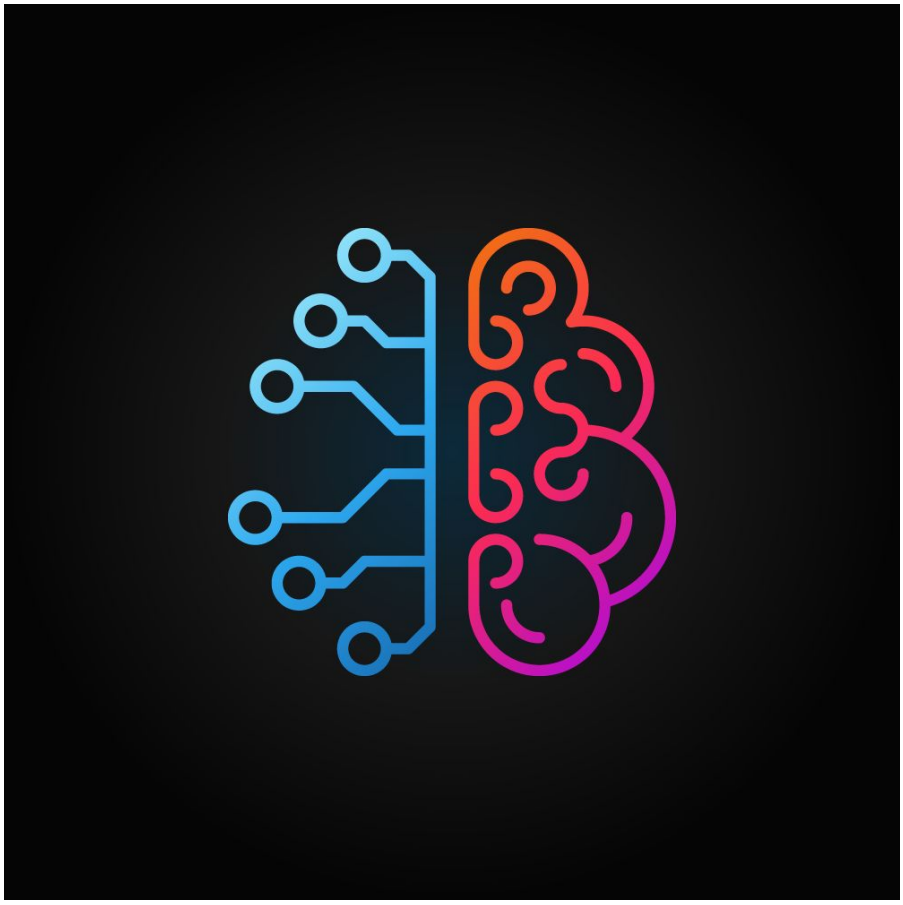
Eighth Annual Midwest Cognitive Science Conference

May 24-26, 2019

The Ohio State University
Columbus, Ohio



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Center for Cognitive and Brain Sciences (CCBS)

Proceedings of the Eighth Annual Midwestern Cognitive Science

Workshop Chairs: Zhong-Lin Lu, Mark Steyvers, Brandon Turner

Conference Chairs: Brandon Turner

Organizing committee: Giwon Bahg, Peter Kvam, Matthew Galdo, Fiona Molloy

Schedule at a Glance

Friday, May 24	
9:00 – 5:00 PM	Workshop on Integrating Neural and Behavioral Data
6:00 – 8:00 PM	Welcome Reception

Saturday, May 25		
8:30 – 8:45 AM	**Coffee Service**	
8:45 – 9:00 AM	Welcome and Opening Remarks	
9:00 – 10:20 AM	**Learning** Gureckis Sloutsky Vigo Wimsatt	**Meaning & Understanding** Klafka Hough Ezpelata Lin
10:20 – 10:40 AM	**Coffee Break**	
10:40 – 11:40 PM	Keynote - Mark Steyvers	
11:40 – 1:20 PM	**Lunch**	
1:20 – 2:20 PM	**Neural models** Candadi Mannering Billock	**Research practices** de Oliveira Wang Erdi
2:20 – 2:40 PM	**Coffee Break**	
2:40 – 4:20 PM	**Decision symposium** Gonzalez-Vallejo Krajbich Johnson Van Zandt Busemeyer	(Poster session setup)
4:20 – 5:40 PM	Poster Session	

Sunday, May 26	
8:30 – 9:00 AM	**Coffee Service**
9:00 – 10:20 AM	**Context, Memory & Attention** Li Jagacinski Siefke Dandignac
10:20 – 10:40 AM	**Coffee Break**
10:40 – 12:20 PM	**Computational modeling** Chang Merkle Galdo Fific Molloy
12:20 – **1:00 PM**	**Closing comments & Awards**

Workshop Schedule

Friday, May 24: Workshop

9:00-9:10 Opening remarks

9:10-9:30 A Consistent Organizational Structure Across Multiple Functional Subnetworks of the Human Brain

Paul E. Stillman | James D. Wilson | Matthew J. Denny | Bruce A. Desmarais | Skyler J. Cranmer | Zhong-Lin Lu*

The Ohio State University | Yale University | University of San Francisco | Penn State University

9:30-10:00 The Computational Neural Mechanisms of Problem Solving

Joshua Brown* | Noah Zarr

Indiana University

10:00-10:30 Per Sederberg (University of Virginia)

10:30-10:45 Coffee Break

10:45-11:15 Neural Evidence for a Model of Video Game Playing

John R. Anderson* | Ryan Hope | Matthew M. Walsh

Carnegie Mellon University

11:15-11:45 The Neural Computation and Comparison of Value in Choice

Ian Krajbich* | Rachael Gwinn | Aidan Makwana

The Ohio State University

11:45-12:15 Linking neural signals to processes and representations in a model of memory search

Sean Polyn*

Vanderbilt University

12:15-1:15 Lunch Break (on your own)

1:15-1:45 Attention to working memory: Effects of cognitive control and physical salience

Susan Ravizza*

Michigan State University

1:45-2:15 Quantifying dynamic decision processes with physiological regressors

Michael Frank*

Brown University

2:15-2:45 Bayesian Knowledge Tracing Using the Brain

Todd M Gureckis* | Shannon Tubridy | David Halpern | Lila Davachi

New York University | Columbia University

2:45-3:00 Coffee Break

3:00-3:30 Robin Thomas (Miami University)

3:30-4:00 Brandon Turner (The Ohio State University)

4:00-4:30 Michael Shvartsman (Facebook Reality Labs)

4:30-5:00 Open Discussion

5:00-6:00 Tutorials

5:00-5:30 Mads Pedersen (HDDM)

5:30-6:00 Giwon Bahg (Joint Modeling)

6:00-8:00 Reception (Bar and H'orderves)

Workshop Abstracts

Title: Neural Evidence for a Model of Video Game Playing

Authors: John R. Anderson* | Ryan Hope | Matthew M. Walsh

Affiliation:Carnegie Mellon University

Abstract: Extending the ACT-R architecture we have developed a single model that learns to play multiple video games (Learning Rapid and Precise Skills, Psychological Review, in press). There is a detailed correspondence between the behavior of the model and human players, but we sought to obtain further evidence from EEG data. We extended a combination of hidden semi-Markov models and multivariate pattern analysis (HSMM-MVPA) to predict game play from EEG. In principle, we can combine

(a) The probabilities of various trajectories through the game space from the ACT-R model incorporated into a HSMM

(b) The conditional probabilities of the EEG trace for each trajectory from MVPA
to identify the most probable trajectory. In practice, because of the huge space of possible game trajectories, we apply this to segments of the game, which we then stitch into full games. The typical (but not universal) outcome is a compelling reconstruction of the game play that would not be possible either on the basis of the ACT-R model alone or the EEG signal alone.

Title: The Computational Neural Mechanisms of Problem Solving

Authors: Joshua Brown* | Noah Zarr

Affiliation: Indiana University

Abstract: Problem solving in a general sense is a core aspect of higher cognitive function. It requires first the ability to assign value flexibly to an arbitrary state of the world as a goal state. With the goal specified, the task is then to figure out the sequence of changes to the state of the world and corresponding actions required to achieve the final goal state. At the neural level, the orbitofrontal cortex has been variously described as implementing value representation or a cognitive map, but the ways in which various brain regions work together to solve problems remains unclear. I will present a computational neural model that learns autonomously to solve an arbitrary problem. To evaluate the model with respect to the human brain, we tested human subjects with fMRI while they performed a problem solving task. The computational model then performed the same task. We used representational similarity analysis (RSA) to compare specific model components with specific brain regions. We find that the model accounts for the roles of a number of brain regions, including the computational role of the orbitofrontal cortex as providing both a cognitive map and a flexible value representation. The model also accounts for the computational roles in problem solving played by the visual cortex, anterior IT, Inferior frontal gyrus, hippocampus, and basal ganglia.

Title: Quantifying dynamic decision processes with physiological regressors

Authors: Michael J. Frank*

Affiliation: Brown University

Abstract: Sequential sampling models provide a good quantitative description of decision processes capturing joint distributions of response times and choice proportions. In contrast theoretical neural network models that are useful hypothesis generators about underlying neural mechanisms but cannot (should not) be used to quantitatively fit behavioral data. I will describe attempts to link across levels of description motivating the use of physiological regressors to estimate their impact on dynamic decision parameters. I will also describe recent approaches using artificial neural networks to stand in for synthetic likelihoods, speeding up processing in approximate bayesian computation and affording powerful tests of neural links to decision parameters.

Title: Bayesian Knowledge Tracing Using the Brain

Authors: Todd M Gureckis* | Shannon Tubridy | David Halpern | Lila Davachi

Affiliation:New York University | Columbia University

Abstract: Knowledge tracing is a popular and successful approach to modeling student learning. In this talk, we explore whether the addition of neuroimaging observations to a knowledge tracing model enables accurate prediction of memory performance in held-out data. We propose a Hidden Markov Model of memory acquisition related to Bayesian Knowledge Tracing and show how continuous functional magnetic resonance imaging (fMRI) signals can be incorporated as observations related to latent knowledge states. We then show, using data collected from a simple second-language learning experiment, that fMRI data acquired during a learning session can be used to improve predictions about student memory at test. The fitted models can also potentially give new insight into the neural mechanisms that contribute to learning and memory.

Title: The Neural Computation and Comparison of Value in Choice

Authors: Ian Krajbich* | Rachael Gwinn | Aidan Makwana

Affiliation:The Ohio State University

Abstract: When asked to indicate a preference between two options, decision makers are thought to evaluate and integrate evidence in an attention-guided process. Little is known about this process’s neural substrates or how attention affects the integrated evidence representations. We conducted a simultaneous eye-tracking and fMRI experiment in which human subjects of either sex gradually learned about the value of two lotteries. With this design we were able to extend decisions over a long period of time, manipulate the time course of evidence, and thus dissociate instantaneous and integrated evidence. We found that

instantaneous evidence was represented in ventromedial prefrontal cortex (vmpfc), while integrated evidence was instead represented in dorsomedial prefrontal cortex (dmpfc) and parietal cortex. Extending past findings, we found that more attention to an option during the learning process increased its choice probability and that gaze amplified instantaneous-value signals in the vmpfc and ventral striatum. Most importantly, we also found that gaze amplified integrated-value signals in the dmpfc, providing novel evidence that attention has lasting effects on the choice process and that activity in the dmpfc reflects integrated value and not simply decision conflict. These results shed new light on the neural mechanisms underlying the attention-guided decision process.

Title: A Consistent Organizational Structure Across Multiple Functional Subnetworks of the Human Brain

Authors: Paul E. Stillman | James D. Wilson | Matthew J. Denny | Bruce A. Desmarais | Skyler J. Cranmer | Zhong-Lin Lu*

Affiliation: The Ohio State University | Yale University | University of San Francisco | Penn State University

Abstract: A recurrent theme of both cognitive neuroscience and network neuroscience is that the brain has a consistent subnetwork structure that maps onto functional specialization for different cognitive tasks, such as vision, motor skills, and attention. Understanding how regions in these subnetworks relate is thus crucial to understanding the emergence of critical cognitive processes. However, the organizing principles that guide how regions within subnetworks communicate, and whether there is a common set of principles across subnetworks, remains unclear. This is partly due to available tools not being suited to precisely quantify the role that different characteristics of network properties play in the organization of a subnetwork. We recently developed a mathematical framework, the correlation generalized exponential random graph model (cGERGM) to quantify subnetwork structure. The cGERGM models a correlation network, such as those given in functional connectivity, as a function of activation motifs, that is, consistent patterns of co-activation (i.e., connectivity) between collections of nodes that describe how the regions within a network are organized, and anatomical properties, that is, relationships between the regions that are dictated by anatomy (e.g., Euclidean distance). We applied the model to nine functional subnetworks and found remarkably consistent organizational properties guiding subnetwork architecture, suggesting a fundamental organizational basis for subnetwork communication. Specifically, all subnetworks displayed greater clustering than would be expected by chance, but lower preferential attachment (i.e., hub use), suggesting that human functional subnetworks follow a segregated highway structure rather than the small-world structure found in the whole-brain.

Title: Linking neural signals to processes and representations in a model of memory search

Authors: Sean M. Polyn*

Affiliation: Vanderbilt University

Abstract: The free-recall task provides a controlled setting to examine how people search through memories of their recent past experience. A series of verbalizable items are studied, followed by a recall period in which the studied items are reported in whatever order they come to mind. Examination of these recall response sequences reveals strong influences of temporal organization (the tendency for neighboring items on the study list to be recalled successively) and semantic organization (the tendency for items with related meanings to be recalled successively). Retrieved-context models provide a framework to understand the cognitive mechanisms underlying these organizational effects, and to link them to particular neural signals recorded during the study and recall periods of the free-recall task. These models propose that during study, integrative processes construct a gradually evolving contextual representation that is associated with each studied item. During the recall period, this contextual representation guides memory search. As specific items are retrieved, the contextual retrieval cue is updated with contextual information linked to the retrieved item, which alters the course of memory search. I'll focus on two studies in which we use a retrieved-context modeling framework to bridge between neural signals and behavior. In one study (Kragel et al., 2015), we link neural activity in the medial temporal lobe to the dynamics of the contextual representation during memory search. In ongoing work (Morton and Polyn, in prep.) we use neural pattern classification techniques to track the integration process during the study period and relate it to later recall performance. Along the way, I will focus on the techniques supporting these results, with special attention to parameter estimation and model comparison techniques.

Title: Attention to working memory: Effects of cognitive control and physical salience

Authors: Susan Ravizza*

Affiliation: Michigan State University

Abstract: Working memory (WM) is enhanced for items that capture attention automatically, but little is known about how it achieves this effect. In this talk, I will provide behavioral and neural evidence that the benefits to WM from attentional capture are primarily through cognitive control rather than from bottom-up attention to physical salience. Using fMRI, we show that activity in the cognitive control network is greater for items that capture attention via a salient, but task-irrelevant, color. Surprisingly, activity of the salience network was not associated with items that captured attention. To obtain a more time-resolved signal, we used ERP to assess whether the effects of attentional capture on WM were found in components reflecting physical salience (P3a) or cognitive control (P3b). The ERP results converged with those of the fMRI study showing that the benefits to WM from attentional capture were associated with cognitive control. A further behavioral study teased apart the effects of cognitive control and physical salience on WM. These results suggest that salience improves the probability that items enter WM, but that top-down control is a better predictor of the quality of the representation. Taken together, these results suggest that models of WM need to distinguish the mechanism by which recall is improved.

Title: A tutorial on joint models of neural and behavioral measures of cognition

Authors: James Palestro | Giwon Bahg* | Per B. Sederberg | Zhong-Lin Lu | Mark Steyvers | Brandon M. Turner

Affiliation: The Ohio State University | University of Virginia

Abstract: Model-based cognitive neuroscience (e.g., Forstmann & Wagenmakers, 2015) has become an essential approach in connecting neural and behavioral measures for bridging Marr's levels of analysis (Marr, 1982) and providing integrative explanations of cognition. Among a variety of approaches (Turner et al., 2017), a joint modeling approach (Turner et al., 2013) allows us to estimate neural-behavioral relationships in terms of covariance between the parameters of "submodels" explaining neural and behavioral activities. One of the advantages of the joint modeling approach is that it leads us to impose reciprocal constraints across computational models of neural and cognitive activities due to its hierarchical Bayesian nature. However, this technique has been less accessible to the public because of the complexity of implementation. In this tutorial, we provide a walkthrough on the development of neural and behavioral submodels, as well as strategies for linking them together in a single modeling framework. Using Just Another Gibbs Sampler (JAGS; Plummer, 2003), we will also demonstrate an example of modeling a perceptual decision-making task by connecting single-trial BOLD activations of early visual cortex to the drift rate parameter of a simplified version of the diffusion decision model (Ratcliff, 1978).

Conference Talk Abstracts

Learning (Saturday, 5/25, 9:00 - 10:20 AM)

9:00 - 9:20

Title: The Limits of Learning: Exploration, Generalization, and the Development of Learning Traps

Authors: Todd M. Gureckis* | Alex S. Rich

Affiliation: New York University

Abstract: Learning usually improves the accuracy of beliefs through the accumulation of experience. But are there limits to learning that prevent us from accurately understanding our world? In this talk I explore the concept of a "learning trap"—the formation of a stable false belief even with extensive experience. I being by reviewing how these traps develop through the interaction of learning and decision making in unknown environments. Next I describe a particularly pernicious learning trap driven by selective attention, a mechanism often assumed to facilitate learning in complex environments. Using computer simulation I demonstrate the key attributes of the agent and environment that lead to this new type of learning trap. Then, in a series of experiments I provide evidence that people robustly fall into this trap, even in the presence of various interventions predicted to meliorate it. These results highlight a fundamental limit to learning and adaptive behavior that impacts individuals, organizations, animals, and machines.

9:20 - 9:40

Title: Hierarchical representation of categories with exceptions: A challenge for existing models

Authors: Nathaniel Blanco | Olivera Savic | Vladimir Sloutsky*

Affiliation: The Ohio State University

Abstract: Formal models of categorization have been an invaluable tool in building toward an understanding of human concept representations. One particularly useful topic in this endeavor has been to evaluate how humans learn and remember categories that contain exceptions. Work on this topic has led to the formation of new models (e.g. RULEX, Nosofsky, Palmeri & McKinley, 1994) and highlighted the shortcomings of some classes of models. To date the model that has been most successful in accounting for a wide range of phenomena has been SUSTAIN (Love, Medin, & Gureckis, 2004). In the current study we explore whether regular and exception items are represented together or separately, by examining how features of regular and exception items contribute to determining category membership. We then compare predictions from SUSTAIN to human generalization patterns. Our results unveil an important asymmetry in the generalization patterns: while properties of regular items are generalized to exceptions, features of exceptions contribute only to categorization of exception-like items—contributing nothing when added to regular items. These results appear inconsistent with either separate representation of exceptions and regulars or a single merged representation, but instead suggest a hierarchically organized representation that is incompatible with existing models.

9:40-10:00

Title: Raising the Bar for Theories and Models of Concept Learning and Categorization: The Need to Resolve Several Basic Paradigmatic Tensions

Authors: R. Vigo | J. Wimsatt | C.A. Doan | D. Zeigler

Affiliation: Ohio University

Abstract: Over the last few decades much theoretical understanding of concept learning and categorization performance has been achieved via theories that describe mechanisms of generalization using some notion of similarity assessment at their core (Medin & Schaffer, 1978; Nosofsky, 1986; Kruschke, 1992; Estes, 1994). However, concept learning and categorization performance are not only limited by low- and high-level generalization mechanisms, but also by the inherent nature of the environmental and mental stimuli entertained by observers during the concept learning process. In this talk, we propose a new direction for concept learning and categorization research based on several dual paradigmatic tensions that hinge on the intrinsic general properties of the components of stimuli, limitations of the innate abilities of the observer to process such components, and the relationship between the two. The tensions range from the various possible properties and constraints of the dimensions underlying categories of object stimuli (e.g., discrete vs. continuous) to various notions of supervised learning capable of significantly altering concept learnability (e.g., contrast cueing vs non-contrast cueing). The substantial extant literature on concept learning research indicates that rigorous empirical investigations targeting these tensions are either non-existent or severely lacking despite their ecological significance. We shall argue that future theory building about concept learning should attempt to resolve these tensions to prevent invalid accounts of empirical results. Finally, as we

present the tensions, we shall discuss some results from ongoing and previous experiments conducted in our lab that constitute incremental steps in tackling this difficult enterprise.

10:00-10:20

Title: Is Concept Learnability Influenced by Global Precedence?

Authors: J. Wimsatt | R. Vigo | M. Krishan | C.A. Doan

Affiliation: Ohio University

Abstract: A wealth of perception research has built upon a seminal finding by Navon (1977) that observers tend to apprehend global features more quickly than local features when presented with stimuli that are organized at these two levels. Despite this, little research has been conducted with respect to how this global precedence effect may impact human categorization and concept learning performance. This gap in the literature is surprising as past research suggests that categorization is significantly impacted by the nature of the dimensions of the stimuli comprising learned concepts: e.g., Nosofsky and Palmeri (1996) showed that the robust difficulty ordering of Shepard, Hovland, and Jenkins (1961) for structures within the 3[4] family is altered for stimuli defined over integral rather than separable dimensions. For the first time, we investigate this classic family of category structures with respect to stimuli defined over global and local dimensions, including cases of both stimulus congruency and non-congruency. Our findings suggest that at the level of category structure, error rates hold at or near the canonical ordering, and that response times do not consistently reflect a global precedence effect. However, global precedence is in some cases observed at the level of structure instances for categories defined by perfect rules depending upon the degree of diagnosticity/redundancy of the dimensions across the global and local levels. We use Generalized Invariance Structure Theory (GIST; Vigo, 2013, 2014) to account for these results and compare the performance of one of its core models to that of alternative models.

Meaning & Understanding (Saturday, 5/25, 9:00 - 10:20 AM)

9:00 - 9:20

Title: Speakers of diverse languages structure their utterances to support optimal communication and preserve Uniform Information Density

Authors: Josef Klafka | Daniel Yurovsky

Affiliation: University of Chicago

Abstract: Language can be thought of as a code: A system for packaging a speaker's thoughts into a signal that a listener must decode to recover some intended meaning. If language is a near-optimal code, then speakers should structure utterances in a way that minimizes the possibility of transmission errors in production or comprehension. One hypothesis suggests that speakers do so by maintaining a uniform density of information across the words of an utterance (Levy & Jaeger, 2007). Yu et al. (2016) challenged this Uniform Information Density hypothesis, showing that the distribution of information across word positions in written English utterances has a reliably non-uniform shape, for instance spiking in utterance-final position. We apply their measure to a diverse set of languages in three contexts: spoken adult-adult conversations (Switchboard); spoken adult-child conversations throughout language development (CHILDES); and large written knowledge base entries (Wikipedia). We replicate Yu et al.'s findings for English, and also find reliably non-uniform and cross-linguistically variable information

trajectories across languages. These language-specific shapes are consistent across spoken and written contexts, and are predictable from typological features, most notably canonical word order (as measured in Dryer & Haspelmath, 2013). However, when we include even a small amount of predictive context (bigrams or trigrams), the language-specific shapes disappear, and all languages are characterized by uniform information distribution. Our work provides cross-linguistic and cross-medium support for the Uniform Information Density hypothesis: Despite cross-linguistic variability in communicative codes, speakers and writers structure their utterances to preserve uniform information distribution and support successful communication.

9:20-9:40

Title: The Understanding Problem in Cognitive Science

Authors: Alexander Hough | Kevin Gluck

Affiliation: Wright State University

Abstract: Understanding is at the core of higher-level information processing and has a long history in the cognitive sciences. It is often described as a complex phenomenon with many dimensions, which makes it difficult to describe with precision. A wide variety of researchers have noted that understanding is often ill-defined, indirectly addressed, or avoided altogether (e.g., Gluck & Laird, in press; Langley, Laird, & Rogers, 2008; Pritchard, 2009; Rogers, 2008; Minsky, 1975; Moore & Newell, 1973; Schank & Abelson, 1977; Simon, 1980, 1986; Smith & Siegel, 2004). This is particularly disappointing considering understanding has been a topic of interest since Socrates (Plato, 1956). In order to address this problem with our understanding of understanding, we reviewed literature from psychology, computer science, education, neuroscience, and philosophy. Here we summarize insights from that review, focusing on similarities and differences across those domains, as well as implications for the nature, measurement, and modeling of understanding.

9:40-10:00

Title: Implications for testing: The Relationships among Stress, Working Memory, and Comprehension levels in college students

Authors: Ashley Ezpeleta | Mitchell Dandignac | Lauren Davidson | Mackenzie Trevethan | Joseph Johnson

Affiliation: Miami University

Abstract: Standardized testing has become a norm across the world and scores on tests like the Scholastic Assessment Test (SAT) and Graduate Record Examination (GRE) are often crucial for students to advance to higher levels of education. While the goals of standardized testing are intended to be positive, their structure may negatively impact cognition. This experiment examines how stress and working memory influence college students' ability to perform on reading comprehension measures such as syllogisms and fill-in-the-blank questions, which are common in many standardized tests. In addition, eye-tracking data was collected on participants' comprehension and decision making processes, including number of regressions, progressions, fixations, and duration of fixations. In this experiment, 128 participants completed working memory and comprehension tests, which were followed by a period of no stress or the Trier Social Stress Test (TSST) and then a second assessment of working memory and comprehension was collected. Results from this experiment indicate that stress does not have a significant impact on logical and inferential comprehension. However, performance on logical and

inferential comprehension tasks relate to each other. In addition, non-native English speakers performed significantly worse on the comprehension tasks than did native English speakers. This experiment suggests that standardized tests may not accurately assess student academic performance. Since the current experiment found that stress does not have a significant impact on comprehension, future research is needed to determine when levels of stress become beneficial as opposed to detrimental for test takers.

10:00-10:20

Title: Orthographic influences on syllable structure perception

Authors: Yu-Jung Lin | Chien-Jer Charles Lin

Affiliation: Indiana University

Abstract: The present study examined the phonological grouping of Mandarin offglides (the second part of diphthongs) and the effects of the orthographic system on these grouping results. The study is guided by two main research questions: (1) what is the status of offglides in the Mandarin Chinese syllable structure? In other words, does the offglide sit at the same position as the post-nuclear nasal does? (2) how does orthographic information influence phonological processing? To be more specific, do speakers of the same native language who learned different Mandarin transcription systems parse the Mandarin syllable in the same way? Two groups of Mandarin native speakers who have learned different transcription systems, which segment vowel-offglide and vowel-nasal sequences in distinct ways, were recruited to do three meta-phonological tasks: mapping, monitoring and deletion. Two modes were designed to see if Mandarin Chinese native speakers can make decisions without the deployment of orthography. The first mode consists of both Mandarin items and foreign language items which the native speakers have never learned, and the second mode contains only Mandarin stimuli.The results showed that two groups reacted to the same sound differently in these tasks, indicating how offglides were grouped in Mandarin syllables was significantly influenced by the transcription system learned. Furthermore, the results of deletion tasks, the most complicated task among three, seemed to show more orthographic effect. Lastly, no difference between offglides and nasals were found. They seemed to sit at the same position in the syllable.

Keynote Lecture (Saturday, 5/25, 10:40 - 11:40 AM)

Title: Computational Analysis of Practice and Age Effects in Large-Scale Cognitive Training Data

Authors: Mark Steyvers

Affiliation: University of California, Irvine

Abstract: Online cognitive training platforms such as Lumosity support the investigation of skill learning and cognition at an unprecedented scale, as part of a trend to use naturally occurring large-scale data sets to develop and test theories of cognition. We will discuss three computational modeling projects that not only leverage the large-scale nature of this data but also address unique challenges when modeling naturally occurring data. In the first project, we develop a computational model of practice effects in task switching (based on the trial-by-trial behavior in the game “Ebb and Flow”) that requires participants to flexibly and efficiently adapt behavior in response to continuously changing contextual demands. The model of task switching includes latent measures of activating the relevant task, deactivating the irrelevant task, and making a decision. While long-term practice improves performance across all age groups, it has a greater effect on older adults. Indeed, extensive task practice can make older individuals

functionally similar to less practiced younger individuals, especially for cognitive measures that focus on the rate at which task relevant information becomes available. In the second project, we explore the consequences of self-direction on cognitive training platforms. Individuals make their own decisions on when to practice a number of cognitive skills and when to dropout from the platform. We show that individuals who drop out earlier lie on a different learning trajectory than those who continue, indicating that group learning functions will be biased by differential participation. We show how to extend cognitive models with a metacognitive control component to jointly model learning and participation policies. Finally, in the third project, we report preliminary analyses of practice effects across cognitive tasks on the platform. Users typically interweave their practice of different cognitive tasks which raises the question of how performance improvements in one task could be predictive of improvements in other tasks, due to transfer and/or the underlying latent structure of cognitive skills. We extend standard factor models to infer the latent structure of learning curve parameters across tasks in order to predict the joint performance across tasks.

Neural models (Saturday, 5/25, 1:20 - 2:20 PM)

1:20-1:40

Title: Characterizing sources of predictive information in embodied neural networks

Authors: Madhavun Candadai | Eduardo J. Izquierdo

Affiliation: Indiana University

Abstract: Over the past decade, predictive coding has emerged as a key phenomenon to bridge the explanatory gap between neural activity and behavior. Predictive coding is the idea that living organisms have internal models that encode the causes of their stimuli, thus enabling them to behave by generating predictions about their future stimuli. One approach to detecting predictive coding in biological systems is predictive information ‚Äì mutual information in the current neural activity about a future stimulus. In the current work, we identify all the different ways an organism can exhibit high predictive information. We postulate that predictive information is available from two sources: externally from the sensory regularities of the environment, and internally from the neural network. In order to study this, we optimized dynamic recurrent neural networks to perform different variations of the cartpole balancing task, and we then analyzed the networks by measuring predictive information in their neural activity about the next stimulus. Results from our analysis demonstrate that agents embedded in fully-observable environments show high predictive information irrespective of their ability to perform a task successfully. This implies that predictive information can arise from regularities of the environment that shapes the sensory stimuli, without the need for an agent to generate it. Furthermore, using an information theoretic approach to detect predictive information that was generated internally, and that did not come from the sensory stimuli, we aim to show that predictive information is generated internally through the neural network dynamics when relevant features of the environment are unobservable.

1:40-2:00

Title: Insulating Distributional Semantic Models from Catastrophic Interference

Authors: Willa M. Mannering | Michael N. Jones

Affiliation: Indiana University

Abstract: Predictive neural networks, such as Word2Vec, are currently the most popular architecture for learning distributional semantics in the fields of machine learning and cognitive science. They are particularly popular because they learn continuously, making them more space efficient and cognitively plausible than classic models of semantic memory. However, a major weakness of this architecture is catastrophic interference (CI): The sudden and complete loss of previously learned associations when encoding new ones. CI is an issue with backpropagation; when learning sequential data, the error signal dramatically modifies the connection weights between nodes,Äîcausing rapid forgetting of previously learned information. CI is a huge problem for predictive semantic models of word meaning, because multiple word senses interfere with each other. Here, we evaluate a recently proposed solution to CI from neuroscience, elastic weight consolidation, as well as a Hebbian learning architecture from the memory literature that does not produce an error signal. Both solutions are evaluated on an artificial and natural language task in their ability to insulate a previously learned sense of a word when learning a new one.

2:00-2:20

Title: Two complementary modes of sensory information interactions: Neural correlates of power law gated amplification and vector-like summation

Authors: Vincent A. Billock | Micah Kinney

Affiliation: Naval Aerospace Medical Research Laboratory, Naval Medical Research Unit − Dayton

Abstract: In both psychophysics and in neuroscience there are two facilitatory modes of sensory information integration: weighted combination (linear or not) and gated amplification. In sensory integration there is a class of neurons known as modulated unisensory cells that do gated amplification. For example, they fire for visual stimuli, do not fire for auditory stimuli, but fire harder for visual stimuli when both are present. Their amplified response is a power law of the unisensory input with a slightly compressive exponent of around 0.85, which explains the principal of inverse effectiveness in sensory integration. Some psychophysical data, including within-sense integration follow the same power law. Also in sensory integration are neurons called bimodal cells which can fire to either of two sensory inputs, but increase their firing rate, sometimes dramatically, when both stimuli are present. We find that these neural responses obey the Minkowski equation, a vector-like sum that can model non-Euclidean space. Some psychophysical data is also modeled well by Minkowski and for commensurate psychophysical and neural data, the same parameterization of the Minkowski equation applies. Modulated unisensory cells are a neural correlate of psychophysical gated amplification and bimodal neurons are a neural correlate for vector-like operations. Neural models of both are in development.

Research practices (Saturday, 5/25, 1:20 - 2:20 PM)

1:20-1:40

Title: Ecological Computational Thinking: Information and Exploration in Visualization and Simulation

Authors: Gui Sanches de Oliveira

Affiliation: University of Cincinnati

Abstract: In recent decades, computational thinking has become a key feature of ecological psychology, as illustrated by the use of dynamical mathematical modeling and simulation of psychological phenomena (e.g., Haken, Kelso and Bunz 1985; Warren 2006; Harrison, Turvey and Frank 2016) and the development of novel nonlinear data analysis and data visualization methods (e.g., Riley and Van Orden

2005; Holden, Riley, Gao and Torre 2013). The goal of this project is to explore theoretical and experimental avenues for an ecological understanding of computational thinking that is in line with ecological psychology's rejection of the computational/representational view of perception, action and cognition (Richardson, Shockley, Fajen, Riley and Turvey 2008; Michaels and Palatinus 2014). I propose that Gibson's (1966, 1979) analysis of pictures and verbal descriptions only partially captures what goes on in computer simulation, data analysis and visualization. Computational methods are unlike pictures and words in that they enable the active exploration of the information carried. At the same time, however, different methods have varying degrees of informational fidelity, and some are not even necessarily built upon experimental data (e.g., dynamical modeling and simulation). This, I propose, makes them even less like pictures and verbal descriptions, and more like tools: as such, they are better understood, from an ecological standpoint, not as carriers of "second-hand" information of some phenomenon, but as autonomous artifacts that are useful because of their affordances. This theoretical account thus invites empirical investigation of scientific computational thinking as an extension of ordinary tool-building practices.

1:40-2:00

Title: The reliability paradox: when high reliability does not signal reliable detection of experimental effects

Authors: Selena Shuo Wang | Paul De Boeck

Affiliation: The Ohio State University

Abstract: The replication crisis has led to a renewed discussion about the impacts of measurement quality on the precision of psychology research. High measurement quality is associated with low measurement error, yet the relationship between reliability and measurement error is not yet well understood. In this study, we attempt to understand the reliability through its mathematical relationship with experimental effects. Multiple-group Structural Equation Models (SEMs) for both between-subject and within-subject study designs are constructed to imitate an experiment that allows us to investigate reliability and experimental effects more closely. Statistical forms of reliability, power, Cohen's d and standard error are derived based on true parameters defined in the models. These forms show that reliability and power move unidirectionally upon changes in factor loadings and measurement error variances, yet move in opposite directions upon changes in the latent variable variances. Well-fitting models, signaled by minor residual variances and sizable factor loadings, help us achieve favorable reliability and strong power. The results from our study show that the pursuit of reliability above .8 by increasing latent variable variances will cause power to decline. This paradox of reliability creates a dilemma in psychology research. We propose a visual demonstration and an extended search for empirical evidence to further illustrate that reliability does not always move in the same direction as power. We believe that the results from this proposed study will lead to better research practices.

2:00-2:20

Title: The Cognitive Science of the Ranking Game

Authors: Péter Érdi

Affiliation: Center for Complex Systems, Kalamazoo College Kalamazoo, MI

Abstract: We like to see who is stronger, richer, better, more clever. Since we humans (1) love lists; (2), are competitive and (3), are jealous of other people, we like ranking. Students ranked in ascending order

based on their heights in a gym reflects objectivity. However, many Top Ten (twenty one, thirty three etc) lists based on subjective categorization and give the illusion of objectivity only. We don't want to be seen always objective, since we don't mind to have a better image and rank as we deserved. While making objective rankings sounds like an appealing goal, there are at least two different reasons why we may not have objectivity: ignorance and manipulation. Persons with less knowledge suffer from illusory superiority due to their cognitive bias, and this phenomenon is called the “Dunning-Kruger effect.” Omnipresent in society is not only ignorance but also manipulation. Manipulators have the intention of gaining personal advantage by adopting different tricks. about the reality, illusion and manipulation of objectivity. Computer scientists design ranking algorithms, and computers can process now huge datasets by these algorithms. As we have seen, we are not always happy with the results, so we might ask whether when and how the results of the a ranking algorithm should be controlled by content curators. Recent public debates about the use and misuse of data reinforce the message. we need the combination of human and computational intelligence. The lecture is basen on the book Péter Érdi: RANKING. The Unwritten Rules of the Social Game We All Play . Oxford University Press (in production), see aboutranking.com

Decision Symposium (Saturday, 5/25, 2:40-4:20 PM)

2:40-3:00

Title: What can we learn from dynamic, pre-decisional measures of choices?

Authors: Claudia González-Vallejo | Jiuqing Cheng

Affiliation: Ohio University

Abstract: We have used the measurement methodology of 'mouse' (cursor) movements to examine participants' temporal and spatial measures when making decisions in inter-temporal, gamble, and consumer choices. We proposed and tested a two-factor model of decision difficulty derived from a psychometric analysis of the measures. The two factors defining difficulty are conflict and wavering. The conflict component appears to be affected by changes in the sign of the payoffs of inter-temporal and gamble choices, with greater means observed in the loss than in the gain context. By contrast, the wavering component is most affected by changes of the similarity between the options' attributes, with greater means when the options were more similar. We discuss implications of this approach as well as challenges.

3:00-3:20

Title: Influence of explicit value cues on the decision process

Authors: Ian Krajbich | Blair Shevlin | Stephanie Smith | Jan Hausfeld

Affiliation: The Ohio State University

Abstract: In this study, we examined how decision-makers respond to information about the overall value of items within a choice set. In many circumstances, decision-makers are not attuned to the overall value of their decisions. This lack of awareness can cause decision-makers to set sub-optimal thresholds for their decisions, leading them to irrationally allocate their time. We hypothesized that providing decision-makers with explicit information about the value of their options would increase the boundary separation for higher value decisions; and have the opposite effect for lower value decisions. Using standard analyses and diffusion modeling, we found that explicit value information decreased subjects’ decision boundaries, reflected in faster choices, and also led to a relative increase in RT for higher value

decisions. This indicates that people are often not fully attuned to the overall value of their decisions, and are therefore setting sub-optimal boundaries when explicit value information is not provided.

3:20-3:40

Title: Using process-tracing data to inform computational models of decision making

Authors: Joseph Johnson

Affiliation: Miami University

Abstract: A number of successful computational cognitive models (CCM) have been developed to predict choices and RTs well across decision-making domains. Furthermore, increasingly sophisticated analytic techniques have allowed for diagnostic evaluation of such models. Here I will advocate for an important addition to this repertoire of research tools: namely, the use of process-tracing data. Lab recording techniques have improved in quality and accessibility to provide researchers with high-resolution data such as eye-tracking, motion capture, and physiological measures that can be informative. These data allow for additional and direct tests of various CCM processes, of which I provide two examples. First, I will review work using eye-tracking measures of attention and information search to support various cognitive processing assumptions in popular CCMs such as sequential sampling models. Second, I will show how decision preferences can be revealed dynamically during a task, and how this data provides further evidence for different model forms. Finally, an important link between these two approaches will show how to use eye-tracking data as an input to a CCM to predict the accumulation of evidence, which is then further tested using dynamic response data.

3:40-4:00

Title: Hierarchical Hidden Markov Models for Response Time Data

Authors: Deborah Kunkel | Zhifei Yan | Peter F. Craigmile | Mario Peruggia | Trisha Van Zandt (presenter)

Affiliation: The Ohio State University

Abstract: Psychological data, particularly measurements obtained sequentially in experiments designed to test theories of decision making in simple choice experiments, are often treated as independent and identically distributed samples from a single distribution that describes the cognitive process. This assumption is made for mathematical and analytic convenience; it is widely appreciated that such data are in fact mixtures from two or more processes, a subset of which are associated with the cognitive process of interest. Our modeling framework describes response times (RTs) as arising from a mixture of three distinct distributions. Transitions across the distributions are governed by a hidden Markov structure whose states produce either fast, average, or slow RTs. This process is nested within a second Hidden Markov structure, producing an “environment” process that allows the distribution of the response status to evolve due to factors such as fatigue and distractions. We performed a detection experiment designed to elicit responses under three environments that mimic the external conditions thought to influence latent statuses. We present our hierarchical model and demonstrate its fit on the experimental data.

4:00-4:20

Title: Markov versus quantum dynamic models of belief change during evidence monitoring

Authors: Jerome R. Busemeyer | Peter D. Kvam | Timothy J. Pleskac

Affiliation: Indiana University

Abstract: Two different dynamic models for belief change during evidence monitoring were evaluated: Markov and quantum. They were empirically tested with an experiment in which participants monitored evidence for an initial period of time, made a probability rating, then monitored more evidence, before making a second rating. The models were qualitatively tested by manipulating the time intervals in a manner that provided a test for interference effects of the first rating on the second. The Markov model predicted no interference whereas the quantum model predicted interference. A quantitative comparison of the two models was also carried out using a generalization criterion method: the parameters were fit to data from one set of time intervals, and then these same parameters were used to predict data from another set of time intervals. The results indicated that some features of both Markov and quantum models are needed to accurately account for the results.

Context, Memory, & Attention (Sunday, 5/26, 9:00-10:20 AM)

9:00-9:20

Title: Affective Schemas for Narrative Communication

Authors: Fritz Breithaupt | Binyan Li | John Kruschke

Affiliation: Indiana University

Abstract: When Frederic Bartlett pioneered the psychological research of narrative recall he found that certain kinds of information were distorted or omitted by his subjects who misremembered stories to fit their personal narrative schemas or stereotypes. Nearly 100 years after Bartlett's original studies, we reemployed his method of serial reproduction (akin to the telephone game) to identify fundamental narrative schemas. Based on previous findings that story surprisingness is better preserved than story events (Breithaupt et al., 2018), we hypothesized that narrative emotions are candidates as basic narrative schemas. To test this hypothesis, we created sets of stories which involve situations that are either happy, sad, embarrassing, disgusting, or risky, and we varied the degree of the targeted emotion. For the five emotions we produced a total of 96 stories, each with a different degree of affect strength as established by raters. In a series of retelling chains, 6,452 subjects retold three stories each, producing 19,356 story retellings, which were passed to other raters who evaluated affect strength and the presence of the original plot event that accounted for the variations in affect strength. This talk will present preliminary analyses of trends in emotional and factual preservation across retellings and implications for narrative schemas.

9:20-9:40

Title: The Shape of Attention When Tracking a Winding Roadway

Authors: Richard Jagacinski | Emanuele Rizzi | Benjamin Bloom | Anil Turkkan | Tyler Morrison | Haijun Su | Junmin Wang

Affiliation: The Ohio State University

Abstract: Perturbation techniques were used to infer the spatio-temporal distribution of attention to preview when drivers tracked a simulated winding roadway. Day-to-day variability in the distribution of attention suggests an underlying attentional dynamic involving a type of Turing instability and rhythmic

pattern formation. Optimal control theory suggests how this underlying dynamic is shaped to achieve effective steering.

9:40-10:00

Title: A context-change account of temporal distinctiveness

Authors: Brian M. Siefke | Troy A. Smith | Per B. Sederberg

Affiliation: The Ohio State University

Abstract: The distinctiveness effect refers to the finding that items that stand out from other items in a learning set are more likely to be remembered later. Traditionally, distinctiveness has been defined based on item features; specifically, an item is deemed to be distinctive if its features are different from the features of other to-be-learned items. We propose that distinctiveness can be redefined based on context change,Äîdistinctive items are those with features that deviate from the others in the current temporal context, a recency-weighted running average of experience,Äîand that this context change modulates learning. We test this account with two novel experiments and introduce a formal mathematical model that instantiates our proposed theory. In the experiments, participants studied lists of words, with each word appearing on one of two background colors. Within each list, each color was used for 50% of the words, but the sequence of the colors was controlled so that runs of the same color for that list were common in Experiment 1 and common, rare, or random in Experiment 2. In both experiments, participants' source memory for background color was enhanced for items where the color changed, especially if the change occurred after a stable run without color changes. Conversely, source memory was not significantly better for nonchanges after runs of alternating colors with each item. This pattern is inconsistent with theories of learning based on prediction error, but is consistent with our context-change account.

10:00-10:20

Title: Predicting Comprehension of Medical Text with Gist Inference Scores

Authors: Mitchell Dandignac, Christopher R. Wolfe

Affiliation: Miami University

Abstract: We developed a method to assess text for features that help readers produce gist inferences. Following Fuzzy Trace Theory, we created Gist Inference Scores (GIS), an average of seven psycholinguistic variables converted to z-scores, which is designed to assess the potential for readers to form gist inferences from observable text characteristics. The GIS formula was developed using a memory study where 66 participants' recalled events under gist or verbatim instructions. To test whether GIS predicts cognitive outcomes, we revised a pair of texts about breast cancer and genetic testing to produce two low GIS texts and two high GIS texts. Each text was revised to convey the same propositions. We hypothesized that participants who read the high GIS text would demonstrate better declarative knowledge and gist comprehension. A total of 162 participants read one of the four texts about breast cancer and genetic testing for 15 minutes. Participants then took a declarative knowledge and gist comprehension exam. Results showed that for the first pair of texts, high GIS readers scored significantly higher on declarative knowledge. For the second pair of texts, high GIS readers scored significantly higher on gist comprehension. These studies suggest that cognitive outcomes related to reading medical information can be predicted based on observable text characteristics. Potential applications for GIS include being a tool for evaluating and revising medical information conveyed to the public.

Computational Modeling (Sunday, 5/26, 10:40 AM - 12:20 PM)

10:40-11:00

Title: Modeling Delay Discounting in Humans using Gaussian Process with Active Learning

Authors: Jorge Chang | Jiseob Kim | Byoung-Tak Zhang | Mark A. Pitt | Jay I. Myung

Affiliation: The Ohio State University

Abstract: We explore a nonparametric approach to cognitive modeling in humans. Traditionally, models in cognitive science have been parametric. As such, the model relies on the assumption that the data distribution can be defined by a finite set of parameters. However, there is no guarantee that such an assumption will hold, and it may introduce undesirable biases. For these reasons, a nonparametric approach to model building is appealing. We propose a framework that combines Gaussian Processes with active learning (GPAL), and evaluate it in the context of delay discounting (DD), a well-studied task in decision making. We evaluate GPAL in a simulation and a behavioral experiment, and compare it against a traditional parametric model. The results show that GPAL is a suitable modeling framework that is robust, reliable, and efficient, exhibiting high sensitivity to individual differences.

11:00-11:20

Title: Complexity of information criteria for hierarchical Bayesian models

Authors: Ed Merkle | Hope Snyder

Affiliation: University of Missouri

Abstract: Information criteria such as DIC or WAIC are often used to compare Bayesian cognitive models. When the models are hierarchical, there are multiple DICs (or WAICs or other ICs) for the same model, with the criteria differing by whether or not the hierarchical parameters are marginalized out of the likelihood. This issue is often overlooked, though it potentially influences model selection and other inferences. In the presentation, we discuss the issues using a broad framework that encompasses hierarchical cognitive models as well as some mixed models and psychometric models. We highlight relationships between different flavors of the information criteria and cross-validation metrics, providing intuition about the uses of each criterion. We illustrate the criteria through a diffusion model application to data from a flanker task.

11:20-11:40

Title: Variational Bayesian Methods for Cognitive Science

Authors: Matthew Galdo, Giwon Bahg, Brandon Turner

Affiliation: The Ohio State University

Abstract: "Bayesian inference has become a powerful and popular technique for understanding psychological phenomena. However, compared to frequentist statistics, current methods employing Bayesian statistics typically require time-intensive computations, often hindering our ability to evaluate alternatives in a thorough manner. Here, we advocate for an alternative strategy for performing Bayesian inference, called variational Bayes (VB). VB methods posit a parametric family of distributions that could conceivably contain the target posterior distribution, and then attempt to identify the best parameters for matching the target. In this sense, acquiring the posterior becomes an optimization problem, rather than a

complex integration problem. VB methods have enjoyed considerable success in fields such as neuroscience and machine learning, yet have received surprisingly little attention in fields such as psychology. Here, we identify and discuss both the advantages and disadvantages of using VB methods. In our consideration of possible strategies to make VB methods appropriate for psychological models, we develop the Differential Evolution Variational Bayes algorithm, and compare its performance to a widely used VB algorithm. As a test problem, we evaluate the algorithms on their ability to recover the posterior distribution of the Linear Ballistic Accumulator model. Although we cannot endorse VB methods in their current form as a complete replacement for conventional methods, we argue that their accuracy and speed warrant inclusion within the psychologist's toolkit."

11:40-12:00

Title: Systems factorial technology provides new insights on the other-race effect

Authors: Mario Fific | Cheng-Ta Yang | Daniel R. Little

Affiliation: Grand Valley State University

Abstract: The other-race effect refers to the difficulty of discriminating between faces from ethnic and racial groups other than one's own. Researchers mostly agree that a major culprit behind the other-race effect is the inability to utilize a fast holistic face perception. It is hypothesized that perception of other race faces uses a slow analytic perception of facial features. In the cross-cultural study we compared both Asian (Taiwanese) and Caucasian (US) participants' face discrimination of both own-race and other-race faces (Taiwanese and Caucasian woman), according to their nose-to-mouth separation and eye-to-eye separation. However, one of the possible confounding factors in understanding the other-race effect could be a possible true racial differences in facial features, such as the feature discriminability rate. To control for the facial feature discrimination rate across racial groups we adjusted individual participants' facial feature discriminability using psychophysical methods and created face sets so that the facial perceptual effects are constant, for both the own- and other-race faces. Then we employed factorial design using the psychophysically adjusted configural facial features in a face categorization task. We applied a parametric systems factorial technology (SFT) analysis of the response times and choice preferences for the full factorial stimulus set. The results of the computational modelling challenged the traditional approach to the other-race effect. Almost all of the subjects used parallel processing of the facial features while some subjects, of both races, utilized facilitatory parallel processing showing the across-feature dependency (parallel facilitatory model) which supports a strong form of holistic hypothesis.

12:00-12:20

Title: Hierarchical Bayesian models for understanding neural dyanmics of response inhibition

Author: M. Fiona Molloy, Giwon Bahg, Zhong-lin lLu, Brandon Turner

Affiliation: The Ohio State University

Abstract: Hierarchical Bayesian analyses allow for systematic purification of data while quantifying uncertainty. This technique is particularly useful in analyzing neural time series data, such as the fMRI BOLD response. Hierarchical Bayesian models expand upon the general linear model (GLM) commonly used in analyzing fMRI data by providing single-trial estimates and allowing for additional constraints across conditions, subjects, and/or regions of interest (ROIs). However, these models can be difficult to implement. We provide a concrete example of how these models can be applied using the stop-signal task (Logan, 1994). We constructed five increasingly complex models, constructing hierarchy across

conditions, ROIs, and subjects. We then compare these models in terms of fit, parameter constraint, and generalizability. For these data, our results suggest that while subject and condition constraints are important for both fit and generalization, region of interest constraints did not substantially improve performance. Finally, we conclude with a discussion on how these models can be used to make theoretical claims. In the stop-signal task, we found evidence of diminished activation in many key ROIs following a stop-signal. Additionally, we found that individual differences appear to be integral to this task. We hope to demonstrate that hierarchical Bayesian models are feasible and useful tools in analyzing fMRI data that can lead to further theoretical development in understanding cognitive processes.

Conference Poster Abstracts

Poster #01

Title: Peripheral Ischemia as a Means to Induce Altered Multisensory Integration

Author: Max Teaford, Jared Fitzpatrick, Madison Filipkowski, Anthony Drew, Justin Hassebrock, Nathan Smith, Leonard J. Smart

Affiliation: Miami University

Abstract: Anorexia Nervosa (AN) is a severe psychiatric disorder which is characterized by chronic caloric restriction, fear of gaining weight and altered experience of one's body. Individuals with AN have also been found to experience multisensory illusions including the rubber hand illusion (which they experience as more vivid) differently from healthy controls. To date this has been attributed to impaired multisensory integration, however no exiting hypotheses to explain these differences take into account changes to the periphery (e.g. acrocyanosis) which could play a role in altering multisensory integration. The aim of the present study was to demonstrate that experimentally induced ischemic nerve dysfunction (via pressure cuff ischemia protocol) is capable of producing Anorexia Nervosa like multisensory abnormalities in healthy participants, namely inducing a more vivid experience of the rubber hand illusion. It was found that individuals who were in the ischemia condition (i.e. the blood pressure cuff was inflated) experienced more proprioceptive drift (the feeling that their hand is drifting towards the fake hand) but did not differ with regards to body ownership questions. These findings are consistent with previous research on individuals with AN, after they controlled for affective symptoms. The results of the present study suggest that pathological changes to the vasculature need to be taken into account when trying to explain multisensory abnormalities in AN.

Poster #02

Title: Comparing Constrained-Sorting Behavior on Integral and Separable Stimuli

Author: Charles Doan, Ronaldo Vigo, Jay Wimsatt

Affiliation: Marietta College

Abstract: An often replicated finding with respect to supervised and unsupervised classification behavior involves the use of a single diagnostic dimension for categorizing sets of objects into different groups (Ashby, Queller, & Berretty, 1999; Colreavy & Lewandowski, 2008; Medin, Wattenmaker, & Hampson, 1987; Nosofsky, Gluck, et al., 1994). Although this finding is robust, research also indicates that observers may sort differently without feedback depending on the task demands or which properties compose the stimuli. For instance, observers may engage in sorting that is characteristic of family-resemblance (Handel & Imai, 1972; Regehr & Brooks, 1995) or exclusive-or (Doan & Vigo, 2016; Love, 2002) strategies. Currently, we compared unsupervised categorization behavior of separable and integral stimuli with respect to these differing profiles of sorting behavior and we contrasted how two successful theories in the literature account for the differential use of these behavioral profiles. In particular, we adopted the category construction and deconstruction procedures of Doan and Vigo and compared modification behavior of color stimuli to behavior observed previously by Doan and Vigo with separable stimuli. The logical structure of the categorical stimuli and the experimental design matched that of Doan and Vigo; while the color stimuli were the multidimensionally-scaled color stimuli previously employed by Nosofsky and Palmeri (1996; p. 224) and Vigo, Doan, and Zhao (In progress). We computed predictions from generalized representational information theory (GRIT; Vigo, 2011, 2013, 2014) and the

simplicity model (Pothos & Chater, 2002, 2005) and compared each of their propensities to parsimoniously account for the results.

Poster #03

Title: Auditory and Vibrotactile Cueing Enhances Dynamic Three-Dimensional Visual Search

Author: Rachel Cunio, Joseph Houpt

Affiliation: Wright State University

Abstract: Maintaining spatial awareness is a primary concern for aircraft operators, but the traditional method of maintaining awareness through visual displays can cause visual system overload and lead to performance decrements. This study examined the benefits of providing spatialized auditory, tactile, and audio-tactile cues for maintaining visual awareness as a method of enhancing visual search performance. We examined visual search performance of 14 participants in an immersive, dynamic (moving), three-dimensional (omnidirectional), virtual reality environment with no cues, spatialized auditory cues, degraded spatialized auditory cues, spatialized tactile cues, spatialized audio-tactile cues, and degraded spatialized auditory combined with tactile cues. Results indicated a significant reduction in visual search time from the no-cue condition when any cues were presented, with the spatialized auditory condition providing the highest response time benefit. We did not observe a significant difference in visual search accuracy across conditions or participants. The results of this study can inform attempts to improve visual search performance in aviation applications, such as determining appropriate display types for providing spatial information.

Poster #04

Title: Investigating Individual Differences in Decision-Making Using Eye Tracking as Attention Weights

Author: Elizabeth Pettit, Lauren Davidson

Affiliation: Miami University

Abstract: Mathematical models exist that are able to predict preferential decision-making, even if the decision is mathematically irrational. One reliably found irrational decision-making effect is known as a preference reversal.The decision-making strategies that produce preference reversals can be understood by observing what information people are paying attention to, which can be measured directly by recording their eye movements. However, eye tracking data cannot indicate how people interpret information; a verbal explanation is needed. By combining a concurrent think-aloud (CTA) protocol with eye tracking, researchers will be able to gather data on attention and interpretation to understand individual differences in decision-making. The strategies resulting in preference reversals are examined by making a comparison between individuals who score high on the Adult ADHD Self-Report Scale (ASRS) and those who score low. Half of all the participants will make decisions using a CTA protocol and eye tracking method, and the other half will complete the protocol without using CTA, instead completing a survey at the end asking about decision-making strategies. Participants scoring high on the ASRS are predicted have greater variation in their eye tracking data, make a greater number of preference reversals, and have a greater mismatch between verbal utterances and eye tracking data. We expect using the CTA plus eye tracking method will provide greater qualitative data explaining decision-making strategies than using the survey plus eye tracking protocol.

Poster #05

Title: Color sorting reflects mental representation of color and salience of perceptual color dimensions

Author: Prutha Deshpande, Aimee Violette, Delwin Lindsey

Affiliation: Ohio State University

Abstract: The striking similarity in color naming systems observed worldwide is often attributed to universal biases in the mental representation of color that guide color lexicon evolution. Although theories of color lexicon evolution emphasize the salience of hue, as hue-based categories are most common among world languages, many languages also name ‚Äúwildcard‚Äù lightness-saturation-based categories. While wildcard categories are thought to be a feature of developing color lexicons, such patterns are also seen in sequential color sorts of English speakers. Sequential sorting of colors into 2, 3, …, N piles representing color lexicons at different stages of evolution is a classic way of studying cognitive biases that may influence color lexicon evolution, and is thought to tap a subject's mental representation of color without influence from their native language. In the present study, subjects sorted one of four different color palettes that varied in size from 25 to 145 colors. All palettes sampled the entire Munsell hue circle but differed with respect to 1) variation in sample lightness and 2) the density with which the hue circle was sampled. Our results show that both factors systematically affect subjects' sequential sorts, and are well accounted for by a simple model based on the relative salience of hue and lightness in each test palette. Our results also provide a cautionary note on the use of the sorting paradigm as a non-lexical window into color lexicon evolution: subjects mental representation of color is flexible and contingent on the color-statistics of the to-be-sorted palette.

Poster #06

Title: Evidence for Suppression in Auditory Selective Attention

Author: Heather R. Daly & Mark A. Pitt

Affiliation: The Ohio State University

Abstract: Many definitions of selective attention tend to reference two components: a facilitatory mechanism that enhances the signal of interest, and an inhibitory mechanism that suppresses irrelevant and potentially distracting signals. Although there are a number of studies providing behavioral and neural evidence for each of these mechanisms in visual selective attention, evidence is currently less clear in audition. Are similar mechanisms operational in auditory selective attention? We addressed this question, searching for evidence of suppression in auditory selective attention. To accomplish this goal, we designed an auditory version of the visual search task employed by Wang & Theeuwes (2018). Participants listened to complex scenes consisting of several voices saying series of numbers and a distracting environmental noise. There were two possible distracting noises, one of which occurred much more frequently (70%) than the other (30%). One voice on each trial was a gender singleton, and participants were instructed to find that voice and report whether it was saying even or odd numbers. If suppression is an active component of auditory selective attention, it should mitigate the detrimental influence of the distracting noise that occurs more frequently. Results revealed significantly faster RTs when the high-probability distracting noise was in the scene relative to when the low-probability distracting noise was in the scene, suggesting that participants were able to use statistical regularities to perform the task more efficiently. This result parallels the visual findings of Wang & Theeuwes (2018), and provides evidence of a suppression mechanism in auditory selective attention.

Poster #07

Title: Connectome-Based Models Predict Attentional Control in Aging Adults

Author: Stephanie Fountain-Zaragoza, Shaadee Samimy, Monica D. Rosenberg, Ruchika Shaurya Prakash

Affiliation: The Ohio State University

Abstract: There are well-characterized age-related differences in behavioral and neural responses to tasks of attentional control. However, there is also increasing recognition of individual variability in the process of neurocognitive aging. Using connectome-based predictive modeling, a method for predicting individual-level behaviors from whole-brain functional connectivity, a sustained attention connectome-based prediction model (saCPM) was derived in young adults. The saCPM consists of two large-scale functional networks: a high-attention network whose strength predicts better attention and a low-attention network whose strength predicts worse attention. Here we examined the generalizability of the saCPM for predicting inhibitory control in an aging sample. Forty-two healthy young adults (n = 21, ages 18-30) and older adults (n = 21, ages 60-80) performed a modified Stroop task, on which older adults exhibited poorer performance, indexed by higher reaction time cost between incongruent and congruent trials. The saCPM generalized to predict reaction time cost across age groups, but did not account for age-related differences in performance. Exploratory analyses were conducted to characterize the effects of age on functional connectivity and behavior. We identified subnetworks of the saCPM that exhibited age-related differences in strength. The strength of two low-attention subnetworks, consisting of frontoparietal, medial frontal, default mode, and motor nodes that were more strongly connected in older adults, mediated the effect of age group on performance. These results support the saCPM's ability to capture attention-related patterns reflected in each individual's functional connectivity signature across both task context and age. However, older and younger adults exhibit functional connectivity differences within components of the saCPM networks, and it is these connections that better account for age-related deficits in attentional control.

Poster #08

Title: A Search for Neural Correlates of Nested Cognitive Architecture in a Visual Detection Task Across the Hemispheres

Author: Heather Gamble, Gaojie Fan, Jessica Rodgers, Robin Thomas

Affiliation: Miami University

Abstract: Systems Factorial Technology (SFT) is a response time based methodology that can reveal the structure of mental processes underlying cognitive tasks. Recently, SFT has been extended to predict patterns of response times for nested architectures potentially at work in visual detection tasks using hierarchical stimuli or compound gratings presented redundantly in both visual fields (bilateral fields, Thomas et al., 2019). In the current study, we collect EEG data in such a visual detection task designed to explore how event-related potentials (ERPs) track visual detection in the different factorial conditions, with the goal of identifying how neural activity relates to underlying cognitive architectures.

Poster #09

Title: Information processing architectures across the visual field: An EEG study

Author: Gaojie Fan, Heather Gamble, Robin Thomas

Affiliation: Miami University

Abstract: How people combine and utilize information from different sources during cognitive processing has always been an interesting topic in visual research. Frameworks such as Systems Factorial Technology (SFT) have been developed to study this process. By using a variety of non-parametric analyses such as mean interaction contrast and survivor interaction contrast, SFT can distinguish between types of information processing architectures (mainly parallel and serial) as well as stopping rules (mainly exhaustive and self-terminating). However, most of these frameworks utilize only behavioral data for model building and psychophysiological activities underlying the models are not commonly examined. The present study aims at both extending SFT with similar visual stimuli presented in bilateral visual fields, and examining the brain activities by looking at ERPs and continuous EEG data. We expect to see different patterns of architectures and stopping rules when the location of stimuli varies, and we also expect to see different patterns of psychophysiological activities from different conditions.

Poster #10

Title: A toolbox for modeling instrumental learning with the reinforcement learning drift diffusion model

Author: Mads Pedersen

Affiliation: Brown University

Abstract: The continuous development of computational models drives understanding of cognitive mechanisms and their neurobiological underpinnings. But this development can also create a gap between modelers and non-modelers as fitting data with complex computational models requires expertise and specialized knowledge. Luckily, during recent years, several groups have created software that simplify the process of fitting computational models. In the work described here, we extend HDDM, an open source python toolbox for bayesian hierarchical parameter estimation of the drift diffusion model. Our extension lets users model two alternative forced choice instrumental learning data with the recently developed reinforcement learning drift diffusion model (RLDDM). The RLDDM simultaneously estimates parameters of learning and choice by assuming decisions are made by accumulating evidence of the difference in expected rewards between choice options until reaching a decision threshold. We show how users can structure data and run analyses including estimating the effect of neural regressors on learning and dynamic choice, and we validate the model through posterior predictive checks and parameter recovery. Lastly we fit the model to pre-collected data on an instrumental learning task.

Poster #11

Title: Modeling Conflict Tasks with Sequential Condition Effects

Author: Noah Thomas, Rolf Ulrich, Trisha Van Zandt

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Abstract: Recently, extensions of the Drift Diffusion Model have been created for conflict tasks. One such extension, the Diffusion Model for Conflict (DMC), additively combines task relevant stimuli processing and task irrelevant stimuli processing in drift rate. DMC predicts shapes of delta functions in conflict tasks such as flanker, Simon and Stroop via the dynamics of the irrelevant processes. DMC can estimate tasks that produce negative going-delta functions which have proven hard to capture in diffusion models. Although this model can generalize widely to conflict tasks, it fails to produce a number of quantitative effects when fit to these specific tasks alone. A recent study has found that the DMC fails to fit to the flanker task when compared to competing diffusion models extensions. This is due to a under prediction

of the leading edge and over prediction of the tail of the RT distributions in conflicted trials, and a failure to account for the difference between the leading edge of RT distributions of the congruent and incongruent conditions. Although there has been evidence to suggest that RT means change as a function of the previous trials' conditions, recent models for these conflict tasks have yet to be extended to incorporate this effect. Here, we investigate whether incorporating these sequential conditional effects may improve the fit of the DMC.

Poster #12

Title: Bayesian Item Response Models of the Peters et al. Delusions Inventory

Author: Ricardo J. Romeu

Affiliation: Indiana University

Abstract: The Peters et al. Delusions Inventory (PDI) measures delusion-proneness within the general population and places this latent trait on the same scale as full-blown delusion in psychosis (as in schizophrenia). While the PDI has been demonstrated to have good psychometric properties, e.g., discriminant validity between low-delusion-prone individuals and actively psychotic patients, there are, to our knowledge, no item response theory (IRT) models of the measure. An item response model gives parameters to both items (i.e., questions on the inventory) and to the person answering the inventory, which allows us to perform analyses at the item level for each individual. Employing an IRT view on the PDI can give us more information than simply looking at the raw total score, since the model relates the latent trait (e.g. delusion-proneness) to the probability of endorsing a particular item. The challenge, however, is that the PDI is composed of conditional responses, which makes the structure more complicated from an IRT perspective. We compare some approaches to modeling this conditional structure from an IRT perspective, and fit the models using a hierarchical Bayesian approach to a published data set of 947 healthy controls (Bronstein et al., 2018). We also analyze parameter recovery statistics for the best-fitting model, where we examine how much confidence we can give to the parameter estimates (and hence their interpretation). We close with a discussion of how one might apply the best-fitting IRT model to a joint-modeling procedure that centers on measuring delusion-proneness from several perspectives.

Poster #13

Title: Does Planning Help Execution? The Complex Relationship Between Planning and Execution

Author: Zhaojun Li, Paul De Boeck, Jian Li

Affiliation: The Ohio State University

Abstract: Planning and execution are two important parts of the problem solving process. Based on related research, it is expected that planning and execution are positively correlated because of underlying individual differences in general mental speed, while there may also exist a direct negative effect of planning time on execution time given the hypothesis that an investment in planning contributes to more efficient execution. The positive correlation and the negative dependencies are not contradictory since the former is a relationship between latent variables and the latter is a relationship between manifest task-specific times, controlling for the latent variables. With generalized linear mixed modeling and factor analysis, these two different kinds of relationships haven been examined. The results supported the above hypotheses. Moreover, the negative dependencies seem to vary among persons and among items. In sum, this study provides a clearer picture of the relationship between planning and execution and suggests that analyses on different levels may show different relationships.

Poster #14

Title: Effects of a novel antidepressant on stress-related behaviors and cognitive learning on a fish model

Author: Hannah Mullinax and Jessica Ward, PhD

Affiliation: Ball State University

Abstract: Emerging evidence suggests that ketamine, a pharmaceutical often prescribed for off-label use as an antidepressant, may be an effective intervention for the treatment of major depressive disorders. Specifically, ketamine works quicker and more effectively than traditional antidepressants because of its ability to rapidly pass the blood brain barrier. However, few studies have been conducted to assess the effects of ketamine on behavior and organismal function; consequently, it is not yet approved by the FDA for use as an antidepressant. Robust studies of animal models are a first step towards understanding the potential utility of a novel medical therapy. Therefore, in vivo studies of the effects of ketamine are a high research priority. In this study, we evaluated the effects of ketamine on stress-related behaviors and cognitive learning in a fish model. Mature zebrafish (Danio rerio) were exposed to either 0, 5, 20, or 40 mg/L ketamine for 1 h before being tested in behavioral assays. We quantified changes in the exploratory behavior of fish in novel environments, including a narrow dive tank and a dark-light tank. We also utilized a plus maze to evaluate the influence of ketamine on simple associative learning. We found detectable effects of ketamine on both stress-related behaviors and cognitive learning. These results will contribute to a growing body of knowledge on the utility of ketamine for use as an antidepressant.

Poster #15

Title: Using mouse-tracking to infer the dynamics of object recognition

Author: Samuel M. Harding, Richard M. Shiffrin

Affiliation: Indiana University

Abstract: Perceptual decisions are made by accumulating noisy evidence over time until a response is made. The strength and quality of the rate of accumulation is thought to derive from stimulus features extracted by perceptual processes before deliberation begins. However, evidence from experiments conducted with dynamic stimuli suggest that perception and decision processes may operate in parallel such that the arrival of individual features changes the strength of evidence over time. One challenge facing these dynamic models is to show that participants are not simply waiting to begin deliberation until after all the features appear. Methods including the use of signal-to-respond paradigms, and rapid feature presentation seek to discourage waiting, but provide no direct measure of evidence. We utilized mouse-tracking technology to measure continuous mouse movements and relate them to the dynamics of ongoing decisions. Subjects learned a novel set of 8 simple objects, half of which acted as targets and the others as foils. Participants were then tasked with identifying objects as they were presented on alternating sides of the screen. When an object appeared, they were instructed to move the mouse cursor to the object and to click on it if it belonged to the target set, but to remain stationary otherwise. We presented individual features of the object sequentially, such that early information was either partially or wholly diagnostic of object identity, misleading, or ambiguous. Analysis of cursor trajectories suggests that participants used this partial information to make judgments, which we capture using a dynamic model.

Poster #16

Title: Examining Word Problem Processing Using Eye Tracking

Author: Jennifer Kaminski, Ke Xu, Nathaniel Charlesworth, Nico Comendador

Affiliation: Wright State University

Abstract: In recent years, researchers have used eye tracking to provide insights into numerical cognition and mathematical reasoning (e.g. Hartmann, 2015). For simple arithmetic processing, studies have found differences in eye gaze correlated with the level of sophistication of the strategy used by participants (e.g. Chesney, et al, 2013; Huebner & LeFevre, 2018). The goal of the present study was to examine eye gaze while solving simple word problems. While most people can accurately solve such problems, we expect that people with higher mathematics background will exhibit more expert-like behavior (e.g. Bedard & Chi, 1992), attending more to the structure of the problem than to superficial features of the problem. For word problems, the specific numbers that appear in a problem are not irrelevant, but they are generally independent of problem structure. Therefore, we hypothesized that participants with high mathematics background will attend less to the numbers present than participants with lower mathematics background. Fifty undergraduate students solved simple forced-choice word problems presented on a computer screen. An Eyelink Portable Duo (SR Research, Inc.) collected eye gaze data. Questions were semantically aligned (see Bassok, 2001) or unaligned. The final data collection is in progress. Analysis will examine possible effects of participants' level of mathematical training and self-reported affinity for mathematics as well as potential interactions with problem type. These findings will contribute to understanding the processing of word problems and some potential individual differences.

Poster #17

Title: What the AI saw: Examining human predictions of Deep Image Classification Errors

Author: Anne Linja

Affiliation: Michigan Technological University

Abstract: Deep Image classifiers have made amazing advances in both basic and applied problems in recent years. Nevertheless, they are still very limited and can be foiled by even simple image distortions. Importantly, the way they fail is often unexpected, and sometimes difficult to even understand. Thus, advances in image classifiers made to improve their transparency and the predictability of their errors may make more of a difference than algorithmic improvements that reduce error rates on benchmarks. To understand the types of expectations humans may have, we conducted a study in which students were asked to predict whether a generic AI system would correctly identify 10 classes of tools (axe, hammer, wrench, flashlight, pliers, saw, scissors, screwdriver, tape measure), with a variety of image transforms (e.g., borders, outline filters, additional objects inserted into image, etc.), and also examined how five commercial deep image classifiers performed on the same imagery. Results revealed that humans tended to predict that distortions and distractions would lead to impairment of the AI systems, and although AI failures did incorporate these factors, they also involved many class-level errors (e.g., calling a wrench a tool or a product), and feature-errors (calling a hammer 'metal' or 'wood') not identified by human novice users. Results will be discussed in the context of Explainable AI systems.

Poster #18

Title: Word Choice Between Synonyms

Author: Jacqueline Erens, Joseph Austerweil

Affiliation: The University of Wisconsin - Madison

Abstract: Previous research suggests that in utterance planning, people choose words based on the amount of information they expect the word to convey to their audience, favoring words that are maximally informative over words that may be ambiguous (Frank & Goodman, 2012). This has been shown in both nouns and pronouns, however less research exists for other word classes, such as verbs, adverbs, and adjectives. The current study examines the role of informativity in word choice between synonyms of the four main word classes. We presented participants with sentences taken from the BYU TV Corpus, with a word from our synonym set removed. We gave participants a choice between two synonyms that could both fit semantically within the context of the sentence, even though one synonym could be considered more informative than the other. Participants indicated which of the synonyms they would use if they were to say the sentence out loud. Some participants experienced conditions that placed a high demand on either their visual or verbal working memory while completing this task, while others completed it without any additional demands. Results indicate that participants across conditions do not prefer more informative synonyms over the less informative choice.

Poster #19

Title: Investigating Strategies of Prosocial-Antisocial Tease Comprehension

Author: Lauren Pino, Emma Bernardi, Vrinda Sawhney, Hanna Detwiler, & John Gibbs

Affiliation: The Ohio State University

Abstract: As part of the multi-stage development of a prosocial-antisocial tease type comprehension measure, we investigated young adults' cognitive strategies for their interpretations of differently-intentioned tease scenarios. In the first stage, participants evaluated and then explained those evaluations of prosocial, antisocial, and ambiguous teases. In the second stage, participants evaluated prosocial, antisocial, and ambiguous teases adapted from the first stage. Results support the use of a cue-based strategy for tease comprehension, in line with social information-processing theories of complex social interactions (e.g., Dodge & Crick, 1990). In both stages, accuracy improved with more cues. In the first stage, participants cited cues in 58% of all explanations, and this cue use differed by tease scenario structure. The specific cues (e.g., facial expression, gesture, relationship information) cited differed by tease type and suggested different cognitive strategies. These differences in cue type use by tease type were demonstrated again in the second stage with accuracy jumps by number of cues, but also by cue type. Accuracy on prosocial teases improved steeply with facial expression cues, whereas there was a slight tendency for accuracy improvement with relationship information cues in antisocial teases. This is in line with the cues cited in the first stage explanations for prosocial and antisocial teases. Altogether, this strongly supports tease-type-specific cognitive strategies. We discuss implications for social-cognitive development as well as possible mechanisms underlying these differences.

Poster #20

Title: Learning Differences Between Intra-and Interpersonal Coordination

Author: Nathan Lautz, Colin Annand, Francis Grover

Affiliation: University of Cincinnati

Abstract: Perceptual-motor research has identified a variety of factors that contribute to the process of learning a new coordination pattern. Among these is the difference between learning to coordinate with oneself (intrapersonal) and coordinating with another (interpersonal). Several advantages and disadvantages for coordination have been separately identified for either scenario. For example, coupling

strength is greater for intrapersonal coordination, which presumably aids learning due to, e.g., tighter compensation between the limbs. However, there is also a more internalized focus of attention, which has been found to hinder learning. While the evidence for these benefits and hindrances is individually clear, little is known about how they might interact. The current study therefore examined participants as they learned to produce a novel coordination pattern (90° relative phase) alone or in pairs. Participants were implicitly tasked with learning the required pattern as they controlled the vertical and horizontal position of an on-screen cursor to trace a circling target. We observed better performance overall (including initial performance) from pairs, but steeper learning trajectories from individuals. We discuss these findings in terms of coordination dynamics, perceptual information, and attentional focus.

Poster #21

Title: Mixed Pattern Generator for Forward Locomotion in C. elegans

Author: Erick Olivares, Eduardo J. Izquierdo, Randall D. Beer

Affiliation: Indiana University

Abstract: C. elegans locomotes in an undulatory fashion, generating thrust by propagating dorsoventral bends along its body. Despite its relative simplicity, how locomotion is generated is not yet well understood. Using the available connectome, we integrated a neuroanatomically- grounded model of its nervous system with a biomechanical model of its body. We then used an evolutionary algorithm to determine the unknown physiological parameters so that the complete system reproduces the locomotive behavior of the worm. We analyzed the ensemble of solutions as a way to generate novel hypotheses about the neuromechanical basis for locomotion. Specifically, we first demonstrate the feasibility of a network CPG in the worm's ventral nerve cord. Our model suggests specific roles for key motoneurons and connections involved in the generation of the oscillation. Building on the first result, we integrate the neural model to the biomechanical model of the body and environment. We demonstrate that a chain of CPGs can drive forward locomotion on agar in the absence of proprioception. In addition to matching the speed of the worm, the model match several other key features of locomotion and of experimental manipulations that the model were not trained to match. Analysis of the solutions reveals three different strategies for how to achieve anterior-posterior coordination. Each of the strategies constitutes a testable hypothesis. Finally, we added stretch receptors to the brain-body-environment model. Analysis of the results suggests that a mixed pattern generator is feasible, along with specific mechanisms for how the stretch-receptor feedback is used to help coordinate the intrinsic oscillators.

Poster #22

Title: Self-Distancing and Its Benefits: The Role of Social Perspective-Taking

Author: Dasom Lee & John Gibbs

Affiliation: The Ohio State University

Abstract: This study explored the role of social perspective-taking in accounting for the relationship that has been found between self-distancing and benefits such as lower emotional reactivity. Studies have shown that self-distancing can help people come to terms with emotionally upsetting experiences. We used both quantitative and qualitative methods to investigate the processes that account for this relationship. 352 undergraduates reflected on a recent interpersonal conflict that still aroused strong emotions. Those who reflected on the conflict from a psychologically distanced perspective reported less intense feelings. Regression analyses indicated that social perspective-taking (e.g., reflecting on the conflict from the viewpoint of the other person) substantially mediated the relationship between

self-distancing and lower emotional reactivity. A content analysis found that most of respondents' open-ended reflections on the conflict were scorable in terms of categories of social perspective-taking. Greater insight into the self-distancing process can enhance the effectiveness of cognitive interventions.

Poster #23

Title: Differences in false recall using auditory and visual DRM lists of semantic, phonological, and hybrid semantic/phonological words

Author: Tanner Green, Sean Keister, Sean Arbogast, & Timothy Dimidik

Affiliation: Wright State University

Abstract: Both semantically generated DRM lists of words and phonologically generated DRM lists of words produce false recall intrusions of critical words used to generate these lists. However, hybrid lists with half of the words from a semantic list and the other half from a phonological list lead to increased false recall on free recall tests compared with the homogeneous lists (Finley, et al., 2017; Watson, et al, 2003). Interestingly, there appear to be differences in the processing of semantic and phonological critical false recall items indicated by remember/know judgments and presentation rates. Reading words may induce both semantic and phonological dual codes, as Paivio (1986) proposed. Analogous to the picture versus printed word effect for visually-presented lists, auditorily-presented lists could enhance the importance of phonological encoding, especially for word lists that are phonologically related. This enhanced similarity should increase the false recall of phonological lists, and hybrid lists, depending on the nature of phonological processing. Within-subject semantic, phonological and hybrid lists were presented to two groups using the same DRM word lists, but one visually- and the other auditorily-presented. Recall of the veridical versus critical items were compared in a 2 x 3 x 2 mixed factorial ANOVA. The visual list results replicated those of Watson et al.'s (2003) experiment 3. Auditory lists produced an additional significant increase in the recall of false items, which, surprisingly, was comparable for all three list types. Importantly, veridical recall was not statistically different for visual and auditory lists. Theoretical implications are discussed.