

**COGNITIVE SCIENCE COLLOQUIUM**  
**Spring 2019**

January 18, 2019 **SUZANA HERCULANO-HOUZEL**, Associate Professor, Psychological Sciences; Associate Director for Communications, Vanderbilt Brain Institute, Vanderbilt University

**TITLE: Life slows down when you have more neurons**

**ABSTRACT:** Sure, having more neurons in the cerebral cortex must make it capable of more complex and flexible cognition, so our sixteen billion cortical neurons place humans at a clear cognitive advantage over all other animals. But in this talk I'll argue that the most consequential effect of having so many neurons is something else: more time to mature and then to live once independence is reached. With more cortical neurons comes more time to gather information, build knowledge, and exchange it with past and future generations – hand in hand, of course, with the increased computational capacity that makes it all possible.

January 25 **MELANIE SEKERES**, Assistant Professor of Psychology and Neuroscience, Baylor University

**TITLE: Run for the cure: Using exercise to minimize cognitive impairment and neurotoxicity following cancer treatment**

**ABSTRACT:** Patients receiving radiotherapy and chemotherapy treatments for brain and non-brain cancers, commonly report cognitive disturbances in memory and executive function. Treatment disproportionately impacts the ability to form new (anterograde) memories, while relatively sparing older (retrograde) memories. Growing evidence from pre-clinical studies in rodents confirm clinical reports in patients and suggest that such cognitive disturbances are mediated by the neurotoxic effects of the radiation and chemotherapeutic drugs which reduce hippocampal volume, neurogenesis, and white matter, and increase expression of pro-inflammatory cytokines. Exercise is a modifiable lifestyle factor with known therapeutic benefits. Considerable overlap exists between the cellular mechanisms supporting running-enhanced cognition, and cellular mechanisms altered by chemotherapy and radiation treatment, including opposing effects on neurogenesis, and inflammatory cytokines. I will discuss findings in patients and rodents suggesting exercise, and running in particular, may be an effective means of

promoting functional recovery from radiotherapy and chemotherapy treatment-related cognitive impairment.

February 1

**MANDY J. MAGUIRE**, Associate Professor of Behavioral and Brain Sciences, University of Texas at Dallas

**TITLE: Using event related potentials and neural oscillations to study developmental changes in language comprehension and word learning**

**ABSTRACT:** EEG, primarily via ERPs (Event Related Potentials), has provided a window into complex and difficult to assess aspects of cognition and language processing for decades. Current advances in data collection and analysis have led to an increase interest in expanding EEG analyses to include studies of event related neural oscillations. The multidimensionality of this data (simultaneous changes in multiple frequency bands at each electrode site) and the fact that neural oscillations are less time limited than ERPs have made them particularly interesting for studying language and language development. Here we review a series of studies using ERPs and neural oscillations to study language comprehension and word learning in children and adults. Overall the findings indicate that ERPs and neural oscillations provide complimentary but sometimes unique windows into language development. These studies provide new insights about developmental changes in neural engagement related to semantics, syntax and word learning. We will discuss implications of this work as well as new applications for using ERPs and neural oscillations during word learning tasks to study the vocabulary gap between children from low- and higher SES homes in grade school.

February 15

**ZOE DRAYSON**, Assistant Professor of Philosophy, University of California at Davis

**TITLE: Inferential cognition**

**ABSTRACT:** What does it mean to describe a cognitive process as inferential? In cognitive science it is common to make a distinction between processes that are inferential and processes that are associative. There is, however, no consensus as to how this distinction should be drawn. I explore various options in the literature, and situate them in the context of broader questions about cognition. Some philosophers, for example, argue that inferential thought is necessarily conscious and thus deny that unconscious processes are genuinely inferential. There is a related concern that inference is tied to notions of rationality and reasoning in a way which renders us responsible for our inferential cognition, which is difficult to reconcile with unconscious processes over which we

have no control. I discuss the way that some of these considerations play out with respect to the psychological and philosophical literature on implicit bias.

February 22

**GERRY ALTMANN**, Professor, Department of Psychological Sciences, University of Connecticut; Director, Connecticut Institute for the Brain and Cognitive Sciences

**TITLE: The challenge of event cognition: Object recognition at the interface of episodic and semantic memory**

**ABSTRACT:** To understand the event corresponding to e.g. “the chef chopped the onion” requires understanding (i) that the things under consideration have properties shared with other similar things (i.e. inherited from their type), (ii) that they have specific properties that uniquely distinguish them from other things of the same type (i.e. they are specific tokens), and (iii) that these properties change over time; the chef and the onion have (intersecting) histories that started with them in one state and ended with them in another. These histories are in fact trajectories of changes in state across time and space, and their intersection defines the interactions between objects (in this case, the action of the chef on the onion). To comprehend events therefore requires that we access knowledge about types of objects and combine this with knowledge about the dynamic episodic properties of individual tokens – that is, it requires creating on-the-fly representations of object tokens and their changes in state. In this talk I shall outline an account of how this might be accomplished in a brain that is able to distinguish the systematic associations that define semantic memory for object types from the non-systematic accidental associations that define the episodic characteristics of object tokens. The talk will include some slime mould, fMRI, and EEG, but presented for the neuroscientific novice.

March 1

**JAY NUNAMAKER**, Regents' and Soldwedel Professor of Management Information Systems, Computer Science, and Communication; Director, UA BORDERS Center

**TITLE: AVATAR--Automated Virtual Agent for Truth Assessment in Real-Time**

**ABSTRACT:** The automated interviewing system called AVATAR is designed to screen people for credibility assessment and deception detection. This talk will focus on an overview description of the AVATAR technology and an AVATAR demonstration.

### **Who is better at distinguishing truth-tellers from liars—A person or an artificial agent?**

Humans are notoriously poor at detecting lies and other tell-tale signs of malintent. Using artificial intelligence and sensor technologies, BORDERS researchers are developing an AVATAR-based screening system that may be able to identify suspicious behavior more accurately than any human.

The AVATAR Kiosk is designed to flag suspicious behavior that should be investigated more closely by a human agent in the field. This “primary screening” technology is designed for use at ports of entry, including border crossings and airports. The kiosk also has many other security applications such as visa processing, asylum requests and personnel screening and interviewing.

#### **Generation Four: Technology and Sensors.**

BORDERS researchers have investigated over 300 psychophysiological and behavioral cues including vocalics, linguistics, kinesics, cardiorespiratory, eye behavior, and facial skin temperature. Based on findings, the AVATAR is equipped with non-invasive and non-intrusive instruments that record an individual’s physiological and behavioral reactions during the interview process:

- Kinesics and facial emotion—Computer vision algorithms via video camera
- Vocalics—Computer aural perception algorithms via-audio—microphone
- Saccade, gaze duration, pupillometry—eye-tracking via near infrared camera
- Linguistic content—natural language processing via deception detection algorithms
- Physiological—Heart rate, respiratory rates, blood pressure, heat signature around eye on nose, mouth.

#### **The Many Faces of the AVATAR.**

BORDERS research shows that people react differently to various types of AVATARS. For example, the AVATAR’S gender, ethnicity and demeanor may produce dissimilar effects on the person being screened. Other factors include the AVATAR’S perceived power, trustworthiness, composure, expertise, likability and attractiveness.

This finding has important implications for future screening practices. For example, human agents may select different AVATARS based on the individual being screened. Cultural considerations and context are also significant and must be taken into account.

#### **What is BORDERS?**

BORDERS is a multi-university research center established in 2008 by the Department of Homeland Security (DHS) as a Center of Excellence in border security and immigration until 2016 for \$21 million.

The total funding for the AVATAR project is \$31 million. Presently BORDERS is funded by the US Army and NSF. Partners include University of California, Santa Barbara, Stanford University, Dartmouth

University, University of Maryland, Rutgers, West Virginia University, Clarkson University, San Diego State University and University of Nebraska at Omaha.

March 15

**JACQUELINE GOTTLIEB**, Professor of Neuroscience; Principal Investigator, Zuckerman Institute, Columbia University

**TITLE: Mechanisms of curiosity and information sampling in humans and non-human primates**

**ABSTRACT:** The vast majority of neuroscience research focuses on tasks in which participants have extensive prior knowledge about the relevant features, usually via explicit instructions that strongly constrain what they should memorize, attend to or learn. In natural behavior however, we rarely have the benefit of such explicit instruction. Instead, our brains must endogenously decide which one, of the practically infinite set of available signs and cues, to use to guide our learning, perception and action. Because of our field's overwhelming reliance on the "instructed cognition" paradigm, the mechanisms of active sampling remain very poorly understood. I will review the significance of this lacuna for current theories of cognition and decision making. I will then discuss behavioral and neurophysiological evidence pertaining to this question from our laboratory, with a focus on single neuron responses in the parietal cortex during the sampling of instrumental (decision-relevant) cues and during sampling of non-instrumental information motivated by curiosity. Time permitting, I will also describe studies analyzing instrumental and curiosity-based sampling in humans using new behavioral tasks and electroencephalography (EEG). Together, these studies begin to reveal the distributed processes through which the brain estimates the benefits and costs of gathering information and implements active sampling policies.

March 22

**CATHERINE HARTLEY**, Assistant Professor of Psychology, New York University

**TITLE: Developmental tuning of action selection**

**ABSTRACT:** Computational reinforcement learning models provide a framework for understanding how individuals can evaluate which actions are beneficial and which are best avoided. To date, these models have primarily been leveraged to understand learning and decision-making in adults. In this talk, I will present studies characterizing developmental changes, from childhood to adulthood, in the cognitive representations and computations engaged to evaluate and select actions. I will discuss how

these changes may optimize behavior for an individual's developmental stage and unique life experiences.

March 29

**NOAM CHOMSKY**, Laureate Professor of Linguistics, Agnese Nelms Haury Chair, University of Arizona

**TITLE: Language architecture and evolution: Some current perspectives**

**ABSTRACT:** Language has been an object of fascination since classical antiquity, but it was not until the development of the theory of computation by mid-20<sup>th</sup> century that it became possible to formulate and investigate effectively the Basic Property of human language: a language L determines an unbounded array of hierarchically structured expressions, each of which is interpreted semantically as an expression of thought, each of which can be externalized in some sensory modality (typically speech). The general faculty of language FL specifies the possible human languages. The theory of FL (UG, "universal grammar") must be rich enough to account for the properties of each particular language L, but also simple enough to account for the acquisition of each L and the evolution of FL. These goals have been approached in revealing ways in recent years, with some surprising results that challenge long-held ideas. I will review progress in this direction, along with open problems and deeper mysteries.

April 5

**NICK CHATER**, Professor of Behavioral Science, Warwick Business School, University of Warwick

*2018-2019 Roger N. Shepard Distinguished Visiting Scholar*

**TITLE: Virtual bargaining: A microfoundation for the theory of social interaction**

**ABSTRACT:** How can people coordinate their actions or make joint decisions? One possibility is that each person attempts to predict the actions of the other(s), and best-responds accordingly. But this can lead to bad outcomes, and sometimes even vicious circularity. An alternative view is that each person attempts to work out what the two or more players would agree to do, if they were to bargain explicitly. If the result of such a "virtual" bargain is "obvious," then the players can simply play their respective roles in that bargain. I suggest that virtual bargaining is essential to genuinely social interaction (rather than viewing other people as instruments), and may even be uniquely human. This approach aims to respect methodological individualism, a key principle in many areas of social science, while explaining how human groups can, in a very real

sense, be "greater" than the sum of their individual members. This viewpoint has implications for the nature of communication, the 'moral emotions,' and the emergence of norms, rules and institutions.

April 12

**LOGAN T. TRUJILLO**, Assistant Professor, Department of Psychology, Texas State University

**TITLE: Testing the free energy principle for the brain during visual categorization in humans**

**ABSTRACT:** According to the theory of active inference, the brain predicts sensations and infers their causes via a generative model of the world. Active inference is achieved when the brain minimizes its free energy, an information-theoretic upper bound on the difference between the brain's current and predicted states; this minimization of brain free energy is termed the "Free Energy Principle (FEP)". Perception and action correspond to two ways a brain can minimize free energy: i) changing its beliefs about the world (i.e. its generative model), or ii) acting on the world in order to change sensory input in accordance with its beliefs. The free energy principle may provide a general explanation for how the brain realizes perception and action; however, empirical confirmations of this principle are currently limited.

This talk will report my efforts to empirically quantify the free energy of global states of the human brain by combining techniques from experimental psychology, electroencephalography, computational modeling, and machine learning. These efforts focus on global brain free energy states arising during the active inference of visual category structure (2-AFC categorization of Gabor stimuli, where the categories are defined by a combination of stimulus orientation and spatial frequency). I find that global brain free energy is lowest when the brain's discrimination of visual categories matches the reported perception of these categories, whereas global brain free energy is highest when the neural discrimination and the reported perception are mismatched. This finding is as expected if visual categorizations are based on a relatively accurate generative model of the true visual category structure. Moreover, total global brain free energy correlates with the free energy and choice precision parameters of a computational model of the categorization task (a partially observable Markov decision process implementing approximately Bayes-optimal decisions). These findings provide evidence for a relationship between visual categorization, active inference, and brain free energy minimization.

April 19

**YEJIN CHOI**, Assistant Professor, Department of Computer Science and Engineering, University of Washington

**TITLE: From native physics to folk psychology: Modeling common sense in language**

**ABSTRACT:** Intelligent communication requires reading between the lines, which in turn, requires rich background knowledge about how the world works. However, learning and reasoning about the obvious, but unspoken facts about the world is nontrivial, as people rarely state the obvious, e.g., ``my house is bigger than me.'' In this talk, I will discuss how we can reverse engineer aspects of commonsense knowledge—ranging from naive physics to more abstract social commonsense knowledge—from how people use language. A key insight is this: the implicit knowledge people share and assume systematically influences the way people use language, which provides indirect clues to reason about the world. For example, if ``Jen entered her house'', it must be that her house is bigger than her.

In this talk, I will present two complementary formalisms that can organize and represent various aspects of commonsense knowledge: commonsense frames and graphs. In particular, I will introduce ATOMIC, an atlas of everyday commonsense reasoning, organized through 877k textual descriptions of inferential knowledge. Compared to existing resources that center around taxonomic knowledge, ATOMIC focuses on causes and effects of everyday events (e.g., "if X pays Y a compliment, then Y will likely return the compliment"). I will then present two complementary approaches—probabilistic inference and deep neural networks—that can learn to reason about commonsense knowledge encoded in language. I will conclude the talk by discussing the challenges in current models and formalisms, pointing to avenues for future research.

April 26

**Cognitive Science Graduate Student Showcase**

**MINGLI LIANG**, Psychology Department

**TITLE:** Human frontal delta-theta dynamics cod distance and time inside teleporters

**ABSTRACT:**

Past studies have suggested the critical role of hippocampal low-frequency oscillations in spatial navigation. Additionally, cortical and hippocampal theta oscillations often synchronize, suggesting the importance of cortical oscillations to movement-related coding as well. In a recent study, we found increased scalp frontal-midline delta-theta oscillations during movement involving free ambulation when compared to standing-still in healthy humans. One intriguing question, given these findings, regards the precise drivers of such low-frequency oscillations. While past studies have suggested spatial distance (Vass et al. 2016) and movement speed (Watrous et al. 2011) may both contribute to low-frequency oscillations, temporal components may also be a significant driver. To address this issue, participants navigated a plus maze containing four target stores at



the end of each arm. Four teleporters were also dispersed in each arm involving different spatial distances and temporal intervals. In a trial, participants first entered a teleporter, and upon exiting, were teleported back to the center of a plus maze, at which time they were instructed to find a target store. In the spatial distance condition, participants judged how far they travelled inside the teleporters; in the temporal interval condition, participants judged temporal interval. On the basis of temporal interval or spatial distance (short vs. long), participants decided which target store to visit. As in the prior study, we used the omnidirectional treadmill to provide locomotion-based VR navigation experiences, simultaneously recording scalp EEG during teleportation and navigation epochs. Preliminary results showed that participants were able to discriminate between different spatial/temporal teleportation experiences at above chance levels and were able to apply the cues to find the appropriate targets. Analyses involving scalp EEG will test whether 1) frontal-midline theta oscillations persist during teleportation without the presence of visual, vestibular and proprioceptive input, regardless of spatial or temporal conditions 2) whether frontal-midline theta oscillations code space, time, or both. Our findings will help advance our understanding of the role of low-frequency oscillations in memory and navigation and deepen our understanding of the nature of “cognitive map” regarding whether a time code and a distance code co-exist in the spatial knowledge.

**ALYSSA SACHS**, Speech, Language, and Hearing Sciences

TITLE: A retrospective study of long-term improvement on the Boston Naming Test

ABSTRACT:

*Purpose.* Lexical retrieval impairment is a universal characteristic of aphasia and a common treatment focus. Although naming improvement is well documented, there is limited information to shape expectations regarding long term recovery. This was the motivation for a retrospective study of longitudinal data on the Boston Naming Test (BNT).

*Methods.* BNT scores were analyzed from a heterogeneous cohort of 42 individuals with anomia associated with a range of aphasia types. The data were collected over the course of 20 years from individuals who had participated in treatment and received at least two BNT administrations. A linear mixed model was implemented to evaluate effects of initial BNT score, time post onset, and demographic variables. For those over age 55, BNT change was evaluated relative to data from the Mayo Clinic’s Older American Normative Studies (MOANS).

*Results.* There was a significant average improvement of +7.67 points on the BNT in individuals followed for an average of two years. Overall, the average rate of improvement was +5.84 points per year, in contrast to a decline of 0.23 points per year in a healthy adult cohort from the MOANS. Naming recovery was approximately linear, with significant main effects

of initial BNT score (i.e., initial severity) and time post onset; the greatest changes were noted in those whose initial severity was moderate.

*Conclusions.* These findings indicate a positive prognosis for naming improvement over time regardless of demographic factors and provide estimates for clinical predictions for those who seek rehabilitation during the chronic phase.

**COGNITIVE SCIENCE COLLOQUIUM**  
**Fall 2018**

August 31, 2018    **KOBUS BARNARD**, Professor of Computer Science, UA Department of Computer Science

**TITLE: Multiple-gaze geometry: Inferring novel 3D locations from gazes observed in monocular video**

**ABSTRACT:** I will briefly discuss the current success of black box classifiers and how they can be less suitable for explanatory and/or mechanistic models that need to use restricted (domain specific) representations. I will then present work on inferring what is going on in videos of people using strong natural representations within a Bayesian framework. More specifically, this framework treats observed image data as being evidence for underlying models that explain it, and going from data to model is achieved using Bayesian inference executed using MCMC sampling. Using this approach, we are able to track the 3D location of people using a single, uncalibrated video camera (e.g., we do not know, in advance, things like the focal length of its lens, which we infer as part of the process).

I will then discuss recently published work on including the gaze directions of the participants, and how our approach for explicitly representing the scene in 3D naturally provides for inferring who is looking at whom or what. Finally, as suggested by the title, I will discuss how our approach can discover 3D locations of what people tend to look at, including locations not visible to the camera. This emerges from our approach rather intuitively, as the intersection of gaze angles rooted in different points in space provides evidence for 3D locations. Finally, I will mention a few possible extensions that we are considering.

While the nuts and bolts of our approach are quite technical, I will attempt to provide a largely non-mathematical understanding of such models and the associated inference engines.

This work is in collaboration with former UA CS PhD students Ernesto Brau, Jinyan Guan, and Tanya Jeffries.

September 7    **TERRY REGIER**, Professor of Linguistics and Cognitive Science, Department of Linguistics, Cognitive Science Program, University of California at Berkeley

**TITLE: Semantic typology and the Sapir-Whorf hypothesis in computational perspective**

ABSTRACT: Why do languages have the semantic categories they do, and what do those categories reveal about cognition and communication? Word meanings vary widely across languages, but this variation is constrained. I will argue that this pattern reflects a range of language-specific solutions to a universal functional challenge: that of communicating precisely while using minimal cognitive resources. I will present a general computational framework that instantiates this idea, and will show how that framework accounts for cross-language variation in several semantic domains. I will then address the Sapir-Whorf hypothesis - the claim that such language-specific categories in turn shape cognition. I will argue that viewing this hypothesis through the lens of probabilistic inference has the potential to resolve two sources of controversy: the challenge this hypothesis apparently poses to the widespread assumption of a universal groundwork for cognition, and the fact that some findings supporting the hypothesis do not always replicate reliably.

September 14

**STEPHEN COWEN**, Assistant Professor, UA Department of Psychology

**TITLE: How ketamine alters brain activity and potential mechanisms for its therapeutic and dissociative effects**

ABSTRACT: Although ketamine was developed in the 1960s as an anesthetic, the potential therapeutic applications for the drug have expanded considerably in the last decade. For example, hour to days-long exposure can provide weeks-to-month reduction of treatment-resistant depression, post-traumatic stress disorder (PTSD), chronic pain, and L-DOPA-induced dyskinesias associated with the treatment of Parkinson's disease. Ketamine is also a popular recreational drug due to its powerful dissociative and perceptual effects that include feelings of disembodiment and vivid perceptual hallucinations. Despite its widespread use and its potential for abuse, little is understood about the neural mechanisms that underlie ketamine's therapeutic or dissociative effects. In this talk, we will review our research investigating ketamine's capacity to produce profound changes in neuronal synchrony throughout the brain. We will also discuss how changes in synchrony may contribute to ketamine's effects on perception and its use as a potential treatment for Parkinson's disease and L-DOPA-induced dyskinesias.

September 21

**KAREN SCHLOSS**, Assistant Professor, Department of Psychology and Wisconsin Institute for Discovery, University of Wisconsin at Madison

**TITLE: Color inference for visual communication**

**ABSTRACT:** Visual reasoning allows people to translate visual input into conceptual understanding. The visual reasoning system presumably evolved so organisms could quickly and flexibly interpret visual input in their natural environment. Now, humans leverage this system for visual communication by creating synthetic environments, or *visualizations*, for others to interpret. These visualizations include the graphs, maps, and diagrams that are central to science communication. Interpreting visualizations is easier when the encoded mappings between concepts and visual features match people's expectations, or *inferred mappings*. To harness this principle in visualization design, it is necessary to understand what determines people's inferred mappings. In this talk, I will present the Color Inference Framework for how people make conceptual inferences from color, and how those inferences influence judgments about the world. I will then discuss studies on color-coding systems for recycling and for colormap data visualizations. The results of these studies demonstrate that inferred mappings are context dependent and flexible, influenced by perceptual relations among colors in visual displays and relative activation of concepts in people's minds. The results have implications for designing effective and efficient media for visual communication.

September 28

**LINDA RESTIFO**, Professor of Neurology, Neuroscience, and Cellular & Molecular Medicine, UA Department of Neurology

**TITLE: Size matters: Heads, brains, and neurons in genetic intellectual disabilities**

**ABSTRACT:** Nearly one thousand human genes are known to be essential for the development of neurotypical cognitive function. Conversely, deleterious mutations in any one of these genes cause intellectual disability (ID), either in isolation or as part of a syndrome. For a substantial fraction of these disorders, small head size (microcephaly), due to impaired brain growth, is detectable during the first few years of life. Almost all of the genes involved are very highly conserved, meaning that they are present and control brain development in simpler organisms, such as the fruit fly, *Drosophila melanogaster*. Members of my research team have investigated mutants of several ID-and-microcephaly genes in *Drosophila*. We discovered that their brain neurons extend small arbors of branches when cultured *in vitro*, but each one has a distinct abnormality. We have also used cultured neurons to identify drugs that reverse defects caused by mutations. I will present the key data in support of a strategy to develop safe and effective drugs for improving brain development in children with microcephaly-associated ID.

October 5

**JANE M CARRINGTON**, Associate Professor, UA Nursing

**TITLE: Nurse-to-Nurse communication using the Electronic Health Record with implications for decision-making and patient outcomes**

**ABSTRACT:** Nearly 100,000 patients die each year in our nation's hospitals due to miscommunication. Unfortunately, the implementation of the current electronic health record (EHR) has done little to improve this statistic. The EHR has increased legibility of the health record, supports data entry, and has made the record available through the network to all members of the health care team. Nurses have also reported, however, that retrieval of patient information is difficult. Furthermore, the patient data collected in the current EHR is not considered valuable towards continuing care of patients. These attributes threaten the effectiveness of the current EHR as a communication system. Nurses have stated their primary source of patient information is the change of shift hand-off. Unfortunately, the hand-off is also an ineffective communication system. The hand-off is often plagued with errors. Interestingly, for the same patient, the EHR and the hand-off rarely align due to missing and inconsistent patient information. In addition, the current EHR and hand-off pose a threat to effective nurse-to-nurse communication and decision-making for patients who experience a change in status. Of particular interest are patients who experience a clinical event (CE) or pain, fever, bleeding, changes in output, respiratory status or level of consciousness. The hypothesis of my research is that effective nurse-to-nurse communication can reduce unexpected deaths for patients who experience a clinical event. My research has focused on language used by nurses to describe CEs in the EHR and hand-off, nurse-EHR interaction and decision-making. My team is working towards solutions to improving the EHR using strategies that include natural language processing, machine learning, and artificial intelligence. Here I will present an overview of my research exploring nurse-to-nurse communication of CEs and decision-making and their impact on patient outcomes.

October 12

**ARNE DAVID EKSTROM**, Associate Professor, UA Department of Psychology

**TITLE: Decoding how we represent space when we navigate**

**ABSTRACT:** While the field has made significant progress in understanding how other species navigate, many fundamental questions remain regarding how humans accomplish this important everyday function. Here, we present studies that attempt to understand our unique and flexible code for space. We present experiments investigating the

interface between cartographic maps and spatial representation, cued recall and spatial representation, and verbal/linguistic codes and spatial representation. Together, these findings will explore key differences in our navigational code compared to other species, suggesting that cognitive representations for cartographic maps and language are dynamically integrated with space to a greater extent than suggested previously.

October 19

**GARY LUPYAN**, Associate Professor, Department of Psychology,  
University of Wisconsin at Madison

**TITLE: From perception to symbolic thought: How language augments human cognition**

**ABSTRACT:** Language is often held to be one of the defining traits of our species. Yet for all its claimed importance, most cognitive scientists work under the assumption that language, while useful for communicating pre-existing thoughts, plays a minor if any role in their construction. I will argue that this view is mistaken and that words play a much more central role in forming useful mental representations than is generally acknowledged. I will show how the use of language actively modulates performance on “nonverbal” tasks from low-level perception to higher-level reasoning. Taken together, the results suggest that some of the unique aspects of human cognition may stem from the use of words to flexibly transform mental representations into more categorical states. These findings have relevance for understanding the cognitive consequences of language impairments and for questions concerning linguistic relativity.

October 26

**CHANGXU WU**, Professor, UA Department of Systems & Industrial Engineering

**TITLE: Human performance modeling and its applications in systems engineering**

**ABSTRACT:** This research seminar introduces the major research activities at the Cognitive System at University of Arizona, focusing on human cognition/performance modeling with its applications in systems engineering (e.g., human-in-the-loop transportation systems and human-machine interaction). Human performance modeling is a growing and challenging area in human factors and cognitive systems engineering. It builds computational models based on the fundamental mechanisms of human cognition and human-system interaction, employs both mathematical and discrete event simulation methods in industrial engineering, and predicts human performance and workload in real-world systems. It can be used to design, improve, and evaluate systems with

human in the loop. Current and future research topics will also be introduced.

November 2      **CHARLES NOUSSAIR**, Professor of Economics, UA Eller Department of Economics

**TITLE: Emotions and economic decision making**

**ABSTRACT:** This talk describes a number of studies relating emotional state and economic decision making. Two technologies that are new to economics are described. These are (1) the use of facereading software to measure and track emotional state, and (2) the use of 360 degree videos shown in virtual reality to induce emotions. The talk describes some results regarding the relationship between emotions and risk taking, honesty, cooperation, charitable giving, and reciprocity.

November 9      **ELIZABETH L GLISKY**, Professor, UA Department of Psychology

**TITLE: Enhancing memory in normally-aging adults**

**ABSTRACT:** This talk will describe two sets of experiments looking at ways to enhance memory in older adults: 1) a cognitive strategy relying on self-referential processing, and 2) a social strategy relying on social interaction.

November 16      **MASSIMO PIATTELLI-PALMARINI**, Professor, UA Departments of Linguistics & Psychology

**TITLE: Normal language in abnormal brains**

**ABSTRACT:** There is little doubt that, in the adult, specific brain lesions cause specific language deficits. Yet, brain localizations of linguistic functions are made problematic by several reported cases of normal language in spite of major brain anomalies, mostly, but not exclusively, occurring early in life. The signal cases are hydrocephaly, spina bifida and hemispherectomy. Many patients have normal syntax and lexicon, but suffer from grave problems in the use of language (they are linguistically dyspraxic), showing that the interface is affected. These cases are discussed and possible solutions are suggested: namely a vast redundancy of neurons and/or the role of microtubules as neuron-internal processors and key factors in signaling and guiding the growth and reconfiguration of the brain.



November 30

**LAURA WAGNER**, Associate Professor, Department of Psychology;  
Director, Language Sciences Research Lab, The Ohio State University

**TITLE: Performance factors influencing competence with linguistic aspect**

**ABSTRACT:** It is frequently argued that children are competent with some dimension of language, but their knowledge is being masked by performance limitations. However, in most cases, the evidence for these performance factors is indirect and the specific links between cognitive skills and linguistic forms is vague. The current work examines a well-documented under-extension in children's language and the cognitive skills that predict children's performance of it. The linguistic phenomenon involves aspect: children prefer to say (and better comprehend) predicates describing bounded events with perfective rather than imperfective morphology and the reverse for unbounded events. That is, despite the fact that all four of the following sentences are grammatical, children prefer "The girl closed the door" over "The girl was closing the door" and "The girl was listening to music" over "The girl listened to music". Children and adults were tested on their ability to understand a range of aspectual combinations (both preferred and non-preferred) and were also tested on a series of independent cognitive assessments. The results showed specific links between inhibitory control and vocabulary size with different non-preferred combinations that were consistent with formal semantic accounts of those linguistic forms. More generally, the results show how it is possible to use performance to illuminate the nature of competence.

**COGNITIVE SCIENCE COLLOQUIUM**  
**Spring 2018**

**January 19, 2018**

**Seana Coulson**, Associate Professor, Department of Cognitive Science, University of California, San Diego

**TITLE**—Conceptual mappings in brain and mind

**ABSTRACT:** I will discuss the importance of metaphoric and analogical mapping as organizing structures in cognition, and suggest that maps and mappings are a fundamental aspect of neurophysiology. In order to demonstrate the role of mapping in language comprehension, I'll present results from several event-related potential (ERP) studies on the comprehension of metaphoric language. Finally, I consider the extent to which synesthesia provides a good model for the neural basis of metaphor.

**January 26**

**Kristy Hollingshead**, Research Scientist, Florida Institute for Human & Machine Cognition (IHMC)

**TITLE**—Everyday language as a signal of mental state

**ABSTRACT:** Language -- spoken or written -- is an activity that we all engage in every day. The way that we use language -- what we say and how we say it -- provides a surprisingly sensitive measure of our own mental state, and as such, may act as a predictor of future behavior. In fact, many mental and neurological health conditions present with changes in language and behavior, such as a switch in the types of topics discussed, a shift in word usage or syntax, variations in the speech signal, or differences in sleep patterns or social interactions. This talk will cover two studies in which natural language processing (NLP) techniques were applied to measure mental state and predict behavior. The first study focuses on assessing mental health disorders, specifically depression, anxiety, and schizophrenia, using language as captured from Twitter. The second study examines the occurrence of "outrage" in online discussions of cyberattacks, using anomaly detection to predict future cyberattacks. In both studies, timeseries analysis revealed interesting patterns when compared to controls, and correlations to a timeseries of relevant events.

**February 2**

**Dominic McIver Lopes**, Distinguished University Scholar, Professor, Department of Philosophy, University of British Columbia

**TITLE**—Third space: Integrating aesthetics research through philosophy

**ABSTRACT:** After decades of neglect, the recent boom in research on aesthetic and artistic phenomena in the behavioural and brain sciences has led to some tentative but not yet profitable exchanges between the "two cultures" of the sciences and the humanities. The diplomacy is delicate and a great deal is at stake, lest we saddle ourselves with a divided self-conception, one scientific and the other humanistic. However, Snow's talk of "cultures" is an obstacle. In this talk, I suggest a better metaphor, one of "common space." To bring us together, a common space needs to have three features: it must be comprehensively bounded, integrated, and layered. I'll explain what I mean with examples.

**February 16**

**Brian McLaughlin**, Professor of Philosophy and Cognitive Science,  
Rutgers University

**TITLE**—Representational issues concerning normal geometrical  
misperception

**ABSTRACT:** Normal geometrical misperception occurs whenever the way something looks with respect to geometrical properties to a normal human perceiver in normal viewing circumstances differs from the way it in fact is. Well-known visual illusions such as the Müller-Lyer arrows illustrate normal geometrical misperception. Although the two arrow shafts are the same length, one looks longer than the other even to a normal human perceiver in normal viewing circumstances. Normal geometrical misperception is not restricted to lab-induced stimuli or special cases. On the contrary, there is a large body of evidence that indicates that normal geometrical misperception is systematic and wide-spread. Indeed, on the evidence, there is normal geometrical misperception virtually whenever a normal perceiver in normal viewing circumstances sees a scene. The talk presents some of this evidence and explores what the fact of systematic, widespread normal geometrical misperception might indicate about visual representation, in particular, about representation in what Ken Nakayama calls “mid-level vision.”

**February 23**

**Kimberly M. Fenn**, Associate Professor, Department of Psychology,  
Michigan State University

**TITLE**—Psychology and the law: Is there a role of sleep?

**ABSTRACT:** The preponderance of exonerations convincingly shows that there are flaws in the criminal justice system in the United States. The National Registry of Exonerations reports that at least 2100 individuals were convicted of crimes that they did not commit and many of these individuals served years in prison before exoneration. These sorts of errors pose dire consequences in that innocent individuals suffer in prison and guilty perpetrators remain free to commit further crimes. In this talk, I will propose that a relatively unexplored factor, sleep, contributes to efficacy of the criminal justice system. Sleep consolidates memory whereas sleep deprivation is associated with a wide range of cognitive deficits, including decreased executive function and impaired decision making ability. This is relevant to psychology and the law because legal actors (e.g., police, witnesses, suspects) may make important decisions having not obtained sufficient sleep. For example, approximately one half of police departments require officers to work 12-hour shifts or rotating shifts, resulting in fewer hours of lower-quality sleep. Insufficient sleep likely also affects witnesses and suspects of crimes. Most Americans do not obtain sufficient sleep each night, a trend which is growing worse with time. I will discuss ongoing work in my laboratory that explores how sleep and insufficient sleep may contribute to successes and failures in the criminal justice system.

**March 16**

**Muhammad Spocter**, Director, Master of Science in Anatomy Program;  
Assistant Professor, Department of Anatomy; Doctor of Osteopathic  
Medicine Program, Des Moines University

**TITLE**—From Big Bad Wolf to Man’s Best Friend: Domestication and its  
effect on the Canid brain

**ABSTRACT:** The domestication of animals marked a major turning point in human prehistory and dramatically affected the behavior and morphology of several target species, including that of the domestic dog. In this talk we will review evidence for changes in brain and brain component size in domestic species and will highlight some key anatomical differences as it relates to the brain of the domestic dog and some of its closest living relatives.

**March 23**

**Tom Griffiths**, Professor of Psychology and Cognitive Science; Director of Computational Cognitive Science Lab and the Institute of Cognitive and Brain Sciences, University of California, Berkeley

*2017-2018 Roger N. Shepard Distinguished Visiting Scholar*

**TITLE**—Universal psychological laws and the algorithmic level of analysis

**ABSTRACT:** One of Roger Shepard's many contributions to psychology is the idea that there might exist universal psychological laws – principles that characterize the behavior of any intelligent organism, regardless of where they are in the universe. Over the last couple of decades methods such as rational analysis have been used to derive candidate universal laws, starting with the abstract problems faced by organisms and asking what ideal solutions to those problems look like. However, this approach typically disregards another kind of universal constraint – that all organisms have limits on their computational resources and competition for their time. In addition, for many aspects of the mind that we might seek to explain – phenomena such as scientific discovery, creativity, and imagination – the key questions we want to answer are not about the abstract problem being solved, but about the method by which it is being solved. I will present a new framework for engaging with these questions, based on the idea of pushing the principle of optimization that is implicit in the derivation of universal psychological laws to what David Marr called the algorithmic level of analysis. The resulting approach, which we call "resource rational analysis," can help to explain some of the ways in which people deviate from classic rational models and provides a way to derive new universal psychological laws at the algorithmic level.

**March 30**

**Bradley S. Gibson**, Professor, Department of Psychology, University of Notre Dame

**TITLE**—Does ADHD reflect a core deficit in working memory?

**ABSTRACT:** Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopment disorder arising from heterogeneous causal pathways. One major pathway is thought to involve deficient executive functioning, and within this pathway, working memory (WM) has been identified as a core deficit underlying the disorder. But, this understanding has not kept pace with contemporary cognitive theories which currently construe WM as a complex construct consisting of multiple components, including executive attention, the focus of attention, and temporal-contextual retrieval dynamics. In addition, each of these components may also be modulated by arousal mechanisms. In this talk, I will interpret behavioral evidence within the framework of the Temporal Context Model of memory search and I will conclude that individuals with ADHD do not have a core deficit in WM. Instead, what appears on some behavioral measures as a deficit in one

component of WM—the ability to use temporal-contextual cues to retrieve goal-relevant information—actually reflects deficient modulation by arousal mechanisms such as alertness or sustained attention.

**April 6**

**Steven Bethard**, Assistant Professor, School of Information, University of Arizona

**TITLE**—Does ADHD reflect a core deficit in working memory?

**ABSTRACT:** Humans can easily read a written narrative and infer the underlying timeline, but this type of language understanding remains a difficult challenge for machines. Human language is rarely explicit in the way that would be most convenient for a computer, and events, times, and temporal relations are often implicit, left to be inferred by the reader. In this talk, I will examine the language of time through two lenses: (1) how well humans are able to make explicit their implicit inferences about time, and (2) how computers can be trained to make similar inferences. These two viewpoints are intertwined, as the machine learning methods we use to teach computers about language rely on humans to provide them with high quality examples annotated explicitly with their implicit semantics. I will show that a variety of ways of encoding human knowledge about timelines are needed to support machine understanding of the language of time.

**April 13**

**Jennifer S. Trueblood**, Assistant Professor, Department of Psychology, Vanderbilt University

**TITLE**—The dynamics of choice

**ABSTRACT:** An important question in decision-making is how preferences for different options are constructed and evolve over time. Dynamic models provide a way to explore the underlying cognitive processes involved in choice behavior, which I will illustrate in two applications. In one application, I will discuss how people make decisions when faced with multiple alternatives and how preferences are influenced by context. For example, most of us recognize that a store's layout (i.e., the context created by product placement) can influence what we buy. In a second application, I will discuss how framing effects in risky decision-making arise from the dynamic interplay of affective and deliberative reasoning systems. In particular, I will show how a dynamic dual process model can account for the influence of time pressure on risky choice behavior.

**April 20**

**Dan Jurafsky**, Professor and Chair of Linguistics, Professor of Computer Science, Stanford University

**TITLE**—“Does this vehicle belong to you?” Processing the language of policing for improving police-community relations

**ABSTRACT:** Police body-worn cameras have the potential to play an important role in understanding and improving police-community relations. In this talk I describe a series of studies conducted by our large interdisciplinary team at Stanford that use speech and natural language processing on body-camera recordings to model the interactions between police officers and community members in traffic stops. We draw on linguistic models of dialogue structure and of interpersonal relations like

respect to automatically quantify linguistic aspects of the interaction from the text and audio. I describe the differences we find in the language directed toward black versus white community members, and offer suggestions for how these findings can be used to help improve the fraught relations between police officers and the communities they serve.

**April 27**

**Daniel Mirman**, Associate Professor, Department of Psychology, University of Alabama at Birmingham

**TITLE**—Neuroanatomy of core language systems: A data-driven journey

**ABSTRACT:** The classic Wernicke-Lichtheim-Geschwind model of the neural basis of spoken language is undergoing major revisions due to the development of non-invasive brain imaging methods and advances in analysis techniques. These new methods have made it possible to apply the classic “lesion method” at a much finer anatomical scale. In several recent studies, we have used machine learning and data science methods to examine large datasets from individuals with language deficits after stroke (aphasia). These studies have identified the cognitive sub-systems that support language processing and the neural basis of those sub-systems. The resulting functional and neuroanatomical model of spoken language processing forms an important bridge between basic research on the neural basis of language and the real-world problem of aphasia diagnosis and treatment.

**May 4**

### **Cognitive Science Graduate Student Showcase**

**Trianna Oglivie**, Group versus individual delivery of enhanced conversational recast

**ABSTRACT:**

**Purpose:** This study examines the effects of Enhanced Conversational Recast for treating morphological errors in preschoolers with Developmental Language Disorder. The study assesses the effectiveness of this treatment in a group (n=2) setting and the possible benefits of exposing a child to their treatment partner's target in addition to his or her own.

**Method:** Twenty children were assigned to either an individual (n=10) or group (n=10, 2 per group) condition. Each child received treatment for one morpheme target for 5 weeks. Children in the group condition had a different target from their treatment partner. Pre- and post-treatment measures compared correct usage of the target morpheme and a control morpheme. For children in the group condition, the correct usage of their treatment partner's target was also compared.

**Results:** Significant treat effects occurred for both treatment conditions for morphemes treated directly. There was no statistically significant difference between the treatment conditions immediately post-treatment or at follow-up. Children receiving group treatment did not demonstrate significant gains in producing their partner's target despite hearing the target modeled during treatment.

**Conclusions:** This study provides the evidence base for Enhanced Conversational Recast Treatment in a small group setting, the most frequently used treatment setting in schools. Results indicate the importance of either attention to the recast or expressive practice (or both) to produce

effective doses in this treatment.

**Siyu Wang**, What is the nature of decision noise in random exploration?

**ABSTRACT:** The explore-exploit tradeoff is a fundamental behavioral dilemma faced by all adaptive organisms. Should we explore new options in the hopes of finding a better meal, a better house or a better mate, or should we exploit the options we currently believe to be best? Striking the right balance between exploration and exploitation is a hard computational problem and there is significant interest in how humans and other animals make explore-exploit decisions in practice. One particularly effective strategy for solving the explore-exploit dilemma is choice randomization. In this strategy, the decision process is corrupted by noise meaning the high value "exploit" options are not always chosen and exploratory choices are sometimes made by chance. In theory, such "random exploration" can be surprisingly effective in explore-exploit problems and, if implemented correctly, can come close to optimal performance. Recent work suggests that humans actually use random exploration to solve simple explore-exploit problems. Despite this progress a number of questions remain about the nature of random exploration as there are a number of ways in which seemingly stochastic choices could be generated. In one strategy, that we call the "external noise strategy", participants can rely on stochasticity in the world and allow irrelevant features of the stimulus to drive choice. In another strategy call "internal noise strategy", people could rely on stochastic processes within their own brains. In this work, we modified our recently published "Horizon Task" in such a way as to distinguish these two strategies. Using both a model-free and model-based analysis of human behavior we show that both types of noise are present in explore-exploit decisions, but that random exploration is dominated by internal noise. This suggests that random exploration is dominated by internal noise. This suggests that random exploration depends on adaptive noise processes in the brain which are subject to (perhaps unconscious) cognitive control.

**COGNITIVE SCIENCE COLLOQUIUM**  
**Fall 2017**

**September 1, 2017**

**Lynn Nadel**, Regent's Professor, Department of Psychology, University of Arizona

**TITLE**—Hippocampus: Why memory and space?

**ABSTRACT:** The hippocampus has been linked to two core cognitive functions: memory and spatial/cognitive maps. In this talk I consider why these two apparently distinct psychological functions engage the same neural system. Data from behavioral and neuroimaging studies will be described, and a fair amount of speculating will be done.

**September 8**

**Mary Alt**, Associate Professor, Department of Speech, Language & Hearing Sciences, University of Arizona

**TITLE**—Working memory profiles of children with dyslexia, language impairment, and typical development

**ABSTRACT:** Compared to children with typical development (TD), children with dyslexia (DYS), language impairment (LI), or both (DYS/LI) often demonstrate working memory deficits. It is unclear how pervasive the deficits are, or whether the deficits align with diagnostic category. The purpose of this study was to determine whether different working memory profiles would emerge on a comprehensive battery of central executive, phonological, and visuospatial working memory tasks and whether these profiles were closely associated with group membership. This talk will review: (1) our team's work to build a comprehensive battery of working memory for children; (2) the use of data from that battery to test models of working memory; (3) the resulting working memory profiles that emerge for children with different clinical diagnoses.

**September 15**

**J. Christopher Maloney**, Professor, Department of Philosophy, University of Arizona

**TITLE**—The phenomenal character of perceptual experience: Direct realism redux

**ABSTRACT:** Contrast perception with other modes of conscious cognition. First you see - and later well remember - a rose to be red. Your perceptual experience and its trailing memory concur in content but differ in conscious phenomenal character. What is like to see the rose differs from what it is like to remember the same. Why? Why if all thought is just representation? Some reply by denying the presupposition. They insist that difference in character demands difference in content after all. Others concede the presupposition. However, they contend that a perceptual experience owes its peculiar character to being the content or target of a monitoring cognitive state. Each answer flounders. It is not the content, but rather the vehicle, of perceptual representation that secures perception's phenomenal character. For in perception the mind extends into its environment to convert stimuli into self-referential representations. As wrongly disparaged direct realists once rightly proposed, perception fulfills its phenomenal promise by permitting direct acquaintance with the world.



What it is like to see is to adopt the scene to see.

**September 22**

**Mary A. Peterson**, Professor, Department of Psychology; Director, Cognitive Science Program, University of Arizona

**TITLE**—Toward a new understanding of object perception

**ABSTRACT:** Visual perception was long understood as a serial feedforward process in which, at a very early stage of processing, borders between regions in the visual input were assigned as bounding contours to the region on one side; this constituted object detection (*aka figure assignment*). The other region, lacking a shaping contour, was perceived as a locally shapeless ground to the object. On this feedforward view, object memories and semantics were accessed only after object detection occurred and only for objects ("figures"), not for grounds. Research in my laboratory shows that this traditional view is incorrect, and favors the alternative view that before object detection, a fast pass of processing activates multiple possible object hypotheses that could fit both sides of borders. These hypotheses compete for perception at high and low levels of the visual hierarchy. The winner is detected/perceived; the loser is suppressed. In my talk, I will review some history and then summarize five recent experiments consistent with the view that object detection occurs via hierarchical Bayesian inference.

**September 29**

**R. Alison Adcock**, Assistant Professor, Psychiatry and Behavioral Sciences; Core Faculty, Center for Cognitive Neuroscience

**TITLE**—Motivation as neural context regulating learning

**ABSTRACT:** Motivation guides and animates behavior based on representation of counterfactuals from memory. The role of motivation in reinforcement learning has long been well studied, particularly in animal paradigms that require extrinsic incentives; yet neuroscience is, ironically, only recently coming to study how motivation guides memory, including the assembly of complex models of the world and the pursuit of knowledge – motives that guide science itself. The last several years have seen an explosion of methods for examining the biology of human cognition and behavior and relating it to rich traditions and findings in animals. In particular, the ability to quantify neural activity associated with distinct motivational states using functional neuroimaging now offers exciting insights into neuromodulatory systems associated with motivation and the neural foundations of adaptive memory formation. These biological findings, in turn, point to new behavioral predictions and questions about learning and memory. The work of the Adcock laboratory is to understand how motivation shapes memory formation and to help leverage that understanding to improve education and learning-based therapies. In this presentation, I will review our recent work guided by hypotheses grounded in both animal models and human clinical insights, selectively targeting the neural architecture of motivational states during memory formation, to understand how they influence both maladaptive ideas and successful human adaptation.

**October 6**

**Lee Ryan**, Professor and Head, Department of Psychology, University of

Arizona

**TITLE**—Contributions of perirhinal and postrhinal cortex to memory: Implications for aging and Alzheimer’s disease

**ABSTRACT:** A prominent view of perirhinal cortex (PRC) and postrhinal/parahippocampal cortex (POR/PHC) function is that these structures are tuned to represent objects and spatial information, respectively. My colleagues and I have recently proposed an alternative view that derives from known anatomical connectivity, neuroimaging data, and the impact of lesions of these structures on cognition. We suggest that PRC and PHC/POR participate in two computationally distinct cortical-hippocampal pathways. A ‘sparse’ pathway forms gist-like representations of scenes/environments. A ‘detail’ pathway processes information about specific sensory features necessary for discrimination across sensory modalities. Importantly, PRC and POR/PHC participate equally in both these pathways. I will discuss recent evidence suggesting that the ‘detail’ pathway may be more vulnerable in normal aging, while functional changes in “sparse” representations may be an early marker of Alzheimer’s pathology.

**October 13**

**Jessica Andrews-Hanna**, Assistant Professor, Psychology and Cognitive Science, University of Arizona

**TITLE**—The dynamics of thought: Language as a window into wandering and sticky minds

**ABSTRACT:** A remarkable characteristic of the human mind is its propensity to wander away from the here-and-now. Along the “stream of consciousness”, our thoughts meander through time and space, constructing mental models of possible futures and providing narrative to our lives. Despite the importance of spontaneous mental activity, methodological challenges and historical biases in cognitive science have thwarted its scientific study. Recent years have brought growing interest and understanding of “mind-wandering,” yet little is known about the content, correlates and consequences of mind-wandering in daily life, nor how such thoughts unfold and transition over time. In this talk, I will 1) describe results from a daily experience sampling study seeking insight into the costs and benefits of off-task thought, 2) introduce a neuroscientific framework for understanding mind-wandering by its dynamic properties, and 3) describe preliminary studies highlighting the potential for language and conceptual processing to illuminate dynamic trajectories of thought, with important implications for mental health.

**October 20**

**Sepideh Friberg Sadaghiani**, Assistant Professor of Psychology, University of Illinois, Urbana-Champaign

**TITLE**—Network dynamics underlying cognitive control

**ABSTRACT:** Cognitive control involves focusing on relevant environmental signals and coordinating complex behaviors. These processes are fundamental to all goal-directed cognition resulting in universal importance in function and dysfunction of the brain. Understanding the neurobiological basis of these functions requires concurrent investigation of the brain at several spatial and temporal scales from control networks

spanning across lobes to fine-scale electrophysiological mechanisms. I will present such a multi-modal approach that characterizes cognitive control functions such as alertness and selective attention in terms of concrete neurobiological mechanisms. I will furthermore discuss how the study of intrinsic or spontaneous background activity in the brain may explain lapses in these cognitive control functions. These findings are integrated in the formulation of a comprehensive model of cognitive control that motivates future investigations.

**October 27**

**LouAnn Gerken**, Professor, Department of Psychology, University of Arizona

**TITLE**—Parallels between non-linguistic and linguistic generalizations by infants and adults

**ABSTRACT:** Shepard, Hovland, and Jenkins (1961) defined six types of non-linguistic visual categories, including 2 rule-based categories (single feature and exclusive OR) and a non-rule-based family resemblance category. In research with adults, the order of supervised learning is single feature > exclusive OR > family resemblance (> indicates “easier than”). However, in unsupervised learning (no feedback), the order is: single feature > family resemblance > exclusive OR. Recently, researchers classified phonological rules of a variety of human languages in terms of the Shepard categories, and found the order to mirror that of supervised learning: single feature > exclusive OR > family resemblance (> indicates “more frequently encountered in human language than”). Since language learning is assumed to be unsupervised, what is the reason for the frequency of rule types across languages? The answer that I will propose is that, while adults are very poor at learning exclusive OR linguistic rules and very good at learning family resemblance rules, infants are a whiz at learning exclusive OR rules. Thus the frequency of phonological rule types across languages reflect what infants, not adults, are most adept at learning.

**November 3**

**Jody Culham**, Professor, Department of Psychology; Graduate Program in Neuroscience; Brain and Mind Institute, Western University, London, Canada

**TITLE**—“The treachery of images”: Why brains, babies and adults react differently to real objects than photos

**ABSTRACT:** Psychologists and neuroimagers commonly study perceptual and cognitive processes using images because of the convenience and ease of experimental control they provide. However, real objects differ from pictures in many ways, including the availability and consistency of depth cues and the potential for interaction. Across a series of neuroimaging and behavioral experiments, we have shown different responses to real objects than pictures, in terms of the level and pattern of brain activation as well as visual preferences. Now that these results have shown quantitative and qualitative differences in the processing of real objects and images, the next step is to determine which aspects of real objects drive these differences.

**November 17**

**CANCELED Michael I. Norton**, Harold M. Brierley Professor of Business Administration, Harvard Business School, Harvard University

# COGNITIVE SCIENCE COLLOQUIUM

## Spring 2017

April 28

### Graduate Student Showcase

**Stanley Donahoo**, Graduate Student, Department of Linguistics, University of Arizona

**TITLE:** The Swearing Brain: Language Comprehension Insights

**ABSTRACT:** Expressives are speaker-oriented, not-at-issue content (Potts, 2005). How is the expressive dimension of language processed and represented? The present study focuses on the most clearly expressive items, swear words (damn, shit, hell, etc.). The study of swear words is important to linguistics and cognition in general. For instance, patients with aphasia or stroke can often recite automatic chunks include swearing (Van Lancker & Cummings, 1999), even when the left hemisphere language areas are completely offline. Thus, swear words provide a testing ground for language processing and representation. In a lexical decision task, participants (N=34) read swear words (shit), negatively valenced but non-swear words (sick), neutral content words (lend), neutral function words (while), and pseudowords. The results show that swear words took longer to access than negatively valenced content words, but were accessed as quickly as the function words. The difference between swear words and negatively valenced but non-swearing words suggests that there is more to the expressive dimension than merely a heightened emotional state. An ongoing EEG experiment (N=9 so far) is further testing the neural basis of expressive language.

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**Bryan Kromenacker**, Graduate Student, Department of Psychology, University of Arizona

**TITLE:** Engagement matters: pupil size and performance on a difficult mental task mediate performance reduction on a subsequent physical task

**ABSTRACT:** Self-control depletion theory claims to account for between-task performance changes in terms of the consumption of a limited cognitive resource. Dual-task designs have been used to demonstrate that *increased* self-control on an initial effortful task predicted *decreased* self-control on a later categorically distinct effortful task, supporting a non-rational (i.e., not based upon explicit value calculation) resource-like effect. These accounts struggle to identify specific mechanisms linking them to rational theories of effort, and the reported effect size has recently come into question. Subject engagement during the depleting task is often assumed, but systematic disengagement may account for inconsistencies in the observed effect. We recreated a common dual-task depletion paradigm using a computer-automated design allowing for measurement of individual task performance as well as pupil size. We found evidence that task engagement measures do indeed account for some individual variation in the depletion effect, offering a possible explanation for inconsistent group-level effects.

**April 21**

**Aneta Kielar**, Assistant Professor, Department of Speech, Language, and Hearing Sciences, University of Arizona

**TITLE:** Language Related and Spontaneous Oscillatory Responses in Acquired Language Disorders

**ABSTRACT:** Mapping oscillatory neural activity with magnetoencephalography (MEG) is a powerful method for revealing the functional organization of different aspect of language, and the changes associated with stroke. Considerable changes in the cortical representation of language processing can follow stroke. However, the neural mechanisms mediating recovery and relative contributions of each hemisphere are not well understood. In the present set of studies I used MEG to understand the roles of perilesional and contralesional activity in recovery of semantic and syntactic processing in patients with post-stroke aphasia, and to explore the role of right hemisphere in language recovery. The resting state MEG and fMRI, as well as blood flow measures were used to identify dysfunctional cortex.

In healthy controls, a left-lateralized temporo-frontal “ventral network” responded to semantic anomalies during sentence comprehension, and a bilateral fronto-parietal “dorsal network” responded to syntactic anomalies. For participants with aphasia, I observed compensatory recruitment in the right hemisphere. Interestingly, the distribution of this effect was depended on the type of linguistic information that was processed. Better recovery of semantic processing was associated with a shift to the right hemisphere components of the ventral network. In contrast, recovery of syntax was mediated by dorsal brain regions, bilaterally.

The analysis of resting state activity indicated that reduced BOLD variability was associated with aging, whereas spontaneous MEG measures were more sensitive to the cortical abnormalities associated with stroke. Furthermore, reduced MEG complexity in perilesional tissue was correlated with hypoperfusion as assessed with arterial spin labeling, while no such relationship was apparent with BOLD variability. These findings suggest that MEG signal complexity offers a sensitive index of neural dysfunction in perilesional tissue in chronic stroke, and that these effects are distinguishable from those associated with healthy aging. The resting state measures may be useful indicators of cortical dysfunction that is potentially reversible with treatment, and may be used to assess the effectiveness of interventions.

**April 14**

**Ying-hui Chou**, Assistant Professor, Department of Psychology, University of Arizona

**TITLE:** Repetitive Transcranial Magnetic Stimulation and Functional Connectivity Mapping in Clinical and Psychological Research

**ABSTRACT:** Repetitive transcranial magnetic stimulation (rTMS) is a non-invasive neuromodulation technique that has been closely examined as a possible treatment for a number of diseases. Although accumulating evidence suggests that rTMS can be utilized to enhance motor or cognitive function in clinical populations, little is known about how the rTMS modulates brain activities and how these changes correlate with improvement of function.

Functional connectivity measured by resting-state fMRI has played an essential role in understanding brain functional networks in healthy

individuals and clinical populations. Resting-state functional connectivity is defined as the temporal co-activation level of spontaneous fMRI signals between spatially distinct brain regions when participants are not required to perform a perceptual or behavioral task.

In this talk, Dr. Ying-hui Chou will first present an overview of rTMS and resting-state connectivity separately. Then she will talk about her research that combines both rTMS and resting-state connectivity to investigate the therapeutic rTMS effects on brain connectivity. The long-term goal of Dr. Chou's lab is to adopt a multi-modal approach that combines rTMS and resting-state functional connectivity in conjunction with other brain imaging techniques to leverage the applications of rTMS and resting-state functional connectivity in the study of both normal and pathological conditions.

**April 7**

**Eric D. Smith**, Assistant Professor, Department of Educational Psychology, University of Arizona

**TITLE**—Glancing Through the Looking Glass: Perpetual Pretending and Bearable Behavior

**ABSTRACT:** The world of fiction appeals to many of us, through books, movies, and even pretending. The power of fictional content has prompted many research questions. How long in life do we engage in pretending? Do children transfer content from fictional worlds, like storybooks, into reality? In this talk, I address these overarching questions by 1) assessing Piaget's claim pretending ceases at 7 years of age; 2) demonstrating permeability in the fiction-reality boundary within the storybook realm; and 3) proposing a working model for fiction-reality breakdowns within the storybook domain.

**March 24**

**Evan MacLean**, Assistant Professor, School of Anthropology, University of Arizona

**TITLE:** The Fundamental Importance of Comparison in the Study of Cognitive Evolution

**ABSTRACT:** Since Darwin, understanding the evolution of cognition has been widely regarded as one of the greatest challenges for evolutionary research. In the last century, comparative psychologists have made great progress toward identifying aspects of cognition that humans share with other species, as well as cognitive processes that may be uniquely derived in our own lineage. Despite this progress, cognitive studies with animals have focused heavily on a few model species, with less effort toward broadly comparative, and explicitly phylogenetic approaches. I will present recent studies emphasizing the role of comparison in 'comparative cognition' to illustrate how these approaches can reveal major forces driving cognitive evolution, and inform hypotheses for how and why cognition has evolved across species, including humans.

**March 3**

**Melissa C. Duff**, Associate Professor, Hearing and Speech Sciences; Director, Communication and Memory Laboratory, Vanderbilt Bill Wilkerson Center, Vanderbilt University School of Medicine

**TITLE:** The role of hippocampus in language use and processing

**ABSTRACT:** Language use requires the rapid and incremental processing of flexible and contextually defined linguistic forms that are formulated in rich, multi-modal environments. How this is accomplished in the brain,

however, is an open question. While attempts to link aspects of memory to particular properties of language are longstanding, the hippocampal declarative memory system has not received serious consideration as a neural/cognitive system involved in language use and processing. This is in part due to the long-held assumption that the hippocampal declarative memory system contributes only to long-term memory representations and not those that are available quickly enough to guide on-line information processing. Combining discourse analysis, eye-tracking, and neuropsychological methods I will present evidence for the proposal that the hippocampal declarative memory system is a key contributor to language use and processing. This proposal draws on the relational binding and representational flexibility that are hallmark characteristics of the declarative memory system, along with recent findings stretching the scope of hippocampus-dependent processes to functions that operate in-the-moment and on the narrowest of time-scales. Linking disruptions in language use and processing to the declarative memory system demonstrates how promiscuously the hallmark processing features of the hippocampus are called upon by a variety of cognitive domains, including language, and expands the network of neural and cognitive systems that support language use.

**February 24**

**Megha Sundara**, Associate Professor, Department of Linguistics, University of California, Los Angeles

**TITLE**—Acquisition of Verbs: A window to the mental representation of morphology and phonology

**ABSTRACT:** Verbs are difficult for infants to learn. Cross-linguistically, children have more nouns in their early vocabulary than verbs. In this talk, I will present perception data from English-learning infants within the first year of life to address when and how infants begin to learn verb forms. Then, I will use infants' abilities (or lack thereof) in relating multiple forms of verbs, like walk, walks, walked and walking, to answer how verbs are represented in the mental lexicon. Finally, I will discuss the implications of these findings for models of spoken word recognition.

**February 17**

**Julia L. Evans**, Professor, School of Behavioral and Brain Sciences, The University of Texas at Dallas

**TITLE**— Poles, Bowls and Dinosaur Bones: How Atypical Lexical Representations may be Derailing Sentence Comprehension for Children with Specific Language Impairment

**ABSTRACT:** Rumelhart (1979) argued that comprehension, like perception, should be likened to Hebb's (1949) paleontologist, who uses his or her beliefs and knowledge about dinosaurs *in conjunction* with the clues provided by the available bone fragments to construct a full-fledged model of the original. In this talk, I explore studies that suggest that, while real world knowledge is intact in children with SLI, deficits at the lexical level (the bone fragments) may be profoundly influencing sentence comprehension performance in children with SLI.

**February 10**

**Maryia (Masha) Fedzechkina**, Assistant Professor, Department of Linguistics, University of Arizona

**TITLE:** Processing and communication shape language learning and structure

**ABSTRACT:** Languages across the world—despite their diversity—also exhibit abstract commonalities. Most theories agree that these commonalities can be traced back to biases and limitations of human cognitive systems. Capturing cross-linguistic generalizations and understanding their causes has been one of the central objectives of linguistics and cognitive science as it can shed light on the nature of constraints underlying language processing and acquisition. My research examines the hypothesis that the cross-linguistic distribution of grammars can be accounted for, at least in part, in terms of their processing or communicative utility (cf. Bates & MacWhinney, 1982; Hawkins, 2004; Christiansen & Chater, 2008).

Using a novel type of the miniature language learning paradigm, I identify biases that cause learners to deviate from the input they receive, thus changing the input to subsequent generations of learners and pushing the system towards language change. I present a series of experiments that investigate whether biases towards efficient information processing and efficient information transmission operate during language acquisition. Our findings support this hypothesis: when presented with inefficient input languages, learners produce languages that deviate subtly but systematically from the input towards more efficient linguistic systems. The newly acquired linguistic systems also tend to more closely resemble cross-linguistic patterns in syntax and morphology than the input learners receive. This suggests that at least some cross-linguistic commonalities originate in biases or limitations of human information processing and communication.

**February 3**

**Michael Hout**, Assistant Professor, Department of Psychology, New Mexico State University

**TITLE:** Becoming an expert at difficult visual search: Experience fine-tunes mental representations of target categories

**ABSTRACT:** In this (still ongoing) project, we investigated effects of expertise on accuracy and oculomotor behavior during difficult visual search. Participants completed up to 23 sessions, searching simultaneously for 20 different categorically-defined targets. Zero to three targets could appear on each trial, with variable frequency, akin to well-documented “prevalence effects.” Unsurprisingly, searchers got faster over time. Despite increased efficiency, with expertise, they were more likely to directly fixate targets, and to spend proportionately more time examining them, relative to distractors. Prevalence effects (better accuracy to more frequent targets) diminished but did not disappear across sessions, and more frequent targets were consistently located more quickly than infrequent ones. Importantly, despite receiving equal attention (indexed by oculomotor behaviors), low-frequency targets suffered more recognition failures (failure to perceive targets after direct fixation) than high-frequency targets. Our findings suggest that, with expertise, searchers refine their mental representations for target categories, particularly common ones, and become more effective at restricting attention to the most relevant features.

**January 27**

**Michael Grandner**, Assistant Professor, Department of Psychiatry, University of Arizona

**TITLE:** Neurocognitive Effects of Sleep Loss and Impact on Cardiometabolic Disease Risk



**ABSTRACT:** Sleep is implicated in a large number of physiologic regulatory properties. Sleep loss has been implicated in cardiometabolic health risk factors including weight gain and obesity, hypertension, diabetes, hypercholesterolemia, and coronary disease. Sleep loss is also implicated in cognitive dysfunction, including decreased attention, impaired working memory and executive function, and problems with decision making. These two domains may overlap. Neurocognitive impairments due to sleep loss may interact with physiologic cardiometabolic risks to increase likelihood of obesity, cardiovascular disease, and diabetes. This presentation will provide an overview of sleep and cardiometabolic disease risk, sleep and neurocognitive function, and how these may overlap.

## COGNITIVE SCIENCE COLLOQUIUM Fall 2016

December 2

### Graduate Student Showcase Presenters, Titles & Abstracts

**Noah Nelson**, Graduate Student, Linguistics-major; Cognitive Science-minor

**Title:** Targeted reduction of phonetic cues to promote lexical contrast

**Abstract:** In speech, phonetic cues to the identity of segments are enhanced in response to competition from similar-sounding words (e.g., voice onset time: bat ~ pat). This is explained by two major theoretical approaches. Production-based approaches assume that activation of a word spreads to similar-sounding competitors, and feedback from those competitors further increases activation within the word, leading to increased phonetic durations. Perception-based approaches assume that, for segments that distinguish two words (e.g., /b/ and /p/ in bat ~ pat), the specific cues that differentiate those segments are made more contrastive. This greater contrast is assumed to increase the perceptual distance between competing words. Notably, perception-based approaches predict that competition can lead to reduction of phonetic cues if that reduction creates a greater contrast between competing words. Production-based approaches predict only enhancement of phonetic cues because the competition process leads to increases in activation. I present evidence from the Buckeye Corpus of Conversational Speech (Pitt et al. 2007) that two very different cues to segment identity in English can be contrastively reduced. This result is predicted by perception-based theories of competition effects, but is difficult to reconcile with production-based approaches.

*and*

**Adam King**, Graduate Student, Linguistics

**Title**—Why Junk in the Trunk Matters: Less predictable words end with more redundant material

**Abstract:** Much psycholinguistic research has shown that listeners process words incrementally. For many words, the point at which sufficient information has been heard to positively identify the word (the "uniqueness point") occurs before the end of the word. For example, the three sounds in "cor-" could be part of several words, "corsair", "corsage", "corpus", but a single sound more, "corp-", can only be the word "corpus". As a consequence, material after the uniqueness point in a word (the "-us" in "corpus") is redundant. In my talk, I will present corpus data from English showing that words which are on average less predictable by their sentential context tend to have more of this redundant material. This supports the hypothesis that this extra material after the so-called uniqueness point plays

a functional role in speech processing by providing additional redundant cues to unexpected words.

**November 18**

**Joshua Knobe**, Professor of Philosophy, Psychology, and Linguistics,  
Department of Psychology, Yale University

**TITLE:** The Essence of Psychological Essentialism

**ABSTRACT:** People appear to understand the social world in terms of essences. This notion plays a key role in the way that people ordinarily think about social categories (gender categories, religious categories, etc.) and also in the way that people think about individuals (the person you truly are deep down inside). But how exactly do people ascribe these essences? I present a series of new studies suggesting that people's judgments of essence can be affected in surprising ways with value judgments. These results provide support for the hypothesis that people's ordinary notion of essence is not a purely value-free scientific notion but a notion that is infused through and through with values.

**November 4**

**Judith F. Kroll**, Distinguished Professor, Department of Psychology,  
University of California, Riverside

**TITLE:** Bilingualism, Mind, and Brain

**ABSTRACT:** The use of two or more languages is common in most places in the world. Yet, until recently, bilingualism was considered to be a complicating factor for language processing, cognition, and the brain. In the past 20 years, there has been an upsurge of research that examines the cognitive and neural bases of second language learning and bilingualism and the resulting consequences for cognition and for brain structure and function over the lifespan. Contrary to the view that bilingualism adds complication to the language system, the new research demonstrates that all languages that are known and used become part of the same language system. A critical insight is that bilingualism provides a tool for examining aspects of the cognitive architecture that are otherwise obscured by the skill associated with native language performance in monolingual speakers. In this talk, I illustrate this approach to language processing and consider the consequences that bilingualism holds for cognition more generally.

**October 28**

**Lauren Emberson**, Assistant Professor, Department of Psychology,  
Princeton University

**Title:** How Does Structured Experience Support Perceptual Development?  
The Role of Top-down Information from Learning and Memory Systems

**Abstract:** A hallmark of development is the tuning of perceptual systems to the structure of the environment. These perceptual changes support the development of key abilities such as language comprehension and face processing. I argue that learning and memory systems not only uncover the structure in real-world experience, they also use top-down or feedback connections to shape developing perceptual systems. To this end, I use functional near-infrared spectroscopy (fNIRS) to record the same physiological signals as fMRI (i.e., hemodynamic response) but using light instead of magnetic fields. This emerging neuroimaging modality allows spatial localization of neural signals while infants are awake and learning. Using fNIRS, I'll present evidence that perceptual systems are shaped by learning and top-down information early in life and within minutes of experience. Moreover, comparisons of typically-developing and at-risk populations (preterm infants) reveal that early deficits in learning-based changes in perceptual systems predict atypical developmental trajectories.

**October 21**

**Ervin R. Hafter**, Professor of the Graduate School, Department of Psychology, University of California, Berkeley

**TITLE:** "Relating shared attention in simple psychophysical dual tasks to processing of natural speech spoken by multiple talkers."

**ABSTRACT:** Reduced performance found when we have to do two things at the same time is often blamed on informational overload, that is, on the need to share a limited attentional resource. In work to be presented here, I will describe results from two quite different conditions that reflect this problem. In one, a subject responds to the levels of simple auditory and visual stimuli when they are presented simultaneously, but otherwise independently, in a psychophysical dual task. In the other, a listener in a simulated cocktail party environment (albeit, w/o booze) derives meaning from speech coming from two different people, each speaking in a cadence descriptive of natural listening. In both conditions, our interest is in the difference between situations where there is a cost of shared attention (serial processing) and where there is not (parallel processing). Without promising closure on this ancient question, I hope to argue convincingly that knowledge of a seemingly related factor in the two conditions, the memories to which target stimuli are compared, provides insight into what it is that allows or prevents freedom from cost in multi-tasking.

**October 14**

**Mariam Aly**, Postdoctoral Research Associate, Princeton Neuroscience Institute, Princeton University

**TITLE:** Perception and Attention in Memory Systems

**ABSTRACT:** Research in cognitive neuroscience has traditionally progressed by studying different components of cognition largely in isolation. But, ultimately, complex behavior is the result of the interplay between multiple aspects of cognition at the behavioral and the neural

levels. With a combination of behavioral, neuroimaging (fMRI) and patient studies, I'll argue that the computations performed by brain regions allow them to critically and flexibly support many different aspects of cognition, from attention to perception to long-term memory. In the first part of my talk, I'll show that at a behavioral level, perception shares functional commonalities with long-term memory, and traditional memory systems of the brain play a critical role in perception. In the second part of my talk, I'll show that attention modulates these "memory systems", and that this modulation has consequences for attentional and mnemonic behavior. Together, my research points to the utility of understanding the brain and behavior by thinking about the mechanisms that allow any given brain region to flexibly contribute to diverse aspects of cognition.

**October 7**

**Laura Schulz**, Associate Professor of Cognitive Science, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology

**2016 Roger N. Shepard Distinguished Visiting Scholar TITLE—**

Inferential economics: Self-knowledge and children's understanding of the costs and rewards of behavior

**ABSTRACT:** Across a series of studies, I will show that very young children reason about when learning will be easy and when it will be difficult. I will suggest that children's understanding of the costs and rewards of information affect both how they learn and how they teach, and I will discuss the ways in which reasoning about the costs and rewards of action gives children insight into others' mental states broadly. Finally, I will suggest that children actively assess their own abilities and that this affects how hard they try at challenging tasks.

**September 30**

**Jacqueline Snow**, Assistant Professor, Department of Psychology, Program in Cognitive and Brain Science, and Program in Integrative Neuroscience, University of Nevada, Reno

**TITLE—**"The treachery of images": how (and why) behavior and brain responses differ for real-world objects versus their representations

**ABSTRACT:** Ultimately, we aim to generalize and translate scientific knowledge to the real world, yet our current understanding of visual cognition is based almost exclusively on studies of impoverished stimuli. In this talk I will present convergent evidence from human behavioral, neuropsychological, and fMRI studies, showing that real objects elicit differences in behavior and neural coding, compared to matched image displays. I will discuss the underlying mechanisms for the observed effects, and describe a range of innovative techniques and apparatus for 'bringing the real world into psychology and neuroscience'.

**September 23**

**Adam Ussishkin**, Associate Professor, Department of Linguistics, University of Arizona

**TITLE—**Morphology facilitates word recognition independently of phonology: evidence from auditory masked priming

**ABSTRACT:** Words consist of a phoneme or letter sequence that maps onto meaning. Most prominent theories of word recognition (auditory and visual) portray the recognition process as a connection between these small units and a semantic level. However, there is a growing body of evidence suggesting in the priming literature that there is an additional, morphological level that mediates the recognition process. In morphologically linear languages like English, however, morphemes and letter or sound sequences are co-extensive, so the source of priming effects between related words could be due to simple phonological overlap as opposed to morphological overlap. In Semitic languages, however, the non-linear morphological structure of words reduces this confound, since the morphemes are interdigitated in a non-linear fashion. Semitic words are typically composed of a discontinuous root (made up of three consonants) embedded in a word pattern specifying the vowels and the ordering between consonants and vowels. Active-passive pairs in Maltese, the official language of Malta, illustrate this relationship (the root is underlined); e.g., fetah ‘open’-miftuh ‘opened’.

In this talk, I report on a number of experiments our lab has carried out in Maltese and Hebrew investigating the extent to which the non-linear morphemes used in Semitic facilitate auditory word recognition, and to what extent potential priming effects are independent of the phonological overlap typically inherent in morphological relationships. These experiments make use of the auditory masked priming technique (Kouider and Dupoux, 2005). I show that not only do roots facilitate auditory word recognition in these languages, but that these morphological effects are independent of phonological overlap effects.

**September 16**

**Daniel Sullivan**, Assistant Professor, Department of Psychology, University of Arizona

**TITLE:** Exploring the Cultural Psychology of Time and Space

**ABSTRACT:** Researchers in cultural, cognitive, developmental, and social psychology have amassed a fascinating and unwieldy corpus of data on both uniformity and variation in the way people think about time and space. What is lacking in this area is (1) a comprehensive theory of how social structural and cultural factors (e.g., mode of subsistence; religion) are related to individual attitudes about and experiences of time, space, and their interrelation, that (2) may be utilized to empirically test psychological hypotheses. Drawing on the sociology of Anthony Giddens and David Harvey, my colleagues and I (Palitsky, Sullivan, Keefer, & Stewart, 2016; Sullivan, Keefer, Stewart, & Palitsky, in press) propose that time-space distanciation is an interdisciplinary, multilevel construct suited to these functions. This construct refers to the extent to which, in a society, time and space are treated as “separate” dimensions, and individual activities are abstracted across distance and timespan. I will present some of our preliminary research showing the implications of cultural and individual

variation in time-space distancing for well-being and health, as well as social and disordered cognition.

**September 9**

**Vicky Lai**, Assistant Professor, Department of Psychology & Cognitive Science Program, University of Arizona

**TITLE:** The Role of Metaphor in Embodied Cognition

**ABSTRACT:** Metaphors occur on average once every twenty words in daily language. It has been suggested that metaphors play a major role in the organization of semantic memory, as cognitive and neural resources for dealing with concrete domains are recruited for the conceptualization of more abstract ones. In this talk I will discuss the when and the where of metaphor grounding and how such grounding may be enhanced in context. Our latest findings indicate that concrete senses, when used in a metaphorical way, are exploited further and made semantically richer for grounding the abstract concept of interest.

## **COGNITIVE SCIENCE COLLOQUIUM Spring 2016**

**April 22**

**Graduate Student Showcase**

**Speakers:** Dylan Cooper and Katie Newman-Smith

**Dylan Cooper**, Graduate Student, Management (Major), Management and Organizations (Major), Cognitive Science (Minor)

**Title:** Social-Standing and Decision-Quality Goals in Advice Taking

**Abstract:** Research in advice taking has traditionally assumed that people accept or reject advice based on perceptions of its usefulness for solving the issue for which it is offered. The research described in this talk tests whether anticipated social consequences of the use of advice are an additional antecedent of advice taking. I first differentiate between decision quality goals and social standing goals: Decision quality goals increase striving toward a good outcome, while social standing goals focus attention on the social effects of the act of taking or rejecting advice. For example, advisees may take advice when they fear that rejecting it will anger their advisor. I then propose that an advisor's relative expertise influences advice taking through decision quality goals, while the advisor's position in a formal hierarchy (i.e., supervisor, peer, or subordinate) influences advice taking through social standing goals.

**Katie Newman-Smith**, Graduate Student, Psychology (Major), Psychology (Minor)

**Title:** Using Targeted Memory Reactivation (TMR) to Induce Forgetting

**Abstract:** Recent studies demonstrate memory improvement following targeted memory reactivation (TMR) using associated sounds or odors during sleep (see Oudiette & Paller, 2013 for review). TMR can also diminish fear conditioning (Hauner, Howard, Zelano, & Gottfried, 2013) and implicit social biases (Hu et al., 2015). Here we investigate whether TMR can induce forgetting in episodic memory. Eighteen participants completed two learning tasks prior to sleeping. In the first task, participants experienced a directed-forgetting task with words. Participants saw 46 words, with half followed by a ‘forget’ tone. For the second task, participants saw 28 novel object-location pairs. Objects were paired with their associated sounds. From these objects, we randomly chose five for reactivation and five for controls. At night, during the first period of slow wave sleep, we reactivated the five objects with the forget tone 20 times. One week later we tested participants memories of the objects and words using free-recall and recognition. Participants recalled fewer reactivated than control objects ( $t(1,17)=3.682$   $p = .002$ , Cohen’s  $d = 1.23$ ). Of the reactivated objects that were not recalled, participants were also less likely to remember their spatial locations ( $t(1,15) = -2.132$   $p = .05$ , Cohen’s  $d = .764$ ) and had lower confidence in their answers ( $t(1,15) = -5.558$   $p >.001$ , Cohen’s  $d = 1.983$ ). We demonstrate proof of concept that TMR can be used to reduce memory for objects one week later. Participants are less likely to recall the objects, and are also less likely to correctly locate those they successfully forgot. Future studies will determine whether TMR-forgetting can reduce stronger or more emotional memories, paving the way for novel therapeutic treatments for disorders including PTSD or phobias.

**April 15**

**Randall O'Reilly**, Professor, Department of Psychology and Neuroscience, Institute of Cognitive Science, Center for Neuroscience, University of Colorado, Boulder

**TITLE:** The Emergence of Symbolic Cognition from Sensory-Motor Dynamics

**ABSTRACT:** One of the greatest mysteries of human cognition is how higher-level symbolic processing emerges out of lower-level sensory-motor learning. We are developing biologically-based computational models that explore this transition, in the domain of active processing of visual displays, leading up to the ability to perform tasks such as the Raven’s progressive matrices – a widely-used test of general fluid intelligence. It has been critical to incorporate the functions of the deep neocortical layers, and their interactions with the thalamus, to enable our models to exhibit the dynamic top-down attention required. These attentional mechanisms interact with bidirectional excitatory connectivity in the superficial cortical layers to support flexible access to visual information by executive function areas in the prefrontal cortex and basal ganglia.



**April 8**

**Jamie Edgin**, Assistant Professor, Department of Psychology; Director, Memory Development and Disorders Lab, University of Arizona

**TITLE**—Sleep: The beloved teacher?

**ABSTRACT:** In recent years there has been a resurgence of an age-old idea that adequate sleep is needed for healthy cognition and behavioral development. Numerous studies have pointed to sleep quality as a correlate of a child's level of executive function and behavior, language development, and school performance (Beebe, 2011; Bernier et al., 2013; Edgin et al., 2015). There is also evidence that knowledge may be consolidated across sleep periods (Gomez et al., 2006; Henderson et al., 2012). More recent work has pointed to the provocative notion that sleep might actually serve a mechanistic role in how the brain refines networks important for higher-level cognitive function (Huber & Born, 2014; Walker, 2006). In this talk I will discuss some knowns and unknowns regarding the relationship between sleep quality, physiology, and learning. I will draw examples from my research program, which examines the effects of early sleep quality on memory and learning in typical and atypical development.

**April 1**

**Andrew Lotto**, Associate Professor, Speech, Language and Hearing Sciences, University of Arizona

**TITLE**—The Sorcerer's Spectrum: Relative Perception in the Auditory System

**Abstract:** The human ability to understand speech from talkers with widely varying vocal anatomy is remarkable. It has been proposed that humans solve the problem of acoustic variance in speech by relying on either innate (divinely-granted?) specialized processes or on substantial linguistic knowledge. I will present evidence that this ability is actually accomplished by a general auditory mechanism that likely evolved to handle the problem of detecting acoustic events in the presence of noise. I will then ask whether such a mechanism can also account for demonstrations that listeners tune their speech perception to accommodate speakers with a non-native accent or a different speaking style. If nothing else, I hope to demonstrate the usefulness of the first chapter of the first Harry Potter book for studying perception.

**March 25**

**Cathleen Moore**, Professor, Psychological and Brain Sciences, The University of Iowa

**TITLE**—Beyond parsing: Some functional consequences of perceptual organization in vision

**ABSTRACT:** Processes of perceptual organization, such as those that result in phenomena like grouping, surface completion, and figure-ground segregation, have been a central focus in vision research since at least the 19th century. One reason for this focus—besides the appeal of the phenomenology—is that perceptual organization is considered foundational; it parses the retinal image into the building blocks out of

which more complex visual representations are built. Research has focused on understanding the rules of organization, such as “similarly colored items tend to be grouped together”, “aligned edges tend to be represented as continuous” and “surrounded regions tend to be represented as figure rather than ground.” In this talk rather than rules, I will consider some of the functional consequences of perceptual organization for downstream visual processing. Specifically, I will suggest that perceptual organization processes serve to establish changeable information “channels” that guide the updating of existing visual representations on the basis of newly sampled visual information. While not directly conflicting with more traditional treatments of perceptual organization, this view seeks to emphasize the functional role that perceptual organization plays in dynamic visual processing.

**March 11**

**Julie Miller, Ph.D.**, Assistant Professor, Departments of Neuroscience and Speech, Language, and Hearing Sciences, University of Arizona

**Title:** The Role of the Basal Ganglia in Neural Control of Speech

**Abstract:** Information from multiple brain regions contributes to neural control of speech, but in more recent years, studies have highlighted an important role for the basal ganglia in vocal learning and control. When neural circuits in the basal ganglia are disrupted by disorders or neurological diseases, communication is impaired. Insights into the normal and abnormal functioning of these vocal motor pathways have been obtained through studies using the songbird model. I will present data on molecular mechanisms important for vocal learning and control including the role of dopamine.

**March 4**

**Noa Ofen**, Assistant Professor, Life-Span Cognitive Neuroscience, Institute of Gerontology, Wayne State University

**TITLE:** The Development of Memory Systems in the Human Brain

**ABSTRACT:** Episodic memory – the ability to encode, maintain and retrieve information – is critical for everyday functioning at all ages, yet little is known about the development of episodic memory systems and their brain substrates. The use of neuroimaging methodologies including magnetic resonance imaging (MRI) in the study of episodic memory development is providing new insights into the neural underpinnings that support improvements in episodic memory. I will present data on these neural mechanisms and highlight evidence that demonstrates how functional and structural brain development underlies changes in memory functioning throughout childhood and adolescence. We find age-related increase in memory-related activation in prefrontal cortex (PFC), a region that also shows protracted structural development. Age-related increase in the functional contribution of the PFC to memory may be directly related to improvement in the use of mnemonic strategies with age. The hippocampus, known to be critical for the integrity of episodic memory, shows a more complex pattern of functional development that may be dependent on its

involvement in binding and associating among an increasingly large knowledge-base through development. Characterizing normative development of brain systems that support episodic memory has direct implications for the understanding of memory systems in adults and aging, as well as in atypical development.

**February 26**

~~**CANCELLED--Melissa Duff**, Assistant Professor, Interdisciplinary Graduate Program in Neuroscience, the University of Iowa Graduate College~~

**February 19**

**Amitai Shenhav**, Princeton Neuroscience Institute

**Title:** The Costs of Choice and the Value of Control

**Abstract:** Two largely separate bodies of research offer different insight into the process by which we engage decisions. Research on goal-directed, value-based decision-making describes how we weigh the costs and benefits of our options, whereas research on cognitive control describes how we exert the necessary cognitive effort to overcome prepotent biases that interfere with the execution our choice (e.g., flankers directing us toward the incorrect response). I will discuss recent and ongoing studies aimed at examining questions that arise at the intersection of these two fields. I will focus in particular on two sets of studies that explore the cognitive effort costs we associate with the act of making a choice: one set of studies examines the neural circuits that drive simultaneously positive and aversive experiences of being offered multiple good options (e.g., great graduate schools to attend); the other set of studies explores the costs of considering alternatives to our default option (i.e., the choice we are prepotently biased to make in a given situation). I will then describe a recent theoretical framework and ongoing modeling work that seeks to address how we weigh the costs and benefits of control itself (i.e., how much cognitive effort is worth exerting?).

**February 5**

**Yuhong Jiang**, Professor, Department of Psychology, University of Minnesota

**TITLE:** Attention in Space and Time

**ABSTRACT:** The visual world is complex; it is not possible to process all incoming sensory information at once. Selective attention allows us to prioritize processing of behaviorally relevant information. Selectivity often applies to specific spatial locations and occurs in certain moments of time. In the first part of this talk on “attention in space”, I present evidence that implicit learning affects spatial attention. Borrowing terminologies from memory research, I divide attention into a declarative component - the “where” of attention, and a procedural component - the “how” of attention. I show that implicit learning affects how people deploy attention in a viewer-centered (egocentric) reference frame. I argue that successful target detection serves as a reinforcement signal for learning. In the second part of the talk on “attention in time”, I present behavioral and fMRI evidencethat

detecting behaviorally relevant events in time facilitates global perceptual and brain function. Such facilitation overcomes dual-task interference and counters the traditional push-pull effects of spatial attention.

**January 29**

**Andrew Yonelinas**, Professor, Psychology Department; Associate Director, Center for Mind and Brain, University of California, Davis

**TITLE**—The Role of the Medial Temporal Lobe in Memory, Perception and Emotion: The Promiscuous Hippocampus

**ABSTRACT:** (Tentative abstract) The ability to remember the important events that make up our lives is critically dependent on the medial temporal lobe (MTL). Today, I will start by briefly reviewing some work indicating that different regions within the MTL play distinct roles in long term episodic memory. More specifically, I will describe work suggesting that the hippocampus plays a central role in binding together and subsequently recollecting the different aspects that make up an episode or event, whereas other regions such as the perirhinal cortex can support familiarity-based memory discriminations even when recollection fails. Second, I will then discuss some more recent work that has suggested that the MTL may not be limited to supporting long term episodic memory, but that it may also be involved in supporting short-term memory and even visual perception, and will present data that suggests that in general the primary function of the hippocampus is to support processing of high-resolution complex bindings, that can play a critical role in making long term memory, short term memory and perception judgments. Third, I will examine how emotion impacts remembering and show emotional memories are particularly resistant to the effects of forgetting. I will argue that this arises because the amygdala supports recollection of emotional bindings that exhibit relatively slow forgetting compared to hippocampal bindings. Forth, I will present data showing that when acute stress occurs immediately after an event has been encoded into memory that this can rescue memory from the effects of forgetting. I will then present some data suggesting that this occurs because stress acts as a mnemonic filter biasing us toward remembering items that were strongly encoded by the MTL.

**January 22**

**Jonathan Weinberg**, Associate Professor, Department of Philosophy, University of Arizona

**TITLE:** Cognitive science can help burn an armchair, but can it help separate wheat from chaff? On the ‘experimental philosophy’ challenge to traditional philosophical methodology.

**ABSTRACT:** An important methodology in philosophy, in recent decades but also going back to Socrates, has been the *armchair method of cases*: we consult our armchair judgments about what hypothetical cases are or are not instances of philosophically interesting categories. If you want to know about the nature of knowledge, consider what pre-theoretically seem to count as excellent cases of knowledge, and excellent cases of non-knowledge, and try to systematize. Likewise for, say, moral goodness, or

human agency, and so on. This methodology has come under fire in recent years from ‘experimental philosophers’, deploying both existing results and empirical research tools from the social sciences to argue that armchair judgments about these cases may be susceptible to all sorts of noise: order effects, framing effects, demographic variation, and so on. More recent results indicate that philosophical training and experience does little to dampen the influence of such noise. I will discuss this body of work, and then ask the audience for help with what seems to me one of the most pressing questions: if we cannot trust the armchair to help us determine the nature of philosophical categories, can we find ways for scientific tools and methods to help us do better?

## COGNITIVE SCIENCE COLLOQUIUM

### Fall 2015

**December 4**

**Elissa Newport**, Professor, Georgetown University Medical Center;  
Director, Center for Brain Plasticity and Recovery

**TITLE**—Statistical Language Learning: Computational, Maturational, and Linguistic Constraints

**ABSTRACT:** In recent years a number of problems in the brain and cognitive sciences have been addressed through statistical approaches, hypothesizing that humans and animals learn or adapt to their perceptual environments by tuning themselves to the statistics of incoming stimulation. Our own work on statistical language learning shows that infants, young children, and adults can compute, online and with remarkable speed, how consistently sounds co-occur, how frequently words occur in similar contexts, and the like, and can utilize these statistics to find candidate words in a speech stream, discover grammatical categories, and acquire simple syntactic structure in miniature languages.

However, statistical learning is not merely learning the patterns that are presented in the input. Our research also shows that there are maturational changes in statistical learning, with children sharpening the statistics and producing a more systematic language than the one to which they are exposed. Our most recent work examines variation in relation to linguistic universals, suggesting that, when inconsistencies occur on dimensions on which languages tend strongly to align in one direction, learners also shift the languages they learn in this direction. These processes potentially explain why children acquire language (and other patterns) more effectively than adults, and also how systematic language structures emerge in communities where usages are varied and inconsistent.

**November 20**

**Matthew D. Grilli**, Assistant Professor, Department of Psychology,  
University of Arizona

**TITLE**—Mechanisms and Functions of Personal Semantic Memory: Insights from Amnesia

**ABSTRACT:** Personal semantic memory can be defined as knowledge that is specific and unique to each individual. It consists of autobiographical facts, knowledge of self-referential traits and roles, and personal thoughts and beliefs. Recently, there has been much interest in understanding the cognitive and neural bases of personal semantic memory, as well as the contributions of this type of memory to other cognitive constructs. In regards to mechanisms, current research is focused on elucidating the extent to which personal semantic memory relies on two other types of human memory: episodic memory, which is memory for unique events, and semantic memory, which is general world knowledge. In addition to the cognitive and neural mechanisms of personal semantic memory, there is

considerable theoretical and clinical interest in shedding light on how this type of memory can be used to support the self-concept: the cognitive construct that enables us to experience an identity. To provide insight into the mechanisms and functions of personal semantic memory, I have conducted a series of studies investigating personal memory and self-concept in individuals with medial temporal lobe (MTL) amnesia. Based on the findings of this work, I will present a conceptual model that separates personal semantic memory into “experience near” semantics, which contain information linked to personal experience and depend on the MTL for retrieval, and “experience-far” semantics, which are abstract memories that rely on neocortical brain regions involved in retrieval of general semantic memory. I also will discuss findings demonstrating that personal semantic memory supports the ability to construct a self-concept in the present moment and to create a continuous sense of identity across mental time.

**November 13**

**Nina Dronkers, Ph.D.**, VA Research Career Scientist, Director, Center for Aphasia & Related Disorders, University of California, Davis

**TITLE:** Lesion and Connectivity Analysis of a Network Supporting Language Comprehension

**ABSTRACT:** Classic models of language comprehension have focused on the left posterior superior temporal gyrus as the key region involved in language comprehension. However, recent lesion and functional imaging studies have suggested the involvement of numerous cortical regions that could assist in supporting the complexities of language. This presentation will review some of the major findings from our laboratory concerning the neural correlates of auditory comprehension disorders in stroke patients with aphasia. Voxel-based lesion-symptom mapping analyses of behavioral and neuroimaging data from aphasic patients will be presented that associate several brain regions with the language disorders of our patients. In addition, the structural and functional connectivity of these regions will be described, based on our recent work using diffusion tensor and resting-state functional magnetic resonance imaging (MRI). This comprehensive approach has allowed us to evaluate both the cortical regions and the underlying fiber pathways that are affected after brain injury and to examine the ramifications of these disconnections for patients with language comprehension disorders.

**November 6**

**Teenie Matlock**, McClatchy Chair of Communications, Associate Professor of Cognitive Science, University of California, Merced

**TITLE:** A Look at Linguistic Framing in Everyday Language

**ABSTRACT:** Framing is important in everyday communication and reasoning. People constantly frame events, states, and situations with the intention of encouraging others to adopt a particular point of view or take particular actions in the world. Social scientists and linguists know a good deal about framing, but relatively little about how some of the finer linguistic details effect reasoning. This presentation will discuss recent

experimental findings on aspectual and metaphorical framing across various domains, including political messages, reckless driving reports, and risk alerts.

October 30

## STUDENT SHOWCASE

Presenters—

Natalie Dailey, Graduate Student, Speech, Language and Hearing Sciences

Title: Neurological Models of Dyslexia and White Matter Integrity

Abstract: Dyslexia is a neuropsychological developmental disorder, affecting roughly 5 - 12% of the population, and persisting into adulthood. Previous research has identified neurological differences in individuals with dyslexia. However, little is known about the white matter integrity of the cerebellar-cerebral pathways within the reading network for adults. The current proposal outlines neurological models of dyslexia and how cerebellar-cerebral pathways relate to reading. Building upon previous findings from function MRI, the present study proposes differences in white matter integrity within in the reading network, between individuals with and without dyslexia. Bilateral Iterative Parcellation (BIP) will be introduced and discussed as a novel method to identify the location and size of connected cortical regions involved in reading. Results from preliminary analyses will be presented, demonstrating successful implementation of the BIP procedure and the identification of cortically connected regions important for reading.

*Continued on next page*

Noah Nelson, Graduate Student, Linguistics

**Title:** Hyperarticulated Speech Correlates with Phonetically Specific Lexical Competition

**Abstract:** Languages change over time in many ways, including the sounds that are used to form words. One possible way for this to happen is in gradual shifts in the pronunciation of words in response to similar-sounding competitors. True to this view, phonetic competition between words correlates with hyperarticulation, or the exaggeration of distinguishing phonetic cues (Baese-Berk & Goldrick, 2009). Experimental work to date has focused on either very broad measures of competition or very phonetically specific ones, leaving uncertain what intermediate types of competition may affect phonetic realizations of words (though see Kirov & Wilson 2012 and Schertz 2013). What is more, very little work has attempted to find these effects in conversational speech outside the lab.

To address these issues, the present study examined spontaneous, conversational speech from the Buckeye Corpus (Pitt et al. 2005, 2007) to see what measures of competition correlate with hyperarticulation. Only the most phonetically specific measure of competition was found to reliably predict hyperarticulation, suggesting that speakers may manipulate fine-



grained phonetic detail to enhance intelligibility. This finding is consistent with previous research suggesting that phonetically specific competitor words may drive language change (Wedel et al. 2013).

**October 23**

**G. John Andersen**, Professor, Department of Psychology, University of California, Riverside

**TITLE:** Age-related Declines in Vision and Recovery of Function Using Perceptual Learning

**ABSTRACT:** A major problem for the rapidly growing population of older adults (age 65 and older) is age-related declines in vision, which have been associated with increased risk of falls and vehicle crashes. My talk will briefly review what is known about age-related declines in vision and review in detail behavioral and imaging research that examines how training using perceptual learning methods can be used to improve vision and sensory processing among older adults. This research has found that with a few days of training older adults can perform visual tasks as well as untrained college age adults, that the improvements are maintained for up to 3 months, are not the result of task practice and that the improved performance is not associated with changes in attention. The results of our imaging studies indicate activation changes for younger adults and structural changes for older adults due to training – providing evidence of multiple mechanisms of plasticity within the adult brain. These findings, considered together, indicate that behavioral interventions can greatly improve visual performance for older adults.

**October 16**

**Chad Woodruff**, Associate Professor, Psychological Sciences, Northern Arizona University

**TITLE:** EEG  $\eta$ -rhythm  $\beta$ -rhythm and Event-Related Potential Correlates of Perspective-Taking, Personal Distress and Self-Other Discrimination

**ABSTRACT:** Taking another's perspective requires not only the experiencing of another's intentions/feelings, but these experiences must be represented as belonging to the other and not to the self. Failures of self-other discrimination can lead to personal distress, which necessarily entails self-focus – the antithesis of empathy. This talk will feature a series of experiments demonstrating some of the neural correlates of processes related to empathy. Using  $\eta$ - and  $\beta$ -rhythms (possible correlates of mirror neuron activity) as well as ERP's, we will see that empathy-related processes correlate not only to neural responses to others, but also to self-other differences in neural responses. The data are consistent with claims that greater self-other discrimination relates to greater empathic abilities. The talk will also include comparisons of  $\eta$ -rhythms from omnivores and vegetarians as relates to perception of traditional food animals and, separately, from those who do and do not hold paranormal beliefs.

October 9

**CANCELLED** ~~Evelina Fedorenko, Assistant Professor, Psychiatry Department, Massachusetts General Hospital; Department of Brain & Cognitive Sciences, Massachusetts Institute of Technology~~

October 2

**Tania Lombrozo**, *Roger N. Shepard Distinguished Visiting Scholar*, Associate Professor, Department of Psychology, University of California-Berkeley

**TITLE**—Explanation: The Good, The Bad, and the Beautiful

**ABSTRACT:** Like scientists, children and adults are often motivated to explain the world around them, including why people behave in particular ways, why objects have some properties rather than others, and why events unfold as they do. Moreover, people have strong and systematic intuitions about what makes something a good (or beautiful) explanation. Why are we so driven to explain? And what accounts for our explanatory preferences? In this talk I'll present evidence that both children and adults prefer explanations that are simple and have broad scope, consistent with many accounts of explanation from philosophy of science, and with ties to ideas about inference to the best explanation in epistemology. The good news is that a preference for simple and broad explanations can sometimes improve learning and support effective inferences. The bad news is that under some conditions, these preferences can systematically lead children and adults astray.

September 25

**Mark T. Wallace**, Director, Vanderbilt Brain Institute, Vanderbilt University

**TITLE**—Development and Plasticity of Multisensory Function: Single Neurons to the Clinic

**ABSTRACT:** We live in a world in which we are continually bombarded with stimuli from a number of different sensory modalities. As such, one of the important functions of our brains is to combine this rich sensory mélange into a coherent and unified perceptual representation. Although we now know a great deal about how multisensory interactions guide behavior and shape perception and cognition, and about the neural correlates of these interactions, our knowledge about the development and plasticity of multisensory representations has lagged behind. In this talk, I will begin with an overview of the benefits that can be gleaned from multisensory interactions, and review some of the neural bases for these effects. I will then describe work in animal models that has revealed some of the basic features of how multisensory representations develop, and the inherent plasticity contained within these representations. I will then transition to describe studies in humans that highlight the multisensory plasticity that takes place not only during the course of development, but also in the adult. I will end with a discussion of the clinical implications of alterations in multisensory function, with an emphasis on neurodevelopmental disabilities.

**September 18**

**Jonathan Tullis**, Assistant Professor, Educational Psychology, University of Arizona

**TITLE**—Reminders: The influence of prior episodes on present behavior  
**ABSTRACT:** One aspect of successful cognition is the efficient use of prior relevant knowledge when navigating novel situations. Reminders – stimulus-guided retrievals of prior episodes – allow us to link prior knowledge to current problems by prompting retrieval of relevant knowledge from events that are distant from the present. Here, I explore the causes and consequences of reminders for interpretation, memory, and generalization. I will present research showing that reminders bias the interpretation of ambiguous stimuli, that memory for the first item in a reminded pair is enhanced, that the benefits of reminders depend upon the association and lag between related presentations, and that reminders can produce better generalizations than comparison. Further, I will describe a mathematical model of reminders, which demonstrates that reminders provide a useful unifying theme for memory phenomena that otherwise lack theoretical coherence. Reminders are an important cognitive mechanism that enables our past experiences to influence our current behavior.

**September 11**

**Don T. Fallis**, Professor, School of Information, University of Arizona

**TITLE:** Shedding Light on Keeping People in the Dark

**ABSTRACT:** We want to keep hackers in the dark about our passwords and our credit card numbers. We want to keep potential eavesdroppers in the dark about our private communications with friends and business associates. And especially after Snowden's revelations, we probably want the government kept in the dark as well. But in order to know whether we are achieving these sorts of goals, we first need to understand exactly what it is to \*keep someone in the dark\* about something. Several philosophers (e.g., Bok 1983, Scheppele 1988, Mahon 2009, Carson 2010) have analyzed this concept in terms of concealing and/or withholding information. However, these analyses incorrectly exclude clear instances of keeping someone in the dark. And more importantly, they incorrectly focus on possible \*means\* of keeping someone in the dark rather than on what it \*is\* to keep someone in the dark. In this talk, I argue that you keep X in the dark about P if and only if you intentionally leave X without a true belief about P. I then show how my analysis of keeping someone in the dark can be generalized from a categorical belief model of epistemic states to a degree of belief model. I also show how my analysis connects to recent research in cryptography and game theory.

**September 4**

**Martin Reimann**, Assistant Professor, Marketing, Eller College of Management, University of Arizona

**TITLE:** Can a Happy Meal help you eat less? New behavioral and neurophysiological findings on motivating smaller portion choice

**ABSTRACT:** Four studies show that offering consumers the choice between a full-sized food portion alone and a half-sized food portion paired with a small non-food premium (e.g., a small Happy Meal toy or the mere possibility of winning frequent flyer miles) motivates smaller portion choice. Importantly, we investigate why this is the case and find that both food and the prospect of receiving a non-food premium activate a common area of the brain (the striatum), which is associated with reward, desire, and motivation. Finally, we show that the choice results are mediated by a psychological desire for, but not by liking of, the premium. Notably, we find that choice of the smaller food portion is most pronounced when the probability of obtaining the premium is not disclosed compared to when the probability is disclosed or when the receipt of the same premium is stated as being certain.

## **COGNITIVE SCIENCE COLLOQUIUM Spring 2015**

**May 1**

### **Graduate Student Showcase**

**Speakers: Goffredina Spano and Erica Wager**

**Goffredina Spano**, Graduate Student, Psychology (Major) & Cognitive Science (Minor)

**Title:** Testing the Boundaries of Boundary Extension Across Development

**Abstract:** In adults, perceptions of the world are influenced by past experience and memory. Boundary extension (BE) is a phenomenon in which observers will extend the background details of a previously viewed scene, reflecting a rapid top-down influence on perceptual representations. Given recent evidence findings suggesting a role for the hippocampus in BE (Mullally, Intraub & Maguire, 2012), and findings evidence of BE in very young infants (Quinn & Intraub, 2007), we tested whether this phenomenon may change during rapid periods of hippocampal development or may be altered in populations with hippocampal dysfunction (i.e., Down syndrome, DS). The findings suggest that there are no clear links between the development of hippocampus and BE in school-age children or individuals with DS. These findings raise questions regarding the continuity of mechanisms underlying BE across development.

**Erica Wager**, Graduate Student, Psychology (Major) & Cognitive Science (Minor)

**Title:** Exploring the Effects of Long vs. Average Sleep on Cognition in Healthy Older Adults

**Abstract:** Previous research suggests that too little or too much sleep time in adults can have negative consequences on mortality, health, mood and various cognitive outcomes. Most of these studies, however, have measured sleep subjectively by using sleep diaries and self-report measures. I'll be discussing results from a Multi Site Sleep Study where we explored how average or long sleep measured objectively in older adults is associated with cognitive function. In this study, as part of a larger longitudinal study, we hypothesized that long sleepers would have worse cognitive performance than average sleepers. Among other measures, we calculated total sleep time in 72 healthy older adults by using actigraphy (a device similar to "fitbit") and sleep diaries. The older adults were then classified as average or long sleepers. At baseline, after participants had monitored their time in bed and sleep for two weeks, we gave them various cognitive and health measures. We found that longer sleep among older adults was associated with slower completion time on a task that requires inhibition of an automatic response – the Stroop Task, but that there were no significant differences on a task that requires set shifting and visual attention – the Trail Making Test. I'll discuss these findings and the broader impact of these results in aging populations in my talk.

**April 24**

**Edward F. Chang, MD,** Associate Professor, Departments of Neurosurgery and Physiology, University of California-San Francisco

**TITLE:** Feature Organization in Human Speech Cortex

**ABSTRACT:** Communication systems generally rely on upon defined organizational schemes for signal generation and sensing. In humans, the production and perception of speech is processed by highly specialized neuroanatomical areas and processes. We have recently identified important phonetic-level features for vocal tract control during articulation in the speech motor cortex, and for speech sounds in the higher order non primary auditory cortex. I will discuss important similarities and differences in these representational systems with respect to feature organization and dynamics. I will also present related work on auditory-vocal (sensorimotor) integration and transformation in speech.

**April 17**

**Sarah Shomstein,** Associate Professor of Cognitive Neuroscience, Department of Psychology; Affiliated Faculty, Neuroscience Institute and Mind-Brain Institute, George Washington University **TITLE—** Structuring Visual Input: Evaluating Representations Influencing Attentional Selection

**ABSTRACT:** Behavioral goals and motivations play a critical role in shaping and refining information processing so that only the most relevant sensory stimuli are used to guide attention and ultimately influence perception and decision making. Traditional accounts hold that multiple representations (spatial, object-based, features, etc.) guide attentional selection automatically. Using visual system as a model, I will present evidence drawn from behavioral, neuroimaging, and eye-tracking experiments challenging the traditional automaticity assumptions. Focusing

on the influence of spatial and object-based representations, I will demonstrate that while spatial contribution is automatic, the influence of object representations to attentional selection is not. I will further argue that the degree to which object representations are used for attentional guidance is determined by the amount of uncertainty in the scene.

**April 10**

**Dan Bartels**, Assistant Professor of Marketing, University of Chicago  
**TITLE:** Psychological Connectedness to the Future Self and Forward-Looking Decisions

**ABSTRACT:** In this talk, I'll build on a philosophical account of personal identity (Parfit, 1984) which argues that the degree of concern one has for one's future self may be scaled by the degree of "psychological connectedness"—overlap in properties such as beliefs, values, and ideals—held between one's current and future self. Our studies pose participants with tradeoffs between consuming a benefit in the near future versus consuming more of that benefit in the distant future. When people's sense of connectedness with their future self is reduced, they make impatient choices. When their sense of connectedness with the future self is bolstered, they make more prudent-seeming, forward-looking choices. I'll then discuss some studies that examine people's preferences about whether to engage in discretionary spending vs. save their money and find that reduced spending in the present requires the combination of both being motivated to provide for one's future self (valuing the future) and actively considering long-term implications of one's choices (awareness of the future). Finally, I'll talk about some studies that explore goal setting and striving. The exercise of self-control involves setting priorities and adhering to plans, even in the face of immediate temptations. Many decisions requiring self-control involve trading off consumption or happiness in the present or immediate future with consumption or happiness in the distant future. We posit that a crucial variable in such decisions is how a person views her distant future self (i.e., as a somewhat different person from her current self or as fundamentally the same person). We find, in several studies, that how people view their future selves influences the plans they make and how successfully they adhere to those plans.

**April 3**

**Robert C. Wilson**, Assistant Professor, Department of Psychology and the Cognitive Science Program, University of Arizona

**TITLE:** The Explore-Exploit Dilemma in Human Reinforcement Learning

**ABSTRACT:** When you go to your favorite restaurant, do you always get the same thing, or do you try something new? Sticking with an old favorite ensures a good meal, but exploring other options might yield something better - or something worse. This simple conundrum, choosing between what you know and what you don't, is called the exploration-exploitation dilemma. Whether it's deciding on a meal, a vacation destination or a life partner, this is an important problem for humans and animals to solve.

In this talk I will discuss how humans solve the explore-exploit dilemma. Theory suggests two distinct strategies: a directed strategy, in which choices are biased toward information, and a random strategy, in which exploration is driven by noise. Here I will show that humans use both approaches, and that furthermore, the mixture of random and directed exploration is optimal in that it maximizes reward in the long run. These results have implications for our understanding of how decisions impact learning, the role of exploration in development and mental disorders, and even for choosing what to eat for dinner.

**March 26 & 27 Open Forum (Thursday) & Workshop on Neural Systems and Memory (Friday) Special Event—No Cognitive Science Colloquium scheduled for Friday, March, 27, 2015**

**March 13**

**Tyler Peterson**, Assistant Professor, Department of Linguistics, University of Arizona

**TITLE:** Structural Complexity and the Acquisition of Recursive Locative PPs

**ABSTRACT:** Phase-based models of grammar hold that the role of syntax is to build formal objects that are interpretable at the interface between semantics and syntax. Derivations are believed to be cyclic, such that a structure is built until it constitutes a category of the right type, which can then be mapped into one of the two basic semantic primitives: referential expressions or propositions. At such point in the syntactic derivation, a cycle or phase is complete, and the syntactic object is ‘shipped off’ to the semantic interface. In the syntax, only certain components of it remain accessible for further syntactic manipulations. According to Arsejinovic & Hinzen (2011), the syntactic consequence of this model is that recursion – the basis of the generative capacity of language – does not occur within a single phase. The semantic consequence is that at each point in a derivation of a complex structure, only a single element is interpretable, so that the extension or semantic value can be calculated. Such cyclic accounts of referential opacity predict asymmetries in the interpretation of matrix and embedded constituents, but are silent on whether embedding itself introduces complexity. The overarching goal of this paper is to examine how structural complexity arising from embedding can be represented in this model, and whether grammatical complexity should be defined in terms of compositional semantics, or phrase structure. More specifically, we shed light on the complexity that recursion introduces in grammar and meaning by comparing child and adult patterns of production of recursive noun phrases. The results of this study provide evidence for the limitations of syntax-only or semantics-only approaches to complexity in certain kinds of complex NPs – despite the fact that these NPs are made up of the same syntactic and semantic ingredients.

**March 6**

**David Raichlen**, Associate Professor, Department of Anthropology,  
University of Arizona

**TITLE:** Evolutionary Links between Exercise and the Brain

**ABSTRACT:** Recent work suggests exercise can have profound impacts on the brain. From altering psychological state and improving mood, to enhancing brain structure and improving cognitive function in older adults, aerobic exercise generates surprising links between the brain and body. Here, I explore these effects from an evolutionary perspective. Human evolution was marked by a shift from relatively sedentary, ape-like lifestyles, to more aerobically active lifestyles beginning with the origins of hunting and gathering nearly two million years ago. I suggest that this shift helps us understand how and why exercise alters the brain today. First, humans and other distance running mammals seem to share exercise-induced upregulation of neurotransmitters associated with rewards and analgesia. This convergence may be a product of selection, and suggests that the positive change in psychological state associated with exercise has deep evolutionary origins. Second, humans have a long lifespan compared to other primates and mammals which many suggest evolved so that older adults could help care for, and provide knowledge to, younger generations. Exercise-related improvements in cognitive function and brain structure in older adults may help explain how and why the long human lifespan evolved. Combined, these studies show how we can use our evolutionary history to better understand the links between the brain and body today.

**February 27**

**Anastasia Flevaris**, Postdoctoral Fellow, Department of Psychology,  
University of Washington

**TITLE:** Contextual Processing in the Primary Visual Cortex and Variations with Autistic Tendency

**ABSTRACT:** Neurons in the primary visual cortex (V1) respond to basic image features (e.g., orientation, spatial frequency) in small, restricted areas of the visual field (“receptive field”). However, visual information beyond the receptive field can significantly alter neural responses. For example, the neural response to a stimulus can be suppressed by similar stimuli (e.g., same orientation/spatial frequency) outside the receptive field, in the “surround,” even though the neuron would not otherwise respond to the surround stimulus. This form of contextual processing - termed “surround suppression” - is thought to arise from both lateral connections within V1 itself as well as feedback from higher-level regions. Given the potential high-level influence on surround suppression, an important question is whether and how attention modulates the suppression. In this talk I will discuss attentional influences on surround suppression as well as how surround suppression varies with autistic tendency. In the first part of the talk I will present evidence that surround suppression is modulated by attention to features. Next, I will examine how attentional enhancement interacts with surround suppression. Prior studies have shown that enhanced processing of an attended stimulus automatically spreads to items in an



image that are perceptually grouped with and/or share features with the attended stimulus. I will provide a unified account for surround suppression and surround enhancement by showing that suppression and enhancement in V1 of the *same* stimulus depends on the focus of attention. Finally, in the last part of the talk I will examine how surround suppression in V1 differs as a function of autistic tendency. Prior work has suggested that individuals with autism exhibit differences in perceptual phenomena thought to be associated with surround suppression. I will present data suggesting that surround suppression in V1 of neurotypical individuals varies as a function of the degree to which they have autistic tendencies, as measured by the “Autism Quotient” scale (AQ). Individuals with more autistic tendencies exhibit less surround suppression, which could contribute to the perceptual differences exhibited by individuals with autism.

*For a copy of Dr. Flevaris’ CV, please contact Nova Hinrichs @ [nhinrich@email.arizona.edu](mailto:nhinrich@email.arizona.edu).*

**February 20**

**Tamar Kushnir**, Associate Professor, Department of Human Development, Cornell University

**TITLE**—Seeing the Road not Taken: The Origin of Our Beliefs about Choice in Childhood

**ABSTRACT:** Our adult concept of choice is not a simple idea, but rather a complex set of beliefs about the causes of actions. These beliefs are situation-, individual- and culture- dependent, and are thus likely constructed through social learning. Initially, infants and young children evaluate actions as choices by two criteria: they are intentional, and there are possible (or likely) alternatives. By preschool, these same considerations guide children’s inferences about their own choices as well. Moreover, preschoolers can talk explicitly about how physical, biological, and psychological constraints can limit choice by constraining the possibility to “act otherwise.” Developments beyond the preschool years suggest that more complex aspects of our beliefs about choice - In particular about how actions can or cannot be freely chosen in the face of strong desires or against social and moral norms – take time to emerge, and are subject to significant cultural variation.

**February 6**

**Jill Lany**, Assistant Professor, Department of Psychology, University of Notre Dame

**TITLE:** Discovering the Underpinnings of Statistical Language Learning in Infants

**ABSTRACT:** A longstanding question in the developmental and cognitive sciences concerns how we learn our native language. Very young infants are adept at learning statistical regularities, such as sequential structure and correlations between stimulus dimensions in novel artificial languages. These data suggest that statistical learning plays an important role in language acquisition. They also have implications for children’s real-world language development, as variation in statistical learning ability may help

explain divergent learning trajectories. However, few studies have tested whether there is a connection between statistical learning and native language competence, and little is known about sources of variation in statistical learning. Moreover, statistical learning is itself poorly specified. In this talk I will discuss several studies designed to bridge these gaps in our knowledge. Specifically, these studies test the hypothesis that statistical learning is related to native language development, and that infants' ability to encode and identify fluent speech supports statistical learning.

**January 30**

**Noah Snaveley**, Assistant Professor, Department of Computer Science, Cornell University

**TITLE:** Planet-Scale Visual Understanding from Online Photos

**ABSTRACT:** We live in a world of ubiquitous imagery, in which the number of images at our fingertips is growing at a seemingly exponential rate. These images come from a wide variety of sources, including mapping sites, webcams, and millions of photographers uploading billions upon billions of images to social media and photo-sharing websites such as Flickr, Facebook, and Instagram. Taken together, this imagery can be thought of as constituting a distributed camera capturing the world at unprecedented scale, and continually documenting its cities, events, and the natural environment. This talk will outline how we might use this distributed camera as a fundamental new tool for science, engineering, and environmental monitoring, and how a key problem is deriving \*structure\* from these unstructured and uncalibrated image collections -- making sense of the soup of pixels that is being captured all around the globe. I will talk about my group's work on new computer vision methods for extracting meaning from these massive photo collections.

**January 23**

**Rebecca Gomez**, Associate Professor, Department of Psychology, University of Arizona

**Title:** Sleep and Time Dependent Learning in Infants and Young Children

**Abstract:** It seems as if sleep has taken the world by storm. Not a week goes by that a new finding is not reported in the media regarding the health or cognitive consequences of good or poor sleep. Here I present studies investigating the role of sleep in newly formed memories in infants, toddlers, and preschool children. Sleep and wake, both, contribute to generalization but for very different reasons in different periods of brain development. Our work has implications for understanding the impact of sleep on infant and child learning in language acquisition, as well as for mechanisms of memory formation at these ages, but more generally is the first to ask how learning unfolds over time as a function of sleep across changing neural structures in such young children. Our research also speaks to questions of practical importance such as whether learning time is more

important than nap time in preschool and whether and when preschool children can safely transition out of naps.

## **COGNITIVE SCIENCE COLLOQUIUM Fall 2014**

**December 5**

### **Graduate Student Showcase**

Christina Meyers and Zachary Brooks, presenters

*Titles & Abstracts below*

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**Christina Meyers**, Graduate Student  
Speech, Language, and Hearing Sciences (major)  
Cognitive Science (minor)

**Title:** Effect of Schedule for Children Receiving Treatment Targeting Grammatical Morphology

**Abstract:** This study examined the relative effects of *massed* and *spaced* treatment delivery schedules on learning outcomes for 16 preschool age children with specific language impairment involved in an intervention program targeting grammatical morphology. All children received equivalent individual Enhanced Conversational Recast treatment for 30 minutes each day for five weeks (25 days). Half of the children received treatment in the *massed* condition (30 consecutive minutes in one session) and half of the children received treatment in the *spaced* condition (three 10-minute sessions separated over a 2 hour period). Children's progress was assessed 3 times weekly by probing the use of the treatment morpheme using toys and a set of word stems not used during treatment. Children's use of an untreated morpheme was also tracked over the treatment period as a control for maturational effects. Treatment effect sizes (d) were calculated for each child's treatment morpheme and control morpheme. Overall treatment efficacy was confirmed by effect size (d) for treated morphemes significantly greater than the effect size (d) for untreated morphemes, which was true for both groups, *massed* and *spaced*. There were no group differences for treated morpheme effect size or any other outcome measure. The implications for Enhanced Conversational Recast treatment delivery schedule and treatment efficacy studies will be briefly discussed.

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**Zachary Brooks**, Graduate Student  
Second Language Acquisition and Teaching (major)  
Cognitive Science (minor)

**Title**—Bilingual Decision Making: A Verbal Probability Study

**Abstract:** Probability can be expressed numerically (“75%”) or verbally (“probable”) and both numerical and verbal probability expressions have been studied extensively in medical, management, and political research contexts. However, verbal probability expressions are preferred more than numerical probability expressions despite their lack of precision because of their ease of use (Kuipers, Moskowitz, Kassirer, 1988), their ability to express a wider range of possibilities (Zwick, 1987), and the fact that using verbal probabilities rather than numerical probabilities costs decision-makers very little in terms of accuracy (Hamm, 1991a; Wallsten, Budescu, & Erev, 1988). Using verbal probabilities to investigate possible differences in native vs. non-native numerical valuations is a step to explore if there are differences in decision-making between first-language (L1) and second-language (L2) speakers and if there are by how much in what direction.

In this study, L1 and L2 speakers were provided the same verbal probability expressions (VPEs) in varying contexts and asked to assign numbers to ten VPEs – “rare,” “very unlikely,” “unlikely,” “likely,” “possible,” “probable,” “good chance,” “frequent,” “usually,” and “very probable” (Theil, 2002). Within subject and between subject tests were conducted and results show differences between native and non-native speakers’ numerical valuations in specific sentence contexts. This session reports findings of over 182 L1 and L2 subject responses, and it details the implications for SLA theory in terms of language use differences that translate into decision differences, such as decisions found in medical settings among care providers and patients who speak English as second language.

**November 21**

**Oisín Deery**, Visiting Scholar, Department of Philosophy, University of Arizona

**TITLE:** Neuroscience, Causes, and Free Will

**ABSTRACT:** According to some, neuroscience reveals free will as illusory. This is because we typically judge choices as free only if they are caused by the agent’s mental states, whereas neuroscience claims that choices have sufficient neural causes. If events with sufficient neural causes cannot also have distinct mental causes, then free choice is illusory. Of course, one might deny that events with sufficient neural causes cannot also have mental causes. Still, the claim that choices are free only if they are caused by mental states is often presented as unassailable. I maintain that it is not true *a priori*. It is an empirical question whether the relevant causes are neural. If they are, then neuroscientific skepticism about free will is defused. This is because the term (or concept) ‘free’—when it is used to pick out paradigmatically free choices—functions as a natural-kind term (or concept) that refers to whatever properties underpin such choices. Thus, it is irrelevant whether choices have sufficient neural causes. We are free, unless the properties underpinning paradigmatically free choices do not constitute a kind that is useful for predicting and explaining actions. I

conclude by pointing to work in neuroscience that suggests that neural kinds may *already* be better than psychological kinds at predicting and explaining behavior. If that is right, then not only does neuroscience fail to reveal free choice as illusory, it might tell us what free will is.

**November 14**

**David Raichlen**, Associate Professor, School of Anthropology, University of Arizona

**TITLE:** Evolutionary Links between Exercise and the Brain

**ABSTRACT:** Recent work suggests that exercise leads to improvements in cognition, changes in brain structure and function, and can reduce cognitive decline during aging. While researchers are beginning to understand how exercise affects the human brain, why the brain and body are linked in this way remains unclear. Here, I explore evidence that the effects of exercise on the brain are due, in part, to humans' evolutionary history as aerobic athletes. In this talk, I review evidence that natural selection acting on endurance exercise performance affects the evolution of the mammalian brain. These effects are apparent in experimental evolution experiments as well as in large comparative datasets. Based on comparative evidence, I explore the possibility that aerobic activity in our ancestors altered human brain evolution. The hunting and gathering lifestyle adopted by human ancestors approximately two million years ago required a large increase in aerobic activity. The links between exercise and the brain suggest that a significant portion of human neurobiology may have evolved due to selection on features unrelated to cognitive performance and maybe tied to the adoption of a novel lifestyle during human evolution.

**November 7**

**Jonathan Lifshitz**, Associate Professor, Child Health, College of Medicine-Phoenix, University of Arizona

**TITLE:** Translational Studies into Circuit Reorganization as a Result of Traumatic Brain Injury

**LEARNING OBJECTIVES:**

- (1) Describe the general process by which circuit disruption explains the chronic neurological consequences of traumatic brain injury (TBI).
- (2) Since the CNS is composed of neurons and other components, recognize the neurovascular and neuroglial consequences of TBI.
- (3) Translational studies generate new knowledge necessary to advance the diagnosis and prognosis of TBI.

**ABSTRACT:** To meet the learning objectives, a series of conceptual ideas and experimental results will be presented to introduce and define traumatic brain injury (TBI). Conceptual ideas about neural circuitry will be presented as a concrete analogy to building and rebuilding Lego® structures. By understanding that Lego structures can be built and reorganized with the same basic building blocks, the consequences of TBI are understood as a reorganization of functional circuits. Thus, circuits that are dismantled and subsequently reorganized by TBI would manifest into neurological symptoms, depending on which circuits are reorganized. In the rodent, we

primarily focus on the whisker-barrel circuit, because our diffuse TBI model impacts the somatosensory thalamus and cortex. However, brain injury does not occur with neurons in isolation; glia are active in clearing damaged tissue and contributing to repair. These glial contribution may be principal sites to direct recovery of function. To this end, experimental studies must meet strict translational standards in order to advance the diagnosis, prognosis and treatment of TBI patients. Ongoing experimental studies mirror clinical investigation in order to advance the field.

**October 24**

**Elizabeth Loftus**, Distinguished Professor of Social Ecology, Professor of Law, and Cognitive Science, University of California-Irvine

**TITLE:** The Memory Factory

**ABSTRACT:** In our studies of memory distortion, we can alter, in people's minds, the details of events that were actually experienced. We can also plant entire memories of events that never happened – “rich false memories.” False memories matter: they affect people's later thoughts, intentions, and behaviors. Moreover, false memories look very much like true memories – in terms of behavioral characteristics, emotionality and neural signatures.

**October 17**

**Fei Xu**, *Roger N. Shepard Distinguished Visiting Scholar*, Professor, Department of Psychology, University of California, Berkeley

**TITLE:** Towards a Rational Constructivist Approach to Cognitive Development

**ABSTRACT:** The study of cognitive development has often been framed in terms of the nativist/empiricist debate. Here I present a new approach to cognitive development: rational constructivism. I will argue that 1) learners take into account both prior knowledge and biases (learned or unlearned) as well as statistical information in the input; 2) prior knowledge and statistical information are combined in a rational manner (captured by Bayesian probabilistic models); and 2) there exists a set of domain-general learning mechanisms that give rise to domain-specific knowledge. Furthermore, learners actively engage in gathering data from their environment. I will present evidence supporting the idea that early learning is rational, statistical, and inferential, and infants and young children are rational, constructivist learners.

**October 10**

**Elena Plante**, Professor, Department of Speech, Language, and Hearing Sciences, University of Arizona

**TITLE:** Learning from Inside the Brain

**ABSTRACT:** The typical fMRI study of auditory-verbal language functioning returns what is now so commonly found as to constitute “the usual suspects” of classic language cortex (Broca's and Wernicke's areas) plus fronto-parietal regions associated with attention and memory encoding. Far less is known about how this network emerges. One approach is to study children, who are in the process of acquiring or refining language

skills. Large-scale study of children's language processing has documented age-related changes in networks that already look remarkably adult-like as early as age five. A second approach is to look at language learning, unconfounded by maturational change. My lab has recently implemented natural language paradigms that capitalize on principles from the statistical learning literature to examine learning as it happens in the scanner to examine the emergence of this skill in adult learners. This work demonstrates differences between learners who are provided with consistent statistical regularities in the input and those who are presented nearly identical input that lacks these statistical regularities. We also demonstrate that learners who are given input that contains multiple statistical regularities (e.g., those governing identification of word units and others for word order) shift their processing strategy over time to reflect attention to different aspects of the input.

**October 3**

**Leah Fabiano-Smith**, Assistant Professor, Department of Speech, Language, and Hearing Sciences, University of Arizona

**TITLE:** Misdiagnosis of Speech Sound Disorders in Latino Children: Linking Theory with Practice

**ABSTRACT:** Bilingual children are often misdiagnosed as having a speech disorder when they truly exhibit normal development. In addition, speech-language pathologists (SLP) are avoiding the assessment of bilingual children due to the lack of knowledge and resources necessary for best practice with this population (Kritikos, 2003). Misdiagnosis of speech sound disorders in this population has long-term emotional, financial, and educational costs. These clinical errors can be prevented if we acquire more information on what constitutes normal and disordered speech development in the bilingual population. A theoretical model that allows us to differentiate difference in speech production (i.e., a difference in how a bilingual child speaks due to the influence of one language on the other) from speech disorder (i.e., an underlying speech-learning disability) will provide SLPs with the knowledge they need to prevent misdiagnosis. Recent research has found evidence in bilingual children's speech productions that they may be using some sounds interchangeably in both languages. For example, Fabiano-Smith and Goldstein (2010b) found that bilingual children exhibit higher production accuracy on sounds shared between English and Spanish than on sounds specific to either language. Those findings suggest that perhaps bilingual children have speech sound representations that differ from those of monolingual children. This talk will present a series of studies examining the production patterns of bilingual Spanish-English speaking children in order to (1) extend current theories on speech perception to speech production and (2) provide an evidence-based theoretical framework for assessment practices in bilingual Spanish-English speaking children that takes into consideration interaction between their two languages.

**September 26**

**Bruno Galantucci**, Research Affiliate, Haskins Labs; Associate Professor, Department of Psychology, Yeshiva University

**TITLE:** Studying Novel Forms of Human Communication in the Laboratory

**ABSTRACT:** When deaf people are not exposed to a pre-established sign language, they spontaneously develop a novel one. This phenomenon can be simulated in the laboratory with non-deaf people and this is what my collaborators and I have been doing over the last decade in order to investigate the fundamentals of human communication. In this talk I will provide an overview of these investigations, presenting two lines of research.

The first of these concerns the emergence of basic linguistic structure in human communication systems. In particular, I will present research aimed at uncovering forces that push human communication systems toward a combinatorial design, that is, toward recombining a small set of basic meaningless forms to express an indefinite number of meanings.

The second line of research concerns the foundations of human communication. People sometimes show severe communicative limitations in the laboratory, failing to develop even the simplest forms of communication. This raises the question of how sophisticated forms of human communication can come about. I will present three hypotheses to address this question and discuss some preliminary evidence relevant to them.

**September 19**

**Peter Ditto**, Professor of Psychology and Social Behavior, University of California, Irvine

**TITLE:** Motivated Moral Reasoning

**ABSTRACT:** Moral judgments are important, intuitive, and complex. These factors make them particularly fertile ground for motivated reasoning. After reviewing the general concept of motivated reasoning, I will describe research examining several different pathways by which motivational forces affect moral reasoning including: 1) affecting perceptions of the actor's moral accountability for an act, 2) influencing the normative moral principles people rely on to evaluate an act, and 3) promoting the selective recruitment of factual beliefs related to the practical effectiveness of an act. Discussion will focus on motivated moral reasoning as both a contributor to political conflict and as an example of people's long recognized difficulty maintaining clear conceptual boundaries between descriptive and prescriptive judgment, that is, between what is and what ought to be.

**September 12**

**Mihai Surdeanu**, Associate Professor, School of Information: Science, Technology and Arts, University of Arizona

**TITLE:** Teaching Computers to Answer Non-Factoid Questions



**ABSTRACT:** In this talk, I will describe our work towards teaching computers to answer complex questions, i.e., where the answer is a longer piece of text that explains a complex phenomenon, using linguistic information that is automatically acquired from free text.

I will present a robust question answer model for non-factoid questions that integrates multiple sources of information, such as lexical semantics and discourse information, driven by two representations of discourse: a shallow representation centered around discourse markers, and a deep one based on Rhetorical Structure Theory.

I will describe how to evaluate the proposed system on two corpora from different genres and domains: one from Yahoo! Answers and one from the biology domain, and two types of non-factoid questions: manner and reason. I will experimentally demonstrate that the discourse structure of non-factoid answers provides information that is complementary to lexical semantic similarity between question and answer, improving performance up to 24% (relative) over a state-of-the-art model that exploits lexical semantic similarity alone. I will further demonstrate excellent domain transfer of discourse information, suggesting these discourse features have general utility to non-factoid question answering.

**September 5**

**Mary-Frances O'Connor**, Assistant Professor, Department of Psychology, University of Arizona

**TITLE**—Conflict Resolution in Bereavement and Complicated Grief: An fMRI Investigation

**ABSTRACT:** Complicated Grief, marked by a persistent and intrusive grief lasting beyond the normal grief process, is associated with a relative inability to disengage from idiographic loss-relevant stimuli. Functional magnetic resonance imaging (fMRI) studies investigating the neural networks associated with this bias consistently implicate the anterior cingulate cortex (ACC) in tasks of emotion regulation. To date, no such investigation of the neural mechanisms of Complicated Grief exists. Twenty-eight older adults were categorized into three groups based on grief severity: Complicated Grief (n=8), Non-Complicated Grief (n=9), and Nonbereaved controls (n=11). Using a block design, all participants completed the emotional-counting Stroop task during fMRI data acquisition. Differences in regional activation to grief-related (as opposed to neutral) stimuli across groups were examined. Those with Complicated Grief showed an absence of rACC and fronto-cortical recruitment. Post hoc analysis evidenced activity in the dorsal ACC in the Complicated Grief and Nonbereaved groups late in the task. These results indicate a group-specific deficit in recruitment of fronto-cortical regions often associated with emotion regulation. This deficit was not observed in recruitment of the orbitofrontal cortex and the rACC during processing of idiographic semantic stimuli in Noncomplicated Grief. These findings suggest a relative

inability to recruit the regions necessary for successful grief-related emotion regulation in those with Complicated Grief.

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## COGNITIVE SCIENCE COLLOQUIUM Spring 2014

- May 2**                    **Graduate Student Showcase** (Speakers, titles and abstracts listed below.)
- Jae-Hyun Sung**, Graduate Student, Linguistics (major) and Cognitive Science (minor)  
**Title:** What Does the Tongue Tell Us about Scottish Gaelic? A Case of Lexical Palatalization.
- Jinyan Guan**, Graduate Student, Computer Science (major) and Cognitive Science (minor)  
**Title:** Bayesian Statistical Modeling of Temporal Interpersonal Emotion System (TIES)
- Rachel Kraut**, Graduate Student, Second Language Acquisition and Teaching (major) and Cognitive Science (minor)  
**Title:** L2 Word Recognition and Storage: Evidence from Masked Priming
- April 18**                **Amanda Woodward**, William S. Gray Professor and Chair, Department of Psychology, University of Chicago  
**TITLE:** Infants' Grasp of Others' Intentions
- April 11**                **Gene Alexander**, Ph. D., Professor and Director, Brain Imaging, Behavior, & Aging Lab, Department of Psychology, Neuroscience and Physiological Sciences Inter-disciplinary Graduate Programs and Evelyn F. McKnight Brain Institute, School of Mind, Brain, and Behavior, College of Science, University of Arizona  
**TITLE**—Neuroimaging of the Aging Brain: Implications for Successful Aging and the Risk for Alzheimer's disease
- April 4**                    **Yaoda Xu**, Assistant Professor, Vision Sciences Laboratory, Psychology Department, Harvard University  
**TITLE:** Multi-Level and Dynamic Visual Object Representation in the Human Brain
- March 28**                **Heidi Harley**, Professor, Department of Linguistics, University of Arizona  
**TITLE:** Forces Instead of Events in Verb Meaning
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- March 7**                    **Wally Boot**, Assistant Professor, Cognitive Psychology, The Florida State University  
**TITLE:** Video Games as a Means to Improve Perceptual and Cognitive Abilities? The Promise and Challenges of Video Game Research.
- February 28**                **Noah Goodman**, *Roger N. Shepard Distinguished Visiting Scholar*, Assistant Professor, Department of Psychology, Stanford University  
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**TITLE:** Language, Reasoning, and Commonsense Knowledge
- February 21**                **Barbara Mellers**, Heyman University Professor, Department of Psychology, University of Pennsylvania  
**TITLE:** Improving the Accuracy of Intuitive Predictions of Geopolitical Events by Putting Psychology to Work
- February 14**                **Jessica Payne**, Assistant Professor, Department of Psychology, University of Notre Dame  
**TITLE:** Stress, Sleep, and Memory Consolidation: Independent and Interactive Effects
- January 31**                 **Stuart Hameroff**, MD, Anesthesiology, Psychology, Center for Consciousness Studies, The University of Arizona  
**TITLE:** ‘A finer scale’ – Intra-neuronal origins of EEG, memory, language and consciousness
- January 24**                 **Nicholas Turk-Browne**, Assistant Professor, Department of Psychology, Princeton University  
**TITLE:** Statistical Learning in the Mind and Brain
- January 17**                 **Tony P. Chemero**, Professor, Departments of Philosophy and Psychology, University of Cincinnati  
**TITLE:** The End of the Debate over Extended Cognition
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**COGNITIVE SCIENCE COLLOQUIUM**  
**Fall 2013**

- December 6**                 **Cognitive Science Graduate Student Showcase**  
Three speakers:  
**J. L. Sanguinetti**, Psychology Department  
**Title**—The Ground Side of an Object: Perceived as Shapeless yet Processed for Semantics
- Will Leonard**, Philosophy Department

**Title:** Elusive cognitive experience

**Bryan Chambliss**, Philosophy Department

**Title:** Social Cognition and Social Interaction

- November 22**      **Suzanne Curtin**, Associate Professor, Department of Psychology, University of Calgary  
**TITLE**—How Forms Become Labels: Phonological Knowledge Guides Infants' Word-Object Mappings
- November 8**      **Eric Reiman**, M.D., Banner Alzheimer's Institute and Banner Research, Department of Psychiatry, University of Arizona; Neurogenomics Division, Translational Genomics Research Institute, Arizona Alzheimer's Consortium, Phoenix, AZ  
**TITLE:** Launching the Era of Alzheimer's Prevention Research
- November 1**      **John Serences**, Associate Professor, Department of Psychology, Neuroscience Graduate Program, University of California, San Diego  
**TITLE:** The Role of Attentional Priority Maps in Supporting Selective Attention and Working Memory
- October 25**      **Sharon Thompson-Schill**, Christopher H. Browne Distinguished Professor of Psychology; Director, Center for Cognitive Neuroscience, University of Pennsylvania  
**TITLE:** Costs and Benefits of Cognitive Control for Language Processing
- October 18**      **Leah Kapa**, Ph.D., Research Associate, Department of Speech, Language, and Hearing Sciences, University of Arizona  
**TITLE:** Considering a Bidirectional Relationship between Executive Function and Language-Learning
- October 11**      **Rick Dale**, Associate Professor, Cognitive and Information Sciences, School of Social Sciences, Humanities and Arts, University of California, Merced  
**TITLE:** A "Centipede's' Dilemma" in Human Linguistic Interaction
- October 4**      **Eve Edelstein**, Associate Professor, College of Architecture, Planning and Landscape Architecture (CAPLA), The Institute for Place and Well-Being, University of Arizona  
**TITLE**—The Neuroscience of Design: The Human Response to the Built Environment

- September 27**      **Raymond M. Klein**, Professor, Department of Psychology and Neuroscience, Dalhousie University; Presently on sabbatical in the Department of Cognitive Science, UCSD  
**TITLE**—On the Flavors of Inhibition of Return: Two Ways to Enhance Orienting to Novelty
- September 20**      **Jack Gallant**, Professor, Department of Psychology, University of California, Berkeley  
**TITLE:** Detailed Maps of Semantic Information across the Human Brain
- September 13**      **Terence Horgan**, Professor, Department of Philosophy, University of Arizona  
**TITLE:** Reasons-Responsive Moral Judgment and the Phenomenology of Moral Experience
- September 6**      **Huanping Dai**, Associate Professor, Department of Speech, Language, and Hearing Sciences, University of Arizona  
**TITLE:** Seeing the Forest for the Trees: Delineating Global and Local Processing in the Perception of Sound Patterns