Center for Cognitive and Behavioral Brain Imaging Research Day

Dec. 6th, 2019

THE OHIO STATE UNIVERSITY

Event Info

December 6th, 2019

9:00am - 4:30pm

1739 N High Street,
OSU Union
Room 3140

Keynote Speaker

Dr. Daniel L. Schacter

Department of Psychology

Harvard University

CCBBI | ccbbi.service@osu.edu | www.ccbbi.osu.edu

Center for Cognitive and Behavioral Brain Imaging

The Center for Cognitive and Behavioral Brain Imaging (CCBBI) in the College of Arts and Sciences is a state-of-the art interdisciplinary research facility dedicated to pursuing structural and functional magnetic resonance imaging (fMRI) studies. It aims to contribute to the development of future brain imaging modalities and to create and disseminate knowledge about brain, mind, and imaging research.

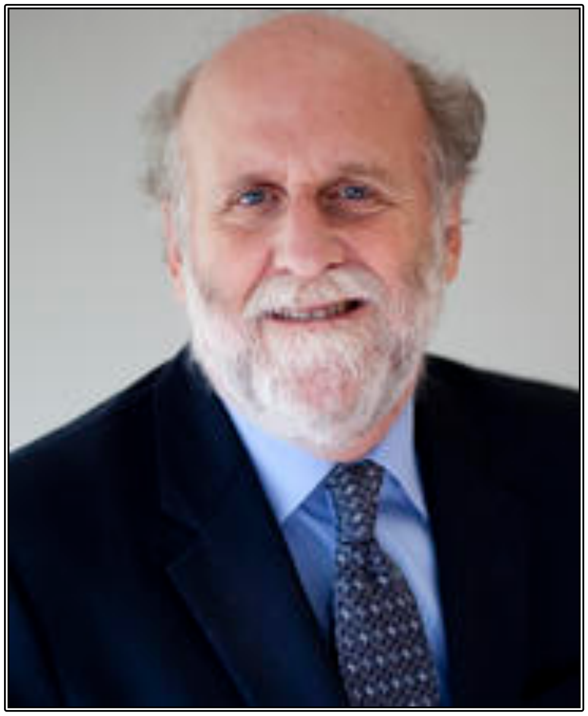
In pursuit of its goal to disseminate knowledge about brain, mind, and neuroimaging research, the Center for Cognitive and Behavioral Brain Imaging (CCBBI) invites the OSU Imaging community, including faculty, postdoctoral scientists, graduate students and research staff to its first annual CCBBI Research Day.

CCBBI Research Day is a celebration of the world-class neuroimaging research being completed at The Ohio State University and will feature a keynote address by Daniel Schacter, Ph.D., a former Chair of the Harvard Psychology Department and current Professor of Psychology at Harvard University; featured faculty presentations; and poster and short oral presentations by undergraduate and graduate students, research staff, and postdoctoral scientists.

CCBBI Research Day Agenda – December 6th , 2019

9:00 – 9:30 am	**Registration and Poster Set Up**
9:30 – 9:45 am	**Opening Remarks: Dr. Ruchika Prakash (CCBBI Director)**
9:45 – 10:45 am	**Keynote Talk: Dr. Daniel Schacter (Harvard University)**
10:45 – 11:00 am	**Coffee/Refreshment Break**
11:00 – 12:15 pm	**Featured Faculty Presentations** (see Page 5) **11:00 – 11:15 am – Julie Golomb, Ph.D.** **11:15 – 11:30 am – Zeynep Saygin, Ph.D.** **11:30 – 11:45 am – Yune Lee, Ph.D.** **11:45 – 12:00 pm – K. Luan Phan, M.D.** **12:00 – 12:15 pm – Q & A**
12:15 – 1:15 pm	**Lunch**
1:15 – 2:30 pm	**Graduate Student/Research Staff Oral Presentations** (see Pages 6 to 9) **1:15 – 1:30 pm – Heena Manglani, Prakash Lab** **1:30 – 1:45 pm – Jin Li, Saygin Lab** **1:45 – 2:00 pm – Allison Londerée, Wagner Lab** **2:00 – 2:15 pm – Sandra Glazer, Hoskinson Lab** **2:15 – 2:30 pm – Q & A**
2:30 – 3:00 pm	**Flash Talks for Poster Presentations**
3:00 – 4:00 pm	**Poster Presentations and Refreshments** (see Pages 10 to 22)
4:00 – 4:30 pm	**Closing Remarks**

Keynote Address: Dr. Daniel Schacter, Ph.D.



"Remembering the Past and Imagining the Future: Mechanisms and Functions"

Dr. Daniel Schacter is the William R. Kenan, Jr. Professor of Psychology at Harvard University. He served as the Chair of the department from 1995-2005 and is well known for his work in the cognitive and neural aspects of human memory. Author of over 400 articles and several books, Dr. Schacter been honored by a number of awards for his work including Notable Books of the Year by the New York Times, the Warren Medal from the Society of Experimental Psychologists, Award for Distinguished Scientific Contributions from the American Psychological Association, and election to the American Academy of Arts and Sciences and the National Academy of Sciences. His work utilizing cognitive, neuropsychological, and neuroimaging approaches has made groundbreaking contributions to understanding the nature and function of human memory.

Featured Faculty Presenters

Julie Golomb, Ph.D.
Associate Professor, Department of Psychology

Seeing in 3D: Representations of Stimulus Depth in Human Visual Cortex

Zeynep Saygin, Ph.D.
Assistant Professor, Department of Psychology

Neuroanatomical Precursors for Uniquely Human Cognition

Yune Lee, Ph.D.
Assistant Professor, Department of Speech and Hearing

Beat the Beat: Promoting the Language Network Through Rhythm Training

K. Luan Phan, M.D.
Chair and Professor, Department of Psychiatry & Behavioral Health
Charles F. Sinsabaugh Chair in Psychiatry

THE Emotional Brain in the Clinic: How Affective Neuroscience Informs Our Understanding of *How* Treatments Work, and *for Whom*

Oral Presentation Abstract 1

A Connectome-Based Neuromarker of Working Memory in Multiple Sclerosis

Heena Manglani, *Stephanie Fountain-Zaragoza, Anita Shankar, & Ruchika Shaurya Prakash*

Department of Psychology, The Ohio State University

Keywords: Connectome-based predictive modeling, multiple sclerosis, working memory, functional connectivity, fMRI

Working memory impairments in multiple sclerosis (MS) are associated with decrements in functional independence, psychological well-being, and quality of life. Heterogeneity in working memory (WM) function among people with MS may be a result of widespread neural alterations driven by disease pathology and require analysis of whole-brain networks. This study used a novel data-driven modeling approach to predict individual differences in neuropsychological function using whole-brain patterns of functional connectivity during task-based fMRI. Two independent samples of individuals with relapsing-remitting MS completed MRI-adapted tests of WM: the Paced Visual Serial Addition Test (PVSAT) and the n-back task, respectively. A WM model was constructed in the training sample and assessed in the novel test sample. Models were trained using leave-one-out cross validation, wherein the strength of functional connections were associated with PVSAT performance in n -1 participants, and predicted PVSAT performance for the left-out participant. The derived networks were used to predict WM scores in the test sample, and the correlation between predicted WM and observed n-back scores in these novel participants quantified model performance. Overlap across all rounds of cross validation revealed 376 functional connections that were predictive of better scores (rho = .58, p = .005), 374 functional connections predictive of worse scores (rho = .56, p = .002), and a combined model that predicted over 35.5% of the variance in WM performance. In the test sample, identified functional connections that were predictive of worse behavior demonstrated significant correlations with observed n-back scores (rho = .51, p = .005), validating the derived WM connectome as a neuromarker of working memory. These results indicate that whole-brain connectivity-based neural markers of working memory may capitalize on the heterogeneity of individual-level functional connectivity and behavior to identify meaningful brain-behavior relationships, and serve as target for cognitive rehabilitation of working memory deficits in MS.

Oral Presentation Abstract 2

Cortical Selectivity Driven by Connectivity: Innate Connectivity Patterns of the Visual Word Form Area

Jin Li, *David E. Osher, Heather A. Hansen, & Zeynep M. Saygin*

Department of Psychology, The Ohio State University

Keywords: Functional connectivity; Connectivity hypothesis; Neonates; Visual word form area; Language

The human brain is a patchwork of different functionally specialized areas. What determines this functional organization of cortex? One hypothesis is that innate connectivity patterns shape functional organization by setting up a scaffold upon which functional specialization can later take place. We tested this hypothesis here by asking whether the visual word form area (VWFA), an experience-driven region that only becomes selective to visual words after gaining literacy, was already connected to proto language networks in neonates scanned within one week of birth. We found that neonates showed adult-like functional connectivity, and observed that i) the VWFA connected more strongly with frontal and temporal language regions than regions adjacent to these language regions (e.g., frontal attentional demand, temporal auditory regions), and ii) language regions connected more strongly with the putative VWFA than other adjacent ventral visual regions that also show foveal bias (e.g. fusiform face area, FFA). Object regions showed similar connectivity with language areas as the VWFA but not with face areas in neonates, arguing against prior hypotheses that the region that becomes the VWFA starts out with a selectivity for faces. These data suggest that the location of the VWFA is earmarked at birth due to its connectivity with the language network, providing novel evidence that innate connectivity instructs the later refinement of cortex.

Oral Presentation Abstract 3

The Orbitofrontal Cortex Spontaneously Encodes Food Taste and Health and Contains More Distinct Representations for Foods Highest in Taste

Allison M. Londerée *& Dylan D. Wagner*

Department of Psychology, The Ohio State University

Keywords: food, reward, orbitofrontal cortex, multivariate pattern analysis, representational similarity analysis

Functional neuroimaging studies have shown that food-cue related activity in the brain's reward system is associated with poor dietary self-control, weight-gain and greater overall body mass. Understanding how neural responses to food cues are related to the features of food items (e.g., taste, health) may offer insight into what drives neural responses in the reward system and ultimately what contributes to dietary self-control failure. Eighteen healthy non-dieting participants with no dietary restrictions or food allergies underwent functional neuroimaging to examine the neural representation of tastiness and health for a set of 28 food categories selected to be orthogonal with respect to both dimensions. From the average neural response to each of the 28 food categories, a neural dissimilarity matrix was created and compared to model dissimilarity structures derived from subjective ratings of food attributes. Using representational similarity analysis, in conjunction with linear mixed-effects modeling, we demonstrate that the orbitofrontal cortex automatically encodes both the dimensions of food taste and health simultaneously. Moreover, using model dissimilarity matrices that encode overall taste and health magnitudes we find evidence that the neural representation of foods grows more distinct with increasing tastiness. In a separate study of 56 participants, we use lexical analysis of natural language descriptions of food to show that food tastiness is associated with more elaborated descriptions of food. These data show not only that the orbitofrontal cortex spontaneously encodes both the dimensions of taste and health when viewing appetitive food cues but that the neural and cognitive representations of those foods that are the highest in taste are more refined than those lower in taste. Together these findings suggest that food taste and health are primary dimensions of food evaluations and may be computed automatically by individuals when confronting foods in their environment.

Oral Presentation Abstract 4

Examining Social and Cognitive Working Memory in Pediatric Brain Tumor Survivors via Task Performance and Structural Volumetrics

Sandra Glazer, *Hanan Guzman, Holly Aleksonis, Randal Olshefski, Kathryn Vannatta, & Kristen R. Hoskinson*

Center for Biobehavioral Health at the Abigail Wexner Research Institute at Nationwide Children's Hospital

Keywords: cancer, pediatric, working memory, fMRI, volumetrics

Objective:
Pediatric brain tumor survivors (PBTS) are at risk for poor working memory (WM), which can impact cognitive and social functions. This may be due to diminished volume in relevant brain regions, e.g., the mentalizing network (MN) for social WM and central executive network (CEN) for cognitive WM. These connections remain underexplored in PBTS and are the focus of this pilot study.

Methods:
Twelve PBTS (9 boys, M=12.3yr) and 10 healthy controls (HC; 6 boys, M=12.3yr) completed functional magnetic resonance imaging while engaging in two novel paradigms: the People game (social WM), and the Places game (cognitive/spatial WM). Overall task accuracy and accuracy on more difficult levels were analyzed in conjunction with MN and CEN volumetrics, quantified using Freesurfer 6.0 for left (LH) and right hemisphere (RH).

Results:
PBTS performed more poorly on People than HC, in overall accuracy (68.9% v. 79.1%; d=0.72) and accuracy on the most difficult levels (65.2% and 59.1% v. 76.7% and 70.0%; ds=0.54 and 0.48). PBTS also performed more poorly on Places in overall accuracy (79.2% v. 87.1%; d=0.60) and accuracy on one of the most difficult levels (69.7% v. 93.3%; d=1.48). HC had larger RH CEN volume than PBTS; otherwise network volume did not differ. At the most difficult level, performance on People was negatively correlated with LH CEN (r=-.43) and LH MN (r=-.65). Performance on Places was negatively correlated with LH CEN (r=-.45), and RH (r=-.40) and LH MN (r=-.67).

Conclusions:
PBTS displayed worse cognitive and social WM than HC, perhaps partially explained by the impact of a tumor and its treatment on brain systems. Unexpectedly, associations among network volume and performance were negative. This may reflect inefficient neural pruning, but corroboration among volumetric and functional activation data are warranted. Future research should attempt to confirm these associations, ideally in a larger sample.

Poster Abstract 1

The Developmental Trajectory of the Domain General Cortex

Athena L. Howell *& Zeynep M. Saygin*

Department of Psychology, The Ohio State University

Keywords: Frontoparietal, Development, Attention, Domain General, Functional Activation

The human cortex is not fully mature at birth. In particular, the frontal and parietal regions of the brain take the longest to mature, and takes longer to mature in humans than in other primates. The behavioral consequence of this delay in maturation for humans remains unknown. In human adults, parts of frontal and parietal cortices are engaged in "domain general" mental functions (i.e. required for tasks that involve extra mental effort, working memory, and attention, regardless of the particular task or mental domain). Consequently, in adults, these areas show greater activation during difficult tasks vs. easy tasks; further, these areas are more connected to each other than to other networks (e.g. more intranetwork connectivity vs. internetwork connectivity). It remains to be seen, however, whether these areas in children i) show a mature pattern of functional activation in response to task difficulty, ii) show a more prolonged development than adjacent areas engaged in other mental processes, and iii) show immature connectivity within and between functional networks. In this study, we assessed the functional activation and connectivity of frontoparietal cortical areas in adults and kids. Preliminary results indicate that children exhibit generally weaker activation in domain-general areas as compared to adults and immature connectivity as well. Ongoing and future longitudinal work will relate individual immaturity of function and connectivity to behavioral assessments and developmental milestones

Poster Abstract 2

Mind-Wandering and Functional Connectivity in the Aging Brain

Oyetunde Gbadeyan & *Ruchika Shaurya Prakash*

Department of Psychology, The Ohio State University

Keywords: Functional connectivity, graph theory, cognitive neuroscience, mind wandering, connectome based predictive modeling, aging

Background: Stimulus-independent thoughts, colloquially known as mind wandering (MW), refers to qualitative shift from exogenous, stimulus-dependent processing to endogenous, internal mentation. Although previous studies have characterized the neural correlates of these cognitive processes, the majority of these studies have employed univariate, GLM-based analyses, with no study, to our knowledge, examining functional connectivity (FC) correlates of MW.

Objectives: Using a data-driven approach known as connectome based predictive modeling (CPM), we built a network-based model of MW from whole-brain FC patterns observed in older participants during the completion of an attentional task.

Methods: Fifty healthy older adults (27F/23M, ages 65-85) underwent functional MRI (fMRI) while performing the gradual-onset Continuous Performance Task (gradCPT). MW was quantified with reaction time coefficient of variation (RT_CV; standard deviation of RT/mean RT). CPM allowed to build a MW neuromarker using each individual's RT_CV score and FC data. Consistent with previous CPM studies, a significance threshold of $p<.01$ was applied to select the network edges that were positively and negatively correlated with MW. We also assessed the robustness of our model using a liberal ($p<.05$) and more stringent ($p<.001$) thresholds. Observed and predicted RT_CV scores were correlated to assess model performance.

Results: Using edge selection threshold of $p<.01$, the MW model successfully predicted MW (rho=.38, $p=.02$). Additional thresholds applied during edge selection step did not yield significant prediction of MW (all p values >.05).

Conclusion: The finding that CPM selectively predicted MW based on the edge selection threshold suggests substantial heterogeneity in brain-behavior associations across our sample. Another tentative explanation is that RT_CV, as assessed in this task, did not robustly capture MW, and thus resulted in only subtle changes in FC pattern associated with MW. Our future directions involve further understanding the distribution of RT_CV within task and exploring these analyses with datasets that explicitly assess MW.

Poster Abstract 3

Theory of Mind-Related BOLD Signal Activation in Pediatric Brain Tumor Survivors

Hanan Guzman, *Ryan Wier, Anthony Romyn, William A. Cunningham, Randal Olshefski, Kathryn Vannatta, & Kristen R. Hoskinson*

Nationwide Children's Hospital - Center for Biobehavioral Research

Keywords: Neuroimaging, Cancer, Pediatrics

Objective
Pediatric brain tumor survivors (PBTS) are at risk for deficits in social cognition, including cognitive Theory of Mind (ToM), i.e., the ability to appraise others' thoughts and beliefs. Prior neuroimaging studies implicate the Default Mode (DMN) and Mentalizing Networks (MN) as important for the development of ToM. We examined functional activation in these regions during a ToM task in PBTS.

Participants and Methods
Ten PBTS (M=12.4yr, 7 boys) and 8 HC (M=12.4yr, 4 boys) completed Jack and Jill, a cognitive ToM task, during functional magnetic resonance imaging. Functional activation (i.e., BOLD signal) within the DMN and MN was assessed using template masks via FSL 5.0 during trials specifically requiring engagement of ToM.

Results
Using a region-of-interest approach and FDR at $p<.05$, groups had similar activation within the medial superior frontal cortex and posterior cingulate. Relative to HC, PBTS had greater BOLD signal activation across several right hemisphere regions, including the posterior cingulate, supramarginal gyrus, paracingulate cortex, superior frontal cortex, frontal pole, and precuneus, as well as in the left superior frontal cortex, medial frontal cortex, and bilateral temporal poles. In contrast, HC had greater BOLD signal activation in the left superior frontal cortex, left angular gyrus, and bilateral middle temporal gyrus.

Conclusions
Deficits in social cognition for PBTS may be due to the impact of a tumor or its treatment on brain regions that support these skills, including the DMN and MN. Though constrained by a small sample in this pilot study, PBTS may compensate for inefficiencies in these networks through over-recruitment of oxygenated hemoglobin to key brain regions relative to HC to complete the ToM task. Future studies aiming to improve PBTS interventions and quality of life may consider treatment modality and neurotoxicity, as well as thorough examination of social cognition in daily life.

Poster Abstract 4

Evaluating the Predictive Ability of Resting-State Networks for Sustained Attention in Aging

Michael R. McKenna, *Stephanie Fountain-Zaragoza, Shaadee Samimy, & Ruchika Shaurya Prakash*

Department of Psychology, The Ohio State University

Keywords: Network neuroscience, aging, sustained attention

Objective: Connectome-based predictive modeling (CPM) capitalizes on individual-level maps of functional connectivity to predict behavior. One of CPM's most validated applications has been the creation of a sustained attention model (saCPM) in young adults that includes a pair of networks whose connectivity during a continuous performance task predicts task performance. Previous work by our lab demonstrated generalizability of the saCPM in young adults (YA) and older adults (OA), showing that connectivity of the high and low attention networks of saCPM during a Stroop task predicted Stroop performance, a measure of executive control of attention. The goal of this study was to investigate whether connectivity in the saCPM during resting-state would predict Stroop performance in OA and YA.

Participants and Methods: 21 OA and 21 YA completed a 6-minute resting state scan and the Stroop task in a 3T scanner. The primary outcome of interest for Stroop was reaction time (RT) cost (incongruent RT - congruent RT). After screening for excessive motion and incidental findings, 17 OA (mean age = 65.2 years) and 16 YA (mean age = 23.0 years) were included in the analyses. We examined whether rsFC within the high-attention and low-attention saCPM networks were able to predict Stroop RT cost.

Results: In OA and YA, rsFC within the saCPM did not successfully predict RT cost in the full sample (Full Model: rsquared = 7.8%, $p = 0.11$; High-Attention Network: rsquared = 9.0%, $p = 0.091$; Low-Attention Network: rsquared = 4.4%, $p = 0.23$) or in the age groups separately.

Conclusions: These results may point to limitations in saCPM's generalizability, although the observed results encourage exploration in a larger sample. Differences in sample and task characteristics, including age, scan type (rest vs. task), and cognitive domain (sustained attention vs. executive control), may have contributed to the observed null results.

Poster Abstract 5

EduCortex: Browser-Based 3D Brain Visualization of Meta-Analysis Maps

Paul Scotti, *Arman Kulkarni, Matan Mazor, Eduard Klapwijk, Tal Yarkoni, & Alex Huth*

Department of Psychology, The Ohio State University

Keywords: visualization, meta-analysis, education, fmri

EduCortex is an educational brain visualizer that can be run in any modern browser and allows the user to type in any keyword (e.g., "motion", "visual", "finger") to visualize the parts of the brain that are most associated with that word. This is accomplished through the combination of the Neurosynth database and the PyCortex brain visualizer. For example, if a young scientist asks "what part of the brain processes faces?", then they can type in "face" and see activation predominantly in the fusiform face area. The user can also click on any part of the brain to see the keywords that are most associated with that brain region. This tool was made during NeuroHackademy 2019 and can be accessed on your phone or computer at paulscotti.github.io/EduCortex.

Poster Abstract 6

How are Illusory Objects Represented in Visual Working Memory?

***Elliot E. C. Ping**, Lisa M. Heisterberg, Ayala S. Allon, & Andrew B. Leber*

Department: Neuroscience, The Ohio State University

Keywords: contralateral delay activity, visual working memory, illusory objects

Visual Working Memory (VWM) is an online workspace that holds a limited amount of information, usually about 3-4 objects, in an active state for a short period of time (Fukuda & Vogel, 2009). One way of coping with these capacity limitations is by grouping and parsing information into integrated units in VWM. Previous findings have demonstrated that using Gestalt grouping cues can improve VWM performance (Gao, et al, 2016; Peterson, et al, 2015). While previous studies have found that grouping cues, such as illusory objects improve VWM performance (Allon et al., 2018), the question of how these improvements arises remains unanswered. Here, we ask whether these behavioral benefits result due to an illusory object (e.g. a Kanizsa triangle) reducing storage demands in VWM. We recorded EEG while subjects completed a bilateral change-detection task, with memory arrays configured in four conditions: 1 item, 3 items forming a Kanizsa triangle, 3 proximity grouped items, and 3 ungrouped items. VWM storage was assessed via the contralateral delay activity (CDA). Behaviorally, we found a performance benefit for the Kanizsa triangle condition, replicating other studies. However, the CDA amplitude for the Kanizsa condition was not significantly different from the 3 proximity grouped and 3 ungrouped item conditions. These results suggest that the behavioral benefits derived from the illusory object Kanizsa triangle are not a result of reduced storage demands in VWM.

Poster Abstract 7

Patterns of Increased Functional Connectivity During Resting-State fMRI Predict Lower Working Memory Performance in People with Multiple Sclerosis

Anita Shankar, *Heena Manglani, Stephanie Fountain-Zaragoza, Dan Evans, & Ruchika Shaurya Prakash*

Department of Psychology, The Ohio State University

Keywords: functional connectivity, multiple sclerosis, working memory

In people with multiple sclerosis, changes to functional connectivity in the brain have previously been associated with disease-driven cognitive changes (Tahedl, 2018). This disease-driven functional reorganization is not well characterized, and as such, it remains difficult to determine which functional connections are related to behavior and the nature of these relationships (Rocca, 2018). Connectome-based predictive modeling (CPM; Rosenberg et al., 2016; Shen et al., 2017) is a data-driven technique capable of identifying brain-behavior relationships as well as creating predictive models of behavioral performance from whole-brain functional connectivity. In the current study, we built two distinct CPMs of working memory using resting-state functional connectivity (Rs-FC) from 27 PwMS (mean age 45.81 Â± 7.36) to predict performance on the Paced Visual Serial Addition Task (PVSAT) and the WAIS-IV Working Memory Index (WMI), respectively. Using a leave-one-out cross validation procedure, both CPMs successfully predicted working memory performance (correlation between predicted and observed scores: PVSAT: $r=.51$, $p<.01$; WMI: $r=.45$, $p<.02$), which indicates that the CPM methodology is both sensitive to brain-behavior relationships in PwMS and able to create predictive models of working memory solely from Rs-FC. Additionally, we differentiated between the functional connections positively correlated with performance scores (a high-WM network) and those negatively correlated with performance scores (a low-WM network). We found the low-WM networks of both models to be particularly important for predictive power (correlation between predicted/observed scores: PVSAT_low: $r=.57$, $p<.01$; WMI_low: $r=.43$, $p=.03$), suggesting that certain increases in functional connectivity at rest may be detrimental to working memory performance or indicative of maladaptive firing. Therefore, our current results support the use of the CPM method as a powerful technique for the prediction of working memory ability in PwMS and suggest the functional connections found in rest are promising indicators of higher-order cognitive function in this population.

Poster Abstract 8

Decoding 3D Spatial Location Across Saccades in Human Visual Cortex

Xiaoli Zhang*, Christopher M. Jones, & Julie D. Golomb*

Department of Psychology, The Ohio State University

Keywords: depth, spatial representation, eye movements, fMRI, MVPA

Visual signals are initially processed as two-dimensional images on our retina. To perceive a 3D world, information about depth must be reconstructed from these 2D images. However, in daily life, we make frequent eye movements, and consequently the 2D retinal inputs constantly change. With these dynamic inputs, are the neural representations of depth information robust across saccades compared with sustained fixation? In an fMRI scanner, while wearing red-green anaglyph glasses, participants passively viewed a random dot patch that randomly appeared in one of four 3D screen locations in blocks of 16s duration. Each location was defined by its 2D position (above or below screen center; y-axis information), and its depth position (in front or behind screen center; z-axis information). In half of the blocks, participants maintained fixation on a stable fixation dot throughout the block (no-saccade blocks); in the other blocks, they made frequent saccades between the left and right sides of the screen (saccade blocks). Multivariate pattern analysis (MVPA) was used to assess the brain representations of 2D location and position-in-depth information in the fixation and saccade conditions. Both 2D (y) and depth (z) information were highly dependent on eye position in no-saccade blocks: we found little information that could be decoded across different eye positions in any visual ROIs. Interestingly, in the saccade blocks, we could decode both types of information in several ROIs, with a decrease of y information and an increase of z information along the visual hierarchy. These results show that the representations of 3D spatial location were dependent on eye position during sustained fixations, but were more tolerant of eye position when participants made repetitive saccades. This indicates that active remapping during saccades may encourage more stable representations of the world.

Poster Abstract 9

Neural Reconstructions of Attended Object Features using fMRI and EEG

Jiageng Chen, *Emma Wu Dowd, Maurryce D. Starks, & Julie D. Golomb*

Department of Psychology, The Ohio State University

Keywords: Spatial Attention; Features; Inverted Encoding Model

Spatial attention is thought to play an essential role in selecting relevant information and ignoring irrelevant information. But spatial attention is dynamic, constantly shifting and splitting across multiple objects and locations. How can we measure neural representations of visual features under conditions of dynamic attention, and how do these measurements link with behavior? Both fMRI (e.g., Brouwer & Heeger, 2009) and EEG (e.g., Garcia, Srinivasan & Serences, 2013) have recently been used to reconstruct object features. Here we ask whether these reconstruction techniques can be applied to behaviorally-relevant, attended features (from a multi-item display), and whether the quality of these reconstructions are linked to behavior. In an fMRI task, subjects were briefly shown an array of three colored and oriented gratings. Subjects were then asked to report either the color or orientation of the grating at a spatially pre-cued location. To manipulate dynamic attention, some trials included a second spatial pre-cue at a different location, such that subjects had to covertly shift attention and report the features of the object at the new location. In a similar EEG task, two gratings were shown on the screen, and subjects were asked to covertly attend to one of them to detect subtle orientation changes. Using both techniques, we were able to reconstruct the features of the attended item by applying an inverted encoding model (e.g., Sprague & Serences, 2015). In particular, we achieved reliable feature reconstructions only when the feature was relevant to the current task. Moreover, fMRI neutral reconstruction performance was linked to trial-by-trial behavioral errors. These results emphasize the role of focused spatial attention in the feature-binding process and illustrate the potential of these techniques to provide neural measurements of attended feature representations under dynamic conditions without requiring behavioral responses.

Poster Abstract 10

Adults vs. Neonates: Differentiation of Functional Connectivity Between the Amygdala Subnuclei and Occipitotemporal Cortex

Heather A. Hansen, *Jin Li, & Zeynep M. Saygin*

Department of Psychology, The Ohio State University

Keywords: functional connectivity, development, occipitotemporal cortex, amygdala

The amygdala, a subcortical structure known for social and emotional processing, is composed of multiple subnuclei with unique functions and connectivity patterns. Tracer studies in adult macaques have shown that the lateral and basal subnuclei differentially connect to visual cortical areas, such that connections are stronger to anterior regions and weaker to posterior regions; infant macaques show robust connectivity even with posterior visual regions. Do these developmental differences also exist in the human amygdala, and what is the possible functional role of this prolonged development of connectivity? To address these questions, we explored lateral and basal functional connectivity (from resting-state fMRI data) to occipitotemporal cortex in 40 adult subjects and 36 neonates scanned within one week of life. We not only explored amygdala connectivity to anterior-posterior gradients of the anatomically-defined occipitotemporal cortex, but also to putative functional parcels in occipitotemporal cortex, including primary and high-level visual and auditory cortices (V1, A1, face, scene, object, body, and temporal speech regions). Results showed a decreasing gradient of functional connectivity to the occipitotemporal cortex in adults - similar to the gradient seen in macaque tracer studies - but no such gradient was observed in neonates. Further, adults had stronger connections to higher level functional regions associated with face, body, and object processing, and weaker connections to primary sensory regions (i.e., A1, V1), whereas neonates showed the same amount of connectivity to primary as well as higher-level visual and auditory regions. Overall, these results show that functional connectivity between the amygdala and occipitotemporal cortex is not yet differentiated in neonates, possibly facilitating experience-dependent specialization of cortex.

Poster Abstract 11

Theory of Mind in Pediatric Brain Tumor Survivors: Associations with Corpus Callosum Integrity and Volume

Young Jin (Ginnie) Kim, *Sandra Glazer, Holly Aleksonis, Randal Olshefski, Kathryn Vannatta, & Kristen R. Hoskinson*

Nationwide Children's Hospital - Biobehavioral Health

Keywords: Magnetic resonance imaging, Theory of mind, Corpus callosum, White matter integrity, Pediatric brain tumor survivors,

Objectives

Pediatric brain tumor survivors (PBTS) are at risk for deficits in social cognition and reduced white matter integrity (WMI). The corpus callosum (CC) is a prominent white matter structure associated with social cognition. Reduced CC integrity may contribute to poor social cognition, including theory of mind (ToM). In this pilot study, we examined associations among ToM performance and CC integrity in PBTS and healthy children (HC).

Methods

Twelve PBTS (8 boys, M=12.5yr) and nine HC (5 boys, M=12.9yr) completed the Jack and Jill cognitive ToM task and underwent magnetic resonance imaging including diffusion tensor imaging. CC integrity was assessed volumetrically (Freesurfer 6.0) and microstructurally using TBSS and ENIGMA ROI segmentation. Tractography yielded quantified fractional anisotropy (FA) and axial diffusivity (AD) of bilateral genu (CCg), body (CCb), splenium (CCs), and entire CC.

Results

No significant differences were found between groups on ToM accuracy (PBTS=86.4% vs. HC=90.3%, d=0.22). PBTS showed lower volume in the anterior CC than HC (Eta2=.15). Relative to HC, PBTS had lower FA in the CCb (d=0.72), the CCg (d=0.56), and the entire CC (d=0.65), suggesting reduced WMI. PBTS also showed higher AD than HC in the CCb (d=0.71), the CCg (d=1.10), CCs (d=0.82), and entire CC (d=0.92), indicating reduced WMI. Across groups, ToM task accuracy was significantly associated with brain volume within central (r=.44), mid-anterior (r=.43), and anterior (r=.54) CC. There were no significant associations among task performance and CC tractography.

Conclusions

Consistent with previous findings, PBTS showed reduced WMI across CC segments, and reduced anterior CC volume, perhaps due to the impact of a tumor or its treatment. In this pilot study, even with reduced anterior CC volume, PBTS performed as accurately as HC on the task. Future studies should examine what resilience factors contributed and if tumor types and locations may have differentiated social cognition.

Poster Abstract 12

Hippocampal and Entorhinal Cortex Volume Relate to Body Mass Index in Those at Genetic Risk for Alzheimer’s Disease

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Department of Psychology, The Ohio State University

Keywords: Atrophy; Alzheimer's disease; Body mass index; Hippocampus; Entorhinal cortex; Polygenic risk

Body mass index (BMI) has a complex relationship with Alzheimer’s disease (AD); in midlife, high BMI is associated with increased risk for AD, whereas the relationship in late- life is still unclear. To clarify the relationship between late-life BMI and risk for AD, this study examined the extent to which genetic predisposition for AD moderates BMI and AD-related biomarker associations. Participants included 126 cognitively normal older adults at baseline from the Alzheimer’s Disease Neuroimaging Initiative (ADNI) cohort. Genetic risk for AD was assessed via polygenic hazard score (PHS). AD-related biomarkers assessed were volume of medial temporal lobe regions and cerebrospinal fluid (CSF) biomarkers. Hierarchical linear regressions were implemented to examine the effects of BMI and PHS on AD-related biomarkers. Results showed that BMI moderated the relationship between genetic risk for AD and volume of medial temporal lobe regions, such that individuals with high BMI and high PHS showed lower volume in the entorhinal cortex ($P = 0.013$) and hippocampus ($P = 0.010$). In sex-stratified analyses, these results remained significant only in females. Finally, BMI and PHS were independently associated with CSF biomarkers of AD. These results provide evidence that high BMI is associated with lower volume in AD-vulnerable brain regions in individuals at genetic risk for AD, particularly females. The presentation will discuss the possibility that genetic pathways of AD may be exacerbated by high BMI.

Poster Abstract 13

Parcellation of the Cingulate Gyrus Using Anatomical Connectivity Profiles

Justin Flanagan, *Zeynep Saygin, Fred Lenz, & David Osher*

Department of Psychology, The Ohio State University

Keywords: cingulate, parcellation, connectivity, pain

The human cingulate gyrus has long been implicated in a variety of cognitive functions ranging from attention, mood, emotional regulation, and error monitoring. This evolutionarily conserved piece of cortex has been previously shown to connect to many regions of the brain, and the architecture of these connections can provide a better understanding of the functional differences between the unique regions of the cingulate. Here, we parcellate the cingulate into subregions using known anatomical connectivity patterns of these subregions. Each voxel of the cingulate is assigned to a subregion based on how well its connectivity pattern fits the known anatomical connections of that subregion. Future work will investigate the voxel-wise connectivity-function relationships in the cingulate using the connectivity fingerprinting toolbox.

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Agenda at a Glance

9:00 – 9:30 am	**Registration and Poster Set Up**
9:30 – 9:45 am	**Opening Remarks: Dr. Ruchika Prakash (CCBBI Director)**
9:45 – 10:45 am	**Keynote Talk: Dr. Daniel Schacter (Harvard University)**
10:45 – 11:00 am	**Coffee/Refreshment Break**
11:00 – 12:15 pm	**Featured Faculty Presentations** (see Page 4)
12:15 – 1:15 pm	**Lunch**
1:15 – 2:30 pm	**Graduate Student/Research Staff Oral Presentations** (see Pages 6 to 9)
2:30 – 3:00 pm	**Flash Talks for Poster Presentations**
3:00 – 4:00 pm	**Poster Presentations and Refreshments** (see Pages 10 to 22)
4:00 – 4:30 pm	**Closing Remarks**

thank you

Thanks to all the organizers who made this happen.

Thank you for attending
the first CCBBI Research Day!