in BOLD, while areas in the default network showed a decrease in BOLD around event boundaries. Using a FIR model to analyze successive pattern correlation, we observed successive pattern correlation changes around human boundaries across multiple brain regions belonging to control, default, dorsal attention, and visual networks. To understand the distinct mechanisms involved, we analyzed two types of boundaries derived from computational models: error-based and uncertainty-based. Both error-based and uncertainty-based boundaries uniquely predicted human event boundaries. FIR analysis revealed dissociable neural correlates for these boundary types. Error-based boundaries were strongly associated with successive pattern correlation changes in the ventrolateral prefrontal cortex, while uncertainty-based boundaries were strongly associated with pattern correlation changes in the post central gyrus, dorsal attention network, mid cingulate cortex, and visual networks. Networks associated with both boundary types included medial prefrontal cortex and temporal regions within the default network, which overlapped with regions showing pattern correlation changes during human boundaries. The distinct networks associated with error-based and uncertainty-based boundaries suggest that multiple cognitive mechanisms are involved with event segmentation. Together, our behavioral and neural findings suggest that humans utilize both error and uncertainty signals when segmenting continuous experience into discrete events.

Topic Area: PERCEPTION & ACTION: Vision

F134 - Effects of forward and backward masking on feedforward and feedback processing: evidence from time- and frequency-resolved EEG decoding

Yusuke Nakashima[1] (yusuke_nakashima@brown.edu), Yuka Sasaki, Takeo Watanabe; [1]Brown University

Distinguishing between feedforward and feedback visual processing in the brain is challenging. Some studies suggest that a mask following a stimulus (backward masking) disrupts feedback processing, while a mask preceding a stimulus (forward masking) affects feedforward processing. However, evidence supporting this hypothesis remains limited. To address this issue, we examined which frequency bands of neural oscillations are affected by forward and backward masking using EEG to decode orientation discrimination performance. This approach is inspired by recent neurophysiological studies suggesting that theta and gamma bands predominantly carry feedforward signals, while alpha and beta bands predominantly carry feedback signals. This finding led us to raise the possibility that forward and backward masking affect decoding accuracy in feedforward-related frequencies (theta or gamma) and feedback-related frequencies (alpha or beta), respectively. Participants performed an orientation discrimination task under three conditions: no masking, backward masking, and forward masking. Decoding accuracy for orientation classification was calculated at each time point and frequency band (theta, alpha, beta, and gamma) based on time-frequency coefficients. In the no masking condition, accuracy increased in the theta band during an earlier time window (from 100 ms) and in the alpha band during a later time window (from 200 ms), possibly reflecting feedforward and feedback signals, respectively. Backward masking did not affect theta accuracy but reduced alpha accuracy. Conversely, forward masking reduced theta accuracy but left alpha accuracy intact. These results suggest backward masking disrupts feedback processing reflected in the alpha band, while forward masking disrupts feedforward processing reflected in the theta band.

Topic Area: PERCEPTION & ACTION: Vision

F135 - Unfamiliar distractors disrupt visual search through a combination of forward and backward masking

Ryan E.B. Mruczek[1], Michael J. Lesofsky[1], Mariam A. Ayad[1]; [1]College of the Holy Cross

Long-term familiarity alters the neural processing of objects and enhances recognition efficiency. For example, both parallel (Mruczek & Sheinberg, 2005) and serial (Manahova et al., 2020) visual search is faster when distractors are familiar, possibly due to sharper neural responses to familiar images (Mruczek & Sheinberg, 2007; Meyer et al., 2014). Here, we test whether the disruptive effects of unfamiliar images during serial visual search are due to forward or backward masking using a multi-day behavioral paradigm. For Days 1-3, participants (n=26) engaged in a visual search task for 1 of 8 familiar targets amongst a consistent set of 20 distractors. We demonstrate familiarity with these distractors on Day 4, which introduced 20 unfamiliar distractors. Consistent with our previous results, participants had lower reaction times and search slopes when searching amongst familiar compared to unfamiliar distractors. On Day 5, participants viewed a rapid serial visual presentation (RSVP) stream of familiar distractors (10 items/s) interspersed with 1 familiar target, and 1 unfamiliar distractor appearing within 300 ms of the target (before or after). Compared to baseline trials without an unfamiliar distractor, participants had lower hit rates (~84.0% vs. 88.1% baseline) and higher miss rates (~12.6% vs. 9.2% baseline) when the target appeared just before (~100 ms) or just after (100-300 ms) the unfamiliar distractor. Our results indicate that the stronger and less-selective neural activity typically evoked by unfamiliar images disrupts prior (backward masking) and, to a greater extent, subsequent (forward masking) object processing.

Topic Area: PERCEPTION & ACTION: Vision

F136 - Behavioral correlates of sensory and choice information tuning with (un)confirmed expectations

Gabriela Iwama[1,2,3] (gabriela.iwama@uni-tuebingen.de), Randolph Helfrich[2,3,4]; [1]University of Tübingen, [2]International Max Planck Research School for the Mechanisms of Mental Function and Dysfunction, [3]Hertie Institute for Clinical Brain Research, [4]University Hospital Tübingen

Prior expectations play a critical role in how we perceive and interpret the world. To guide adaptive behavior in dynamic environments, these expectations must flexibly integrate with perceptual decisions. Despite extensive evidence that expectations impact perception, the neural mechanisms behind this remain unclear. Does the brain enhance expected visual information or emphasize unexpected information? In this study, we developed a behavioral task that combines reversal learning with a motion discrimination challenge. This approach allowed us to disentangle the formation of prior expectations and how they influence visual decisions. We estimated participants' prior beliefs using behavioral modeling and examined neural activity patterns to decode sensory and choice information. Our findings reveal that stronger priors enhance the generalizability of pre-stimulus sensory information, even when expectations are not confirmed. Furthermore, we observed no statistical differences in the decoding of expected and unexpected sensory information, but a consistent dampening of expected choice information across subjects. Most notably, we observed a correlation between choice dampening and confirmation bias in accuracy and reaction time and a correlation between sensory tuning and speed-accuracy trade-offs. These results support perceptual prediction theories, including the opposing process theory, and highlight how priors dynamically shape neural representations depending on their strength and validity.

Topic Area: PERCEPTION & ACTION: Vision

F137 - Fixation-related ERPs (fERPs) to moving stimuli during visual search: Effects of training but not of neurostimulation (rDLPFC HD-tDCS)

Jason R Taylor[1] (jason.taylor@manchester.ac.uk), Stephen J Ball[1], Johan Hulleman[1], Gorana Pobric[1]; [1]University of Manchester

The potential of neurostimulation and cognitive training to improve visual search performance is of interest in both research and applied settings. Fixation-related event-related potentials (fERPs) may be more sensitive than behavioural measures and may help distinguish effects on component cognitive sub-processes. We report a large (N=110) double-blind study of the effects of training and neurostimulation on visual search performance and fERPs. Participants were randomly assigned to Stimulation (MRI-guided 4-1 HD-tDCS to rDLPFC for 20min/session), Sham (stimulation 1min/session), and Control (no equipment) groups. All received 5x 40-minute training sessions on a difficult visual search task: Stimuli were moving squares with smaller squares embedded in the top left corner (target present on 50% of trials) or top right corner (nontarget distractors; 8 or 16 per trial). The task was also performed during two EEG sessions, pre- and post-training (64-channel BioSemi ActiveTwo; eye-tracking via SR Research

Eyelink DUO). Behavioural performance showed clear training effects (main effects of training session) but no effects of stimulation group. fERPs (P1, P300) time-locked to targets and non-targets showed expected targetness effects and training effects (larger targetness effects post-training), but no effects of stimulation. fERPs time-locked to pre-target fixations (N2 posterior-contralateral (N2pc), sustained posterior contralateral negativity (SPCN)) discriminated target location (contralateral vs. ipsilateral) and showed an effect of training (N2pc: larger target location effects post-training) but no effects of stimulation. Overall, training effects (but no stimulation effects) on visual search were evident in behaviour and fERPs associated with perceptual sensitivity (P1), target detection (P300), and spatial attention (N2pc).

Topic Area: PERCEPTION & ACTION: Vision

F138 - The intention to predict upcoming events modulates prediction error but not visual processing

Chen Frenkel[1] (chen.gueta1@mail.huji.ac.il), Leon Deouell[1]; [1]the Hebrew University

Predictive processing theory proposes that the brain generates predictions and processes mainly prediction errors - the difference between the predicted and actual sensory input. This is assumed to be an obligatory perceptual process, but it remains unclear if and how it is modulated by the intention to make predictions. To investigate this question, we examined neural dynamics during mostly passive viewing tasks. Over two sessions, participants (N=30) viewed stimuli varying in category and color while undergoing EEG recording. Response was unexpectedly required in a minority of trials, which were excluded from the electrophysiology analysis. In each session, color or category was sequentially predictable and the other was presented randomly. We manipulated intentions to predict by instructing participants to either explicitly predict upcoming stimuli, judge current stimuli, or maintain previous stimuli in memory (discouraging prediction). Behaviorally, participants were highly accurate on all tasks. Event-related potentials revealed sensitivity to sequence deviations, which varied significantly between the three tasks. Using machine learning we decoded which task was performed and found persistent task representations during passive viewing, intensifying around stimulus onset. Stimuli's color and category were significantly decodable during early perceptual processing, but decoding accuracy was not modulated by task, predictability or the attention. This study reveals that the intention to predict is represented in the brain and modulates the neural mechanisms underlying the generation of prediction errors. However, visual representations were highly generalizable between tasks and unmodulated by the intent to predict, suggesting that visual representations and prediction error responses might be dissociated.

Topic Area: PERCEPTION & ACTION: Vision

F139 - Understanding the representational geometry of psychological and neural spaces across multiple similarity dimensions.

Johan Alejandro Gamba[1] (j.gambasegovia@ufl.edu), Vincent Taschereau-Dumouchel[2], Megan A. K. Peters[3], Brian Odegaard[1]; [1]University of Florida, [2]University of Montreal, [3]University of California Irvine

Assessing similarities between objects is a fundamental cognitive process for humans. Multivariate neuroimaging techniques like Representational Similarity Analysis (RSA) have advanced our understanding of neural activation patterns underlying conceptual distances. In our study, we explored the relationship between eight psychological similarity dimensions and fMRI voxel-based RSA matrices across 11 regions of the ventral pathway and prefrontal cortex in Spanish- and English-speaking populations. Participants rated similarities of object pairs (280 in total) based on eight properties (general similarity, animacy, shape, color, category, dissimilarity, preference, and fear). We compared these behavioral ratings to neural data, employing metrics such as correlational distance (c.d.), c.d. post-Fisher transformation, and cosine similarity, alongside Pearson, Spearman, and Kendall Tau correlations, to identify amplified or generalized features across metrics. Our results revealed a behavioral representational distinction between "object-based" dimensions (e.g., shape) and "subject-based" ones (e.g., preference). Object-based properties showed a consistent representational geometry, whereas subject-based properties exhibited differences that modulated their alignment with neural data. Behavioral categories like "general similarity," "color," and "shape" were highly correlated with neural representations, particularly in occipital and fusiform regions. However, results were influenced by noise ceiling limits of each region of interest. Consequently, our results suggest a higher granularity in sensory cortices compared to multimodal areas and also inform methodological considerations when contrasting results across regions. Overall, our findings highlight consistent cross-population relationships between psychological and neural representational spaces, providing insights into how object-based and subject-based dimensions are encoded across different brain regions.

Topic Area: PERCEPTION & ACTION: Vision

F140 - Swinging into faster learning: Larger motor movements can enhance category learning

Luke Rosedahl[1] (luke_rosedahl@brown.edu), Takeo Watanabe[1]; [1]Brown University

Category learning has traditionally been viewed as a primarily cognitive process, with popular models like the generalized context model, ALCOVE, and SUSTAIN treating it as largely independent from motor systems. Our research challenges this perspective by demonstrating that the magnitude of motor response in categorization tasks significantly impacts learning performance. Using a virtual reality paradigm, participants (N=72) categorized Gabor discs using either controller triggers or virtual lightsaber swings. We tested two category structures: Rule-Based (RB), requiring binary decisions along feature dimensions, and Information-Integration (II), requiring integration of multiple feature dimensions. Based on evidence that II structures engage basal ganglia motor learning systems while RB structures involve prefrontal areas (Ashby & Valentin, 2017), we hypothesized that larger motor movements might specifically enhance II category learning. Participants were evenly divided across four conditions: RB-Button, RB-Lightsaber, II-Button, and II-Lightsaber. While RB performance remained consistent across response types ($t = -.12$, $p = .91$), II category learning significantly improved with lightsaber swings ($t = 2.7$, $p = .006$). Notably, II participants using lightsaber swings achieved 82% accuracy after just 150 trials - a level that exceeded the maximum accuracy (81%) that II button-pressing participants reached after 600 trials. These findings challenge the purely cognitive view of category learning and highlight the importance of motor engagement, particularly for complex categories. This suggests the need to revise existing theories to account for motor system involvement, possibly through enhanced engagement of basal ganglia circuits in procedural learning.

Topic Area: PERCEPTION & ACTION: Vision

F141 - Representational gradient of the hippocampal long axis extends beyond memory to visual processing

Benjamin Chaloupka[1], Troy Houser[1], Dagmar Zeithamova[1]; [1]University of Oregon

Prior memory research has shown a representational gradient along the long axis of the hippocampus, such that coarse-grained (global) information is represented by the anterior hippocampus while fine-grained (local) information is represented by the posterior hippocampus. However, whether this representational gradient in the hippocampus extends to visual processing remains an open question. Here, 61 participants completed Navon's task while undergoing functional MRI. In Navon's task, participant viewed large letters made up of smaller letters and had to identify within each block either the large letter (global information) or the small letters (local information). Participants completed four counterbalanced runs with two local blocks and two global blocks within each run. We found that the anterior hippocampus was preferentially active during global processing, while the posterior hippocampus was preferentially active during local processing. This indicates that the representational gradient in the hippocampus extends beyond memory to visual processing of global and local information.

Topic Area: PERCEPTION & ACTION: Vision

F142 - Generalization Gradients in Deep Vision Models: Insights from Shepard's Universal Law

Daniel Carstensen[1] (daniel_carstensen@brown.edu), Steven M. Frankland[2], Serra E. Favila[1]; [1]Brown University, [2]Dartmouth College

Deep vision models share striking similarities (and differences) to the primate visual system. Understanding the factors that determine these similarities and differences is crucial to creating better models of visual processing in biological systems. Here, we use Shepard's universal law of generalization as a measure of representational alignment. According to the universal law, the perceived similarity between two stimuli should decrease as a concave function of their psychological distance, forming a characteristic generalization gradient. Recent work has found such generalization gradients for sets of natural images and corresponding human similarity judgments [Marjieh et al., 2024]. We asked if these gradients naturally appear when we use the embedding space of deep vision models as a model of the psychological space proposed by Shepard. Drawing on the same image sets, we selected a diverse range of deep vision models and extracted image embeddings from each model. We then computed the pairwise distance matrix of the embeddings and examined the resulting generalization gradients. We found that the relationship between embedding distance and human similarity judgments exhibited a concave generalization gradient for most image sets regardless of model choice, with some models showing this pattern across all sets. Notably, models overestimated the distance between a significant number of image pairs. These results show that deep vision models often acquire an embedding space consistent with Shepard's law, indicating some alignment with primate visual processing. However, the models' tendency to overestimate image distances suggests key differences that warrant further investigation.

Topic Area: PERCEPTION & ACTION: Vision

F143 - Investigating Bifurcation Dynamics and Neural Correlates of Consciousness Using EEG and Report/No-Report Paradigms

Kimiya Kasraeian[1] (kkasraei@ucsc.edu), Jason Samaha[1]; [1]UCSC

Understanding the neural correlates of consciousness (NCC) requires isolating neural activity directly linked to conscious perception from confounding factors such as sensory encoding, attention, and post-perceptual processes. This study explores whether bifurcation dynamics—sharp transitions in neural activity between perceived and non-perceived states—serve as a general neural signature of perceptual consciousness. Using a report/no-report paradigm, we plan to investigate the temporal dynamics and representational content of awareness in the domain of visual perception. Participants are presented with Gabor patch stimuli varying in contrast, location, and orientation. In report conditions, participants provide subjective visibility ratings and perform an objective localization task, enabling analysis of trials with spontaneous perceptual variability. In no-report conditions, participants engage in an unrelated fixation task, minimizing task-related and reporting confounds while maintaining conscious perception of stimuli. Univariate and multivariate decoding techniques will be applied to high density EEG recordings in order to track the time course of neural activity distinguishing between seen and unseen stimuli. This study aims to identify whether bifurcation dynamics occur in multivariate EEG signals, reflecting the presence, location, or orientation of stimuli. Cross-decoding between no-report and report conditions evaluates whether NCCs emerge independently of reporting and post-perceptual processes. By advancing a methodological framework that disentangles NCCs from confounding processes, this work contributes to understanding the emergence of conscious awareness and the relationship between its temporal dynamics and representational content. This research also addresses key theoretical questions about the generalizability of bifurcation as a neural signature of awareness.

Topic Area: PERCEPTION & ACTION: Vision

F144 - XRPsys: A Portable Platform for Low-Vision Assessment and Intervention

Peige Wang[1] (wang.peig@northeastern.edu), Abraiz Azhar[2], Dean Thurston[1], Michele Bevilacqua[3], Bas Rokers[2], Lorella Battelli[3], Aaron Seitz[1]; [1]Northeastern University, [2]New York University Abu Dhabi, [3]Harvard Medical School

More than 6 million individuals in the U.S. suffer from low vision, which profoundly impacts their quality of life, financial independence, and social participation. While transformative procedures and interventions are developed in laboratories, access to these innovations remains limited due to a lack of infrastructure. Advanced assessments and interventions often require specialized equipment and expertise from PhD-level researchers, necessitating that patients travel to labs to benefit from these cutting-edge systems. To address this gap, we are developing XRPsys (eXtended Reality Platform System), an advanced hardware/software solution integrating extended reality (XR) high-resolution displays, eye-tracking, and optional non-invasive brain stimulation. Here we present an overview of the platform and initial prototypes of vision assessments for acuity, contrast sensitivity and perimetry. We also discuss long-term goals of the platform to support new projects that address the needs of low-vision populations as well as other use-cases for both basic and clinical research.

Topic Area: PERCEPTION & ACTION: Vision

F145 - Hierarchical prefrontal contributions to perceptual decision-making

Xinxu Shen[1] (tul04056@temple.edu), Ioannis Pappas[2], Sirawaj Itthipuripat[3], Ruedeerat Keerativittayayut[4], Chayanon Pamarapa[4], Chaipat Chunharas[5], Ian Ballars[1]; [1]University of California, Riverside, [2]University of Southern California, [3]King's Mongkut University of Technology Thonburi, [4]Chulabhorn Royal Academy, [5]Chulalongkorn University

In visual decision-making, both high-level semantic information and low-level visual properties influence choice. However, the strong correlation between these low and high-level features in natural stimuli makes their contributions challenging to isolate. To address this, we used a deep neural network to design a stimulus set that decorrelates these properties. In the task, participants judged the similarity between a root image and two alternatives, differing in their low- and high-level similarities to the root image. Behaviorally, participants were sensitive to high-level similarity, but also showed an additive effect of low-level similarity. Participants were around 20% more likely to select an image when both low- and high-level information agreed on its similarity than when they conflicted. Neuroimaging results showed that activation in the middle frontal gyrus (MFG) increased with both high- and low-level visual similarity. Strikingly, we observed an anterior-posterior gradient within the MFG, with anterior regions linked to higher-level similarity and posterior regions to lower-level similarity. These results showed that the hierarchical organization of prefrontal cortex in encoding visual information mirrors the hierarchy of visual processing in ventrotemporal cortex. At choice, the ventromedial prefrontal cortex (vmPFC) represented the high-level similarity between the chosen image and the root, mirroring its role in representing the subjective value of choices. These findings expand our understanding of role vmPFC beyond traditional value-based decision-making to include representation of decision variables in any domain where options are compared. Together, the results suggest that the brain integrates low- and high-level visual features hierarchically to support perceptual decision-making.

Topic Area: PERCEPTION & ACTION: Vision

F146 - A computational study of subordinate-level processing in faces and objects utilizing the expertise hypothesis

HSUAN-KAI WENG[1] (ba06107064@tmu.edu.tw), Christoph Dahl; [1]Taipei Medical University

The perceptual expertise hypothesis suggests that subordinate-level processing is a hallmark of specialized categorization, often exemplified by face perception.The literature suggests that the mechanisms underlying subordinate-level facial processing extend to non-face objects. The current study investigates whether these mechanisms are, in fact, identical for non-face object categories and extend to other face categories. We trained artificial neural networks on subordinate-level classification for human, monkey, and cartoon faces, as well as object categories. We subsequently tested these networks under specific visual manipulations designed to isolate part-based and configurational processing. Our findings reveal certain inconsistencies with the perceptual expertise hypothesis; subordinate-level processing for objects differs significantly from that for faces. Furthermore, subordinate-level processing across different face types demonstrates moderate modulations in configural processing, while subordinate processing of object categories only relies minimally on configurations of facial parts. This suggests that subordinate-level processing may not generalize across these categories, challenging the assumption that object and face expertise rely on analogous neural or computational mechanisms.

Topic Area: PERCEPTION & ACTION: Vision

F147 - Gaze reinstatement during naturalistic viewing and memory retrieval in children, adults and artificial intelligence models

Iryna Schommartz[1,2] (schommartz@psych.uni-frankfurt.de), Bhavin Choksi[3], Gemma Roig[3,4], Yee Lee Shing[1,2]; [1]Department of Psychology, Goethe University Frankfurt, [2]IDeA – Center for Individual Development and Adaptive Education, [3]Computer Science Department, Goethe University Frankfurt, [4]Center for Brains Minds and Machines, Massachusetts Institute of Technology

Differences in cognition and perception during image viewing influence processing and memory of scene elements. Scan paths during scene perception may also provide insights into pattern completion for partially incomplete images. However, the extent to which eye-gaze patterns predict subsequent memory and how these patterns differ between children, adults, and artificial intelligence (AI) models remains unclear. To investigate, we measured gaze fixations in children (aged 5–12) and young adults (aged 19–30) while they viewed 60 naturalistic images. Gaze fixations were then recorded during image reinstatement on a blank screen, cued by partially occluded images. Representational similarity analysis of fixation-based heat maps revealed that adults exhibited higher encoding-retrieval eye-gaze reinstatement than children, correlating with greater memory accuracy. This finding reflects the prolonged developmental trajectory of gaze reinstatement and its role in scan path consolidation. Using MultiMatch, a metric evaluating scan path similarity, we observed consistent differences between children's and adults' scan paths, highlighting developmental variations in scene perception. Additionally, we employed AI models to investigate their ability to predict scan paths of specific age groups. Providing models with initial human fixations or the first 10 seconds of gaze data significantly improved their performance in replicating mnemonic gaze reinstatement. Our findings have implications for cognitive neuroscience and the development of foveation-based AI models. They shed light on age-related differences in gaze behavior and offer insights for designing AI systems that emulate human-like visual exploration and memory processes.

Topic Area: PERCEPTION & ACTION: Vision

F148 - Comparing the Multidimensional Mental Representations of Object Images and Object Nouns

Laura M. Stoinski[1,2,3] (stoinski@cbs.mpg.de), Tongue Zhuang[1,4], Chris I. Baker[5], Martin N. Hebart[1,4,6]; [1]Max Planck Institute for Human Cognitive & Brain Sciences, Leipzig 04103, Germany, [2]University of Leipzig, Leipzig 04103, Germany, [3]International Max Planck Research School on Cognitive NeuroImaging (IMPRS CoNI), [4]Department of Medicine, Justus Liebig University, Giessen 35390, Germany, [5]Section on Learning and Plasticity, Laboratory of Brain & Cognition, National Institute of Mental Health, Bethesda, MD 20814, USA, [6]Center for Mind, Brain and Behavior, Universities of Marburg, Giessen and Darmstadt

Objects can be distinguished along various properties, from visual-perceptual to higher-level semantic dimensions. Visual and semantic dimensions are often intertwined, making it challenging to separate the influences of visual input and semantic knowledge. We can address this by comparing the dimensions underlying object images with those of their corresponding nouns, since words, unlike images, contain no image features. This allows us to distill the dimensions dominating object representations when visual features are present versus absent. Here, we aimed to identify core dimensions underlying mental representations of object words and systematically compare them with 49 dimensions previously identified from similarity judgments of object images (Hebart et al., 2020). We gathered over 1.3 million odd-one-out judgments of 1,388 diverse object nouns, revealing 50 interpretable dimensions using a computational model trained to capture these similarity patterns. The 50 dimensions captured known semantic relationships and higher-level categories and predicted cross-validated similarity choices close to intersubject consistency (94% of explainable variance). Correlating the representational similarities of objects based on word-derived dimensions with those from image-derived dimensions showed that words captured much of the similarity structure of images ($r = 0.83$). While images and words shared many semantic dimensions, words were only represented by a few visual dimensions related to shape, without capturing other perceptual aspects related to color or texture. Together, our findings underscore the central role of semantics in mental object representations and highlight the importance of image presentations for evoking visual-conceptual structure in similarity judgments.

Topic Area: PERCEPTION & ACTION: Vision

F149 - Predictive power of the divisive normalization model of numerosity perception

Joonkoo Park[1] (joonkoo@umass.edu), Jenna Croteau[1], Michele Fornaciai[2], David E. Huber[3]; [1]University of Massachusetts Amherst, [2]Université Catholique de Louvain, [3]University of Colorado Boulder

Numerosity perception remains a neurocomputational puzzle, as it's unclear how discrete number representations emerge from continuous neural activity. Recently, Park & Huber (2022) proposed a computational model and demonstrated that a simple neural network with center-surround filters and divisive normalization effectively normalizes the dimensions orthogonal to numerosity of an item array, making the neural network sensitive to numerosity. Here, we develop and test two novel predictions that the model makes using electroencephalography. First, the model predicts that coherence illusion for area and orientation (where numerosity perception is influenced by item homogeneity, for example, in area or orientation) arises from two different neural stages. Second, the model predicts that the visual processing stage at which numerosity is first represented contains no

information about numerosity if the dot-array images are equalized for spatial frequency amplitude spectrum. To test these predictions, the visual-evoked potentials measured from participants viewing images of item arrays were analyzed to evaluate how early visual cortical activities (80-200 ms) are modulated by the manipulation of item homogeneity (in Study 1) and spatial frequency amplitude spectrum (in Study 2). Study 1 showed that area and orientation coherence modulate visual cortical activities at distinct latencies and topographies, aligning with the model's prediction. Study 2 showed that equalization of spatial frequency amplitude spectrum abolishes early, but not later, visual cortical sensitivity to numerosity, also in part aligning with the prediction. These findings provide strong empirical support for the divisive normalization model as an algorithmic-level theory of numerosity perception.

Topic Area: PERCEPTION & ACTION: Vision

F150 - Computational Mechanisms of Temporal Anticipation in Perception and Action

Gal Vishne[1,2] (gal.vishne@mail.huji.ac.il), Leon D. Deouell[1], Ayelet N. Landau[1,3]; [1]The Hebrew University of Jerusalem, [2]Columbia University, [3]University College London

To interact effectively with our surroundings, we employ strategies to reduce uncertainty. One important source of information is temporal regularities, which enable us to form predictions about when events will occur, and through this, prepare for them in advance (Nobre & Van Ede, 2018). Such preparation was shown to facilitate motor planning, yet the impact of temporal anticipation on perceptual acuity is unknown, and the cognitive computations underlying this process remain debated. To answer these questions, we designed a novel difficult change discrimination task, where the interval between the first and second stimuli was varied on a trial-by-trial basis, drawing from one of three predefined distributions (uniform, exponential and flipped-exponential) and administered it to N=142 participants online. Our results show that both perceptual sensitivity and motor responses are influenced by temporal structure. We employed computational modelling to study the underlying cognitive operations, identifying the logarithmic transformation of the event hazard rate (HR) as the core transformation. This contrasts with recent studies supporting the reciprocal of the PDF as the underlying computation (Grabenhorst et al., 2019, 2021). Importantly, we also reveal a key role for temporal estimation noise in shaping the process at two distinct stages: (1) Encoding, when temporal information is learned and represented and (2) Decoding, when it is extracted and used to guide behavior. These findings shed light on the brain's capacity to leverage probabilistic temporal information to guide behavior, advancing our understanding of how temporal structure influences perceptual and motor processing.

Topic Area: PERCEPTION & ACTION: Vision

F151 - Neural investigation of color coherence in numerosity perception

Shimin Hu[1] (shiminhu@umass.edu), Joonkoo Park[1]; [1]University of Massachusetts Amherst

We recently proposed a hypothesis that numerosity perception arises as a byproduct of a canonical neurocomputational mechanism across the visual stream. According to this view, numerosity is encoded across multiple processing stages, with each stage that is best suited to encode the features represented in the stimulus. Here, we test this hypothesis by investigating the visual-evoked potential (VEP) signatures of the coherence illusion in color. Behaviorally, numerosity of an array of items with heterogeneous colors are underestimated compared with a homogeneous color. As past research in color perception demonstrates the encoding of color in V1, V2, and V4 with distinct temporal signatures, we predicted that VEPs would differ across latencies for homogeneous and heterogeneous colored arrays. Adult participants (N=43) passively viewed dot arrays that systematically varied in number, size, spacing, and color (homogeneous vs. heterogeneous). A linear mixed model was employed to assess the effects of these fixed-effects predictors on the VEP amplitudes in the occipital channels across the time course. The effects of number, size, and spacing on the neural activity replicated previous findings. The effect of color homogeneity was observed across multiple latency periods, in alignment with our hypothesis. Interestingly, the pattern of these effects across time indicated that the underestimation of heterogeneous colored arrays may arise from late (> 250 ms), rather than early processing stages. These results suggest that numerosity information is encoded across multiple perceptual stages and avenues for further investigation into how this information is read out for a unified percept of numerosity.

Topic Area: PERCEPTION & ACTION: Vision

F152 - Neural oscillations indicate cue combination in navigation

Yu Karen Du[1] (ydu366@uwo.ca), Jennifer E. Sutton[2], Blake E. Butler[3]; [1]University of Western Ontario

Previous studies suggest that when learning multiple spatial cues separately, humans are less likely to integrate the memories from each single cue to form a more precise representation. As the information from single cues is encoded separately, it is possible that retrieving all information takes more effort, which makes memory integration more difficult (retrieval efficiency hypothesis). It is also possible that combining information from multiple cues requires extra effort (combination efficiency hypothesis). To test whether the difficulty of achieving an integrated representation is due to less efficient retrieval or less efficient combination of multiple cues, participants in this study learned a target's position by virtual navigation with two landmarks presented either together or sequentially. In testing, they replaced the target with single or two landmarks presented. Scalp EEG signals were recorded during learning and testing. Preliminary results suggest that the similarity between the observed frontal theta oscillatory activity during encoding and retrieval positively correlates with memory precision. This suggests that better reinstatement is related to memory integration, supporting the retrieval efficiency hypothesis. We also found that frontal theta oscillations are consistent with the predictions of the Bayesian Integration Model throughout the retrieval phase, while posterior alpha oscillations are consistent with predictions only in early retrieval phase. Furthermore, the similarity between observed oscillations and model predictions are not correlated with memory precision, which is inconsistent with the combination efficiency hypothesis. These results indicate that efficient retrieval contributes to spatial memory integration in navigation.

Topic Area: PERCEPTION & ACTION: Vision

F154 - Adaptive inhibitory feedback mechanisms for perceptual learning

Zsofia Zavecz[1] (zz501@cam.ac.uk), Ye Gu[1], Joseph Ziminski[2], Diana Rotaru[3], Yuan Gao[4], Chie Takahashi[1], Uzay Emir[5], Zoe Kourtzi[1]; [1]University of Cambridge, [2]Sainsbury Wellcome Centre, [3]Columbia University, [4]Zhejiang University, [5]University of North Carolina at Chapell Hill

Detecting relevant information in cluttered environments is key for successful recognition and interactions. Yet, our understanding of the brain mechanisms that underlie our ability to improve in perceptual tasks with training—a skill known as perceptual learning—remains limited. Here, we investigate the neurochemical and electrophysiological processes that support perceptual learning. We trained healthy young adults to detect radial vs. concentric patterns embedded in noise (i.e., Glass patterns) and measured neurochemical and electrophysiological signals before and after training. Using magnetic resonance spectroscopy (MRS), we measured neurotransmitters—glutamate and GABA—in the early visual cortex. Using electroencephalography (EEG), we assessed brain synchronization in the alpha frequency proposed as a feedback mechanism between higher- and lower-order visual areas. First, we demonstrate that training improved participants' perceptual judgments. Second, training altered the excitatory-inhibitory balance in the early visual cortex, with glutamatergic excitation increasing while GABAergic inhibition decreasing. Decreased inhibition was associated with faster rates of perceptual learning. Third, alpha synchronization in occipital areas changed with training; that is, alpha power following stimulus presentation increased. This increase in alpha synchronization was linked to faster learning rates, suggesting that inhibitory feedback mechanisms contribute to perceptual learning. Finally, these learning-dependent changes in alpha synchronization were positively correlated with increased glutamate levels in the early visual cortex, suggesting that inhibitory feedback may drive excitation in the visual cortex to boost perceptual decisions with training. Our findings reveal a strong link between adaptive neurochemical and electrophysiological inhibitory mechanisms for optimized perceptual decisions in the adult human brain.

Topic Area: PERCEPTION & ACTION: Vision

F155 - The human brain's functional connectome specifies hierarchical and non-hierarchical visual cortical processing

Alexandros Tzalavras[1,2] (at1159@rutgers.edu), David E. Osher[3], Carrisa Cocuzza[1,2], Lakshman N.C. Chakravarthula[1,2], Ravi D. Mill[1], Kirsten L. Peterson[1,2], Michael W. Cole[1]; [1]Center for Molecular and Behavioral Neuroscience, Rutgers University Newark, [2]Behavioral and Neural Sciences PhD Program, [3]Department of Psychology, The Ohio State University

The human brain utilizes complex visual representations even in simple everyday tasks. Understanding how these representations emerge requires delineating how brain network interactions generate task-relevant information. Previous research in our lab explored these interactions by investigating how the brain generates visual category selectivity through functional connectivity. Building on this, we sought to determine how connectivity shapes V1-initiated processing of visual stimuli in the early visual system, crucial for the emergence of task-relevant visual representations. Current theories suggest that cortical visual processing proceeds hierarchically, starting in V1 and progressing to V2, V3, V4, and beyond in a semi-serial manner. However, the contributions of hierarchical pathways versus direct, non-hierarchical connections remain unclear. We developed a novel functional connectomics approach yielding a confound-controlled whole-cortex connectome. To quantitatively define the visual system's hierarchical structure, we utilized a graph theoretical metric, communicability, with the confound-controlled connectome to establish a connectivity-based hierarchy among early visual areas. We then applied V1-initiated activity flow modeling to test models of network information flow. Surprisingly, our activity flow model reveals that non-hierarchical flows directly from V1 suffice to generate visual representations throughout the early visual system. Incorporating hierarchical connections enhances the prediction of visual responses, suggesting the involvement of both hierarchical and direct pathways. This highlights the distributed and parallel nature of information flow in the visual system. These insights underscore the crucial role of activity flows over functional connections in shaping visual representations, demonstrating how interplay between hierarchical and direct pathways enables the brain to effectively represent visual inputs.

Topic Area: PERCEPTION & ACTION: Vision

F156 - Generative modeling tools for characterizing human higher visual cortex

Margaret M Henderson[1] (mmhender@cmu.edu), Andrew F Luo[1], Sungjoon Park[1], Michael J Tarr[1], Leila Wehbe[1]; [1]Carnegie Mellon University

Characterizing the fine-grained functional organization of human higher visual cortex remains a significant challenge. Traditional neuroimaging experiments are limited in the number of stimuli they can sample, which may bias results toward particular stimulus attributes. In prior work we developed a novel data-driven tool, termed “BrainDiVE” (Luo et al. 2023, NeurIPS), which addresses these challenges by synthesizing images optimized to activate specific brain regions. BrainDiVE leverages pretrained image diffusion models guided by gradients from an image-computable fMRI encoding model. Here, we validated BrainDiVE experimentally by generating images that targeted several functional regions of interest (i.e., images predicted to maximally activate those areas), and showing them to participants in a new human fMRI study. We found that the synthesized images elicited robust and specific responses in the predicted target regions, validating BrainDiVE's ability to capture neural selectivity in human ventral visual cortex. Furthermore, we demonstrated fine-grained experimental control by differentially activating two face-selective regions—the occipital face area (OFA) and fusiform face area (FFA)—suggesting, as reflected in the BrainDiVE images, that they encode distinct aspects of faces. These findings provide new insights into the representational structure of category-selective regions and establish a novel paradigm for targeted exploration of neural selectivity in human visual cortex. More generally, our approach offers a powerful tool for investigating the functional organization of visual cortex at a fine-grained level, exceeding the capabilities of traditional methods across multiple dimensions.

Topic Area: PERCEPTION & ACTION: Vision

F157 - Generalization and Specificity of Offline Performance Gains in Visual Perceptual Learning

Theodore LaBonte-Clark[1] (theodore_labonte-clark@brown.edu), Teruaki Kido[1], Takeo Watanabe[1], Yuka Sasaki[1]; [1]Brown University

Sleep is instrumental for various types of procedural learning, including improvement on basic visual tasks, referred to as visual perceptual learning (VPL). Sleep after training on VPL tasks leads to further task improvement, referred to as off-line performance gains, but the specificity or transfer of these off-line gains to different locations in the visual field remains unclear. Here, we show that off-line performance gains occur at both trained and untrained locations in the visual field. In our experiment, we trained two groups to detect an orientation presented in one upper quadrant of the visual field. They were tested at both the trained and untrained upper quadrants immediately following training and again 12 hours later. The wake group trained in the morning and retested in the evening, while the sleep group trained in the evening and retested the following morning. Only participants in the sleep group slept between posttests. The sleep group exhibited off-line performance gains at both trained and untrained locations, indicating location transfer. Conversely, the wake group does not show a clear pattern of location transfer at this stage of data collection. Our results suggest that sleep may facilitate location transfer of VPL in an orientation detection task, generalizing learning to untrained locations. Interestingly, previous research reported no off-line transfer of learning to untrained orientations in a similar orientation detection task (Tamaki et al., 2020, Nature Neuroscience). Comparing our findings with prior work highlights the possibility that distinct mechanisms underlie specificity and generalization of VPL for features and locations.

Topic Area: PERCEPTION & ACTION: Vision

F158 - Increased visual motion inhibition associated with higher levels of diurnal cortisol

Daniel McDonough[1], Erin Ferguson[1], Rebecca Manley[1], Ainsley Thierren[1], Rachael Walsh[1], Craig M. Story[1], Daniel J. Norton[1]; [1]Gordon College

Depression is associated with changes in visual motion perception. In healthy vision, a performance reduction is associated with discriminating the direction of motion of a large grating stimulus as compared with a small one at high contrast. This is presumed to be a perceptual consequence of center-surround suppression (CSS), and this reduction is increased in currently-depressed adults. Also altered in depression is spatial summation, the advantage offered by a large as compared to a small stimulus at low contrast. The relation between cortisol levels and CSS or spatial summation has not been studied, but may shed light on prior results in depressed individuals, given the links between cortisol, stress, and depression. The present study investigated visual motion perception in small and large stimuli at low and high contrasts and compared these psychophysical data to participants’ (n=14) cortisol levels at their predicted height of diurnal cortisol. An enzyme-linked immunosorbent assay (ELISA) was used to determine participants’ salivary cortisol levels. In the visual perception battery, participants determined the direction of motion of a Gabor patch at varying sizes, contrasts and presentation times. Participants’ level of CSS was operationalized as the difference in accuracy between the small (1.5°) and large (7.5°) variations of the stimulus. Participants were sorted into a high-cortisol or low-cortisol group using a median split. At intermediate presentation times and high contrast, high-cortisol participants showed higher levels of CSS compared to the low-cortisol group. This is consistent with prior studies showing increased CSS in depression.

Topic Area: PERCEPTION & ACTION: Vision

F159 - Face perception differentially contributions to individual differences in face recognition ability depending on how it is measured

Tayan Zhang[1,2] (zhangtayan@gmail.com), Alison Campbell[1,2,5], Jeremy Wilmer[4], Laura Germine[3], Joseph DeGutis[2,3]; [1]Boston University, [2]Boston Attention and Learning Laboratory, [3]Harvard Medical School, [4]Wellesley College, [5]Boston University Chobanian and Avedisian School of Medicine

Face recognition ability is a stable, domain-specific cognitive ability that is highly heritable. Researchers have identified several potential mechanisms that contribute to face recognition ability, including holistic processing and associative memory. However, the involvement of these potential mechanisms may rely on how face recognition ability is assessed. To test this, we examined the contribution of face perception (measured using the Cambridge Face Perception Test-CFPT) to two popular methods of assessing face recognition ability: 1) Cambridge Face Memory Test (CFMT), a test that requires learning and recognizing six unfamiliar faces, and 2) Famous Face Memory Test (FFMT), a test that requires providing identifying information for highly-familiar famous faces. To ensure the replicability of the results, we recruited two large web-based US samples (Sample 1: N=632; Sample 2: N=649) that each completed the CFPT, CFMT, and a different version of the FFMT. First, we found that the CFMT and FFMT were strongly correlated in both samples (r=.55/.55). Importantly, in both samples, the correlation between CFPT and CFMT (r=.56/.55) was significantly stronger than for the CFPT and FFMT (r=.35/.34). Thus, when accounting for perceptual ability, there remains a larger amount of unexplained variance for familiar face recognition. This suggests that, while learning unfamiliar faces in the CFMT depends largely on perceptual ability, recognizing famous faces in the FFMT appears to depend more heavily on extra-perceptual processes such as making and retrieving semantic associations. Mechanistic models of individual differences in face recognition should consider the specific methods used to assess this ability.

Topic Area: PERCEPTION & ACTION: Vision

F160 - Electrophysiological and Behavioral Indices of Numerical Perception and Cognition

Jean Ee Tang[1] (jt2615@tc.columbia.edu), Yuexin Li, Paul Smith, Janiece Spitzmueller, Mischa (Yuri) Gushiken, Christofer Tobing, Peter Gordon; [1]Teachers College, Columbia University

This study explores the neurobehavioral mechanisms underlying the perception of small (1–3) vs. large (4–6) numbers and the effects of numerical change directionality using a 128-channel EEG system. Twenty-four adult participants viewed sequentially-presented dot arrays (1–6 dots) and were asked to detect numerical changes. Reaction time (RT) and accuracy was recorded. Numerical changes were categorized into six conditions based on target size (Small, Large, Crossover) and direction (Increasing, Decreasing), alongside a "No Change" baseline. Event-related potential (ERP) analyses targeted the N1 and P3b components to examine sensory encoding and cognitive context-updating. In Change conditions, Directionality influenced N1 peak latency, with Decreasing change eliciting later peaks. There was an interaction effect of Directionality and Size on N1 amplitude, where Decreasing change had weaker amplitudes than Increasing for Small and Crossover targets, except for Large, suggesting an "off-loading" of perceptual load. P3b amplitudes highlighted a categorical distinction between small and large numbers, with small-number targets eliciting higher amplitudes, reflecting easier context-updating. Large-number targets were more challenging, evidenced by lower accuracy, longer RTs, and attenuated P3b amplitudes. Similarly, Size (not Directionality) influenced P3b latency, where larger sets elicited earlier P3b peaks. These findings reveal a neurobehavioral distinction between small and large numbers, with early sensory encoding sensitive to directionality and later cognitive context-updating emphasizing numerical size. This study extends models of numerical cognition by linking perceptual and cognitive processes in numerical change detection.

Topic Area: PERCEPTION & ACTION: Vision

F161 - Investigating overlap in representations of non-symbolic quantities: Number, area, and fire

Justin Bonny[1] (justin.bonny@morgan.edu), Micah Russell[1]; [1]Morgan State University

There is active debate about shared neurocognitive mechanisms when approximating non-symbolic quantities without symbols or tools. Prior investigations focusing on number and area using comparison tasks have observed associations in performance and neural correlates in the intraparietal sulcus. The present study took a novel approach for examining overlap in number and area approximations: associations with fire intensity. Like number and area, ratio effects have been observed with visual fire intensity, which refer to modulations in performance when comparing two values as differences vary. We hypothesized that evidence of shared mechanisms for number and area approximations would manifest as correlations with fire comparison task performance. Participants (N=148, recruited from Prolific.co) completed three online tasks: two comparison tasks (fire; number or area, randomly assigned) and an ordinal letter task (judging whether three letters were arranged alphabetically; used as a control for general ordinal ability). During the comparison tasks, error rates and response times when judging which of a pair of values was greater were recorded as the ratio difference varied. Significant positive associations between fire and number (r=.40, p<.001) and area (r=.37, p=.014) performance were observed. These remained significant when controlling for letter task performance (ps<.03) with no significant differences in association strength with fire. The results indicated that fire comparison performance was associated with that of number and area. This suggests that approximate representations of these quantities were supported by at least partially overlapping cognitive processes. This research further extends the types of non-symbolic quantities to approximations of visual fire intensity.

Topic Area: PERCEPTION & ACTION: Vision

F162 - Reduced visual evoked potentials in children with autism spectrum disorder

Brooke E. Keough[1,2], Winko W. An[1,2], Virginia A. Rosenberger[1,2], Noah Crane[1,2], Leena Gupta[1,2], April Levin[1,2], Charles A. Nelson[1,2,3]; [1]Boston Children's Hospital, [2]Harvard Medical School, [3]Harvard University

Hypo- or hyper-sensitivity to sensory stimuli is often associated with autism spectrum disorder (ASD). This phenotype is believed to reflect disruptions in excitatory (E) and inhibitory (I) transmission in the brain, and correspondingly, E/I balance. The visual evoked potential (VEP) provides an ideal tool to explore these differences via the production of positive and negative deflections directly linked to the integrity of the visual processing stream. In the current study, we use electroencephalography (EEG) along with a pattern-reversal VEP paradigm in children aged 2-12 years with ASD (n=31) and typically developing (TD) peers (n=27). To allow for individualization of electrode selection, we adopted a novel component-based method to select electrodes containing the best representation of VEP. We ran an ANCOVA and found significantly lower amplitudes in both the N70 (p=0.003) and N70-P100 difference (p=0.017) between the ASD and TD cohorts, while controlling for age differences. We also conducted an exploratory frequency-domain analysis to examine inter-trial phase coherence across the alpha and beta frequency bands. Children with ASD were found to have significantly lower alpha (p=0.011) and beta (p=0.003) mean inter-trial coherence (ITC), potentially indicating a reduction in inhibitory signaling. Overall, these findings demonstrate amplitude reductions in the visual processing pathways and increased response variability across frequency bands in ASD, indexing potential cortical processing differences and alterations in glutamatergic and GABAergic neurotransmission.

Topic Area: PERCEPTION & ACTION: Vision

F163 - Predictive Coding dynamics enhance model-brain similarity

Bhavin Choksi[1] (choksi@uni-frankfurt.de), Manshan Guo[1,2], Sari Saba-Sadiya[1], Radoslaw Cichy[2], Gemma Roig[1]; [1]Goethe University, Frankfurt, [2]Freie Universität, Berlin

Predictive coding is a popular theory in neuroscience that posits that the brain, instead of passively encoding, actively predicts the world around it. Recent advances in deep learning models has led to an increased interest in integrating predictive coding inspired dynamics into artificial neural networks. Various implementations of these recurrent dynamics have been demonstrated to induce human-like properties, such as robustness to noise and ability to perceive illusions, into the neural networks. While these brain-inspired architectural biases have led to interesting properties, it remains unclear if they can improve the alignment between the brain and artificial representations. In this study, we systematically investigate the conditions under which brain-inspired modifications in predictive processing improve alignment between model and neural representations. This is achieved by employing models from the predify library that incorporates generative feedback on top of feedforward networks to perform recurrent dynamics over multiple time-steps. We investigate the representations across various layers in these networks, and their alignment with those obtained from two large neural datasets – one fMRI (Natural Scenes Dataset) and EEG (THINGSEEG). Our preliminary results suggest that, across both the datasets, progressively increasing feedback significantly increases similarity between model representations and those found in the higher-level visual brain areas. When the images are further divided based on their complexities, we found that the generative feedback especially helps when processing visual scenes with higher complexity, in accordance with the currently assumed role of feedback connections in the brain for processing difficult stimuli.

Topic Area: PERCEPTION & ACTION: Vision