Society of Experimental Psychologists
2017 Meeting

Sponsored by the Department of Psychology and College of Arts and Sciences, Vanderbilt University

Thursday, March 2
6:00-8:00 pm ***Reception in lobby of David K. Wilson Hall***

Friday, March 3

Breakfast C210 Kissam Center
8:00-9:00 am

Presentations C210 Kissam Center

9:00-9:20 Gordon Logan and René Marois
Welcome to SEP, welcome to Vanderbilt University

9:20-9:40 Michael Kahana
Widespread desynchronization of high-frequency neural activity marks periods of successful cognition

9:40-10:00 Jeffrey Rouder
Elements of constraint: A Bayesian approach to defining and assessing invariances, order constraints, and mixtures

10:00-10:20 Ed Awh
The primacy of space in visual working memory

10:20-10:40 Irving Biederman, Emily Meschke, Rafael Maarek, and Eshed Margalit
What is the nature of the perceptual deficit in congenital prosopagnosia?

10:40-11:00 ***Coffee Break***

11:00-11:20 Randy Engle
Role of working memory capacity, fluid intelligence, and attention control in general discrimination ability

11:20-11:40 Nelson Cowan
Childhood development of remembering two things at once

11:40-12:00 Phil Kellman
Perceptual learning, cognition, and expertise

12:00-1:00 ***Lunch***

1:00-1:30 ***Norman Anderson Lifetime Achievement Award***

1:30-1:50 James Todd
Visual perception of 3D shape and surface materials from patterns of transmitted light

1:50-2:10 Bill Geisler
Multidimensional normalization is optimal for detection in natural scenes

2:10-2:30 Bill Warren
The local neighborhood in a human crowd

2:30-2:50 Michael Turvey
Retinal image and visibility of light are not axiomatic

2:50-3:10 ***Coffee Break***
3:10-3:30 Kevin W. Potter, Chris Donkin, David Huber
Testing a perceptual fluency/disfluency model of priming with a model of response time and choice
3:30-3:50 Roddy Roediger
Does the range of a confidence scale affect the relation between confidence and accuracy?
3:50-4:10 John Hummel
Different algorithms for featural and relational learning
4:10-4:30 Kathleen McDermott
Individual differences in learning efficiency
4:30-4:50 Tom Carr
Taking a test enhances remembering. Does it help thinking?
5:00 ***Group Picture***

Saturday, March 4

Breakfast C210 Kissam Center
8:00-9:00 am

Presentations C210 Kissam Center
9:00-9:20 Alina Nazareth, Steven M. Weisberg, Kate Margulis, and Nora S. Newcombe
Developmental origins of cognitive maps: Examining age-related differences in navigation proficiency in a virtual environment
9:20-9:40 Susan Fiske
An adversarial collaboration that worked: Advancing the science of the stereotype content model
9:40-10:00 Jack Gallant
Linking neuroimaging data to cognitive theories: An unresolved problem
10:00-10:20 Andrew Meltzoff
Development of social cognition in children
10:20-10:40 ***Coffee Break***
10:40-11:00 Rob Goldstone
Reminding versus comparison as instructional strategies for promoting memory and transfer
11:00-11:20 Tom Zentall
The ephemeral reward task: Why is it so difficult for some species to learn?
11:20-11:40 Steve Grossberg
A neural model of normal and abnormal learning and memory consolidation: Adaptively timed conditioning, hippocampus, amnesia, neurotrophins, and consciousness
11:40-12:00 Silvia Bunge
Reasoning to learn and learning to reason
12:00-1:00 ***Lunch***
1:00-1:30 ***Howard Crosby Warren Medal***

1:30-1:50 Morgan Barense
Neural convergence of perceptual and conceptual information
1:50-2:10 Roberto Cabeza
Exploring the multifaceted nature of memory representations
2:10-2:30 Isabel Gauthier
Individual differences in object recognition
2:30-2:50 Rich Shiffrin and Suyog Chandramouli
Issues concerning reproducibility in science
2:50-3:10 ***Coffee Break***
3:10-3:30 John Wixted
Models of lineup memory
3:30-3:50 James Townsend
Characteristics of disparity measures relating to integrality and configurality
3:50-4:10 Rob Nosofsky
High-dimensional category representations
4:10-4:30 Steve Link
Measuring the time quantum in discriminative decision processes
4:30-4:50 Jim Nairne
Adaptive memory: An update on work in progress
4:50-5:10 ***Business Meeting***

Reception Alumni Hall, rooms 202 and 206
6:00-7:00

Banquet Alumni Hall, rooms 202 and 206
7:00-10:00

LOCATIONS OF THE VENUES FOR THE CONFERENCE

Campus map available: http://www.vanderbilt.edu/map/

Abstracts

Morgan Barense

Neural convergence of perceptual and conceptual information

In what way are the conceptual representations of real-world objects related to the visual perception of those objects? Although there is great interest in understanding the visual basis of conceptual knowledge, the inherent association between the visual and semantic properties of real-world objects presents a challenge when attempting to isolate how the brain represents either attribute. For example, a lion and a tiger are both large jungle cats, and so would be expected to share close quarters in semantic space; however, they also share numerous perceptual features with one another, including sharp teeth, forward facing ears, fur, and overall shape. In this way, visual and conceptual attributes are often confounded. The importance of this point is underscored by a substantial body of research that implicates the anterior temporal lobes, in particular the perirhinal cortex (PRC), in *both* conceptual and perceptual processing – but in these studies conceptual and perceptual features were not independent. In the current study, however, we independently varied conceptual and perceptual overlap across a set of objects. Using data from 2,785 participants, we generated behaviour-based models that captured the conceptual and perceptual similarities among the objects. We then compared these behaviour-based models of conceptual and perceptual object similarity to corresponding measures of neural similarity while a different group of participants completed property verification tasks that encouraged either conceptual or perceptual processing of the 40 objects. Using representational similarity analysis of fMRI data we found that the PRC was the only region in the ventral visual stream to show sensitivity to conceptual and perceptual object information – an effect that was observed regardless of whether the property verification task was conceptual or perceptual in nature. These results suggest that conceptual and perceptual object information converge in the brain, likely at the level of the perirhinal cortex.

Susan Fiske

An Adversarial Collaboration that Worked: Advancing the Science of the Stereotype Content Model

Over the past 15 years, the stereotype content model (SCM) has mapped societies' social groups in a warmth x competence space. Warmth includes seeming trustworthy and sincere, stemming from perceived cooperative intent, and competence includes seeming able and agentic, stemming from perceived status. These dimensions explain ~80% of the variance in impressions and have been validated across methods, samples, time, and societies around the world. However, a plausible competing model recently challenged the SCM with an as-yet unused, more data-driven method. An adversarial collaboration yielded answers about which approach operates when. Constructive engagement advances the field.

Bill Geisler

Multidimensional Normalization is Optimal for Detection in Natural Scenes

A fundamental everyday visual task is to detect specific target objects within a background scene. Under natural conditions, both the properties of background and the amplitude of the target (if present) are generally different on every occasion. To gain some

understanding of detection under such natural conditions we determined the amplitude thresholds in natural images of a matched-template detector, as a function of the three local background properties: luminance, contrast, and phase-invariant similarity to the target. We found that threshold (which is equal to the standard deviation of the template response) is a linear separable function (the product) of all three dimensions—"multidimensional Weber's law." This fact poses a serious problem for detecting targets under natural conditions, where both the properties of the background and the target amplitude are uncertain. Specifically, good performance requires a different decision criterion on the template responses for each possible combination of background properties. However, we show that divisively normalizing the template (feature) responses by the product of the locally estimated luminance, contrast, and similarity creates a distribution of template responses that is normal with a standard deviation of 1.0, independent of the background properties. Thus, for any desired false-alarm rate the optimal hit rate is obtained with a single decision criterion, even under maximum uncertainty. This is just the sort of normalization (gain-control) observed early in the visual system for the dimensions of luminance and contrast, and perhaps for similarity. In psychophysical experiments, we show that human performance is consistent in detail with this normalized matched template observer (which has only a single efficiency parameter). We argue that the rapid and local neural gain-control mechanisms, and the psychophysical laws of masking, are most likely the result of evolving a near optimal solution to detection in natural backgrounds under conditions of high uncertainty.

Stephen Grossberg

A neural model of normal and abnormal learning and memory consolidation: Adaptively timed conditioning, hippocampus, amnesia, neurotrophins, and consciousness

How do the hippocampus and amygdala interact with thalamocortical systems to regulate cognitive and cognitive-emotional learning? Why do lesions of thalamus, amygdala, hippocampus, and cortex have differential effects depending on the phase of learning when they occur? In particular, why is the hippocampus typically needed for trace conditioning, but not delay conditioning, and what do the exceptions reveal? Why do amygdala lesions made before or immediately after training decelerate conditioning while those made later do not? Why do thalamic or sensory cortical lesions degrade trace conditioning more than delay conditioning? Why do hippocampal lesions during trace conditioning experiments degrade recent but not temporally remote learning? Why do orbitofrontal cortical lesions degrade temporally remote but not recent or post-lesion learning? How is temporally graded amnesia caused by ablation of prefrontal cortex after memory consolidation? How are attention and consciousness linked during conditioning? How do neurotrophins, notably brain-derived neurotrophic factor (BDNF), influence memory formation and consolidation? Is there a common output path for learned performance? A neural model proposes a unified answer to these questions that overcome problems of alternative memory models.

References

Franklin, D. J., and Grossberg, S. (2017). A neural model of normal and abnormal learning and memory consolidation: Adaptively timed conditioning, hippocampus, amnesia, neurotrophins, and consciousness. *Cognitive, Affective, and Behavioral Neuroscience*, 17, 24-

76. http://link.springer.com/article/10.3758/s13415-016-0463-y
Grossberg, S. (2017). Towards solving the Hard Problem of Consciousness: The varieties of brain resonances and the conscious experiences that they support. *Neural Networks*, 87, 38-95. http://www.sciencedirect.com/science/article/pii/S0893608016301800

Kevin W. Potter, Chris Donkin, David E. Huber

Testing a perceptual fluency/disfluency model of priming with a model of response time and choice

With immediate repetition priming of forced choice perceptual identification, short prime durations produce positive priming (i.e., higher accuracy when the target is primed, but lower accuracy when the foil is primed). In contrast, long prime durations reverse this pattern. The dynamic time course of this transition from positive to negative priming is well explained by the nROUSE model of Huber and O'Reilly (2003), which includes neural habituation. This model assumes that the speed of perceptual identification is used to decide which choice word was seen most recently as the briefly flashed target. Thus, short duration primes induce faster identification (perceptual fluency) for the primed choice and a bias for the primed alternative whereas long duration primes induce slower identification (perceptual disfluency) for the primed choice and a bias against the primed alternative. This account makes specific predictions regarding perceptual identification latencies, and yet a test of these predictions is difficult with forced choice testing, which reflects a comparison decision process. To address this limitation, we collected forced-choice and single-item same-different responses in the same priming paradigm. We then applied a diffusion race model to the data, transforming the response time and choice data into 'observed' drift rate parameters (i.e., the rate of evidence accumulation). Remarkably, the drift rates were inversely proportional to the identification latencies of the nROUSE model even though each model was applied independently to the data and even though the nROUSE model was only applied to the accuracy data. This convergence of the models confirms key predictions of the nROUSE model regarding perceptual fluency and disfluency.

Michael J. Kahana

Widespread desynchronization of high-frequency neural activity marks periods of successful cognition

The hypothesis that synchronous neural activity underlies eloquent cognition has driven an extensive body of research in human and animal neuroscience. Yet, the absence of data on whole-brain electrical connectivity during cognitive tasks has prevented a direct test of this hypothesis. Through the lens of memory encoding and retrieval processes, we construct whole-brain connectivity maps of fast gamma (45-95 Hz) and slow theta (3-8 Hz) spectral neural activity, in a dataset of 300 neurosurgical patients fitted with indwelling electrodes. We find that gamma networks desynchronize and theta networks synchronize during encoding and retrieval, with particularly strong connectivity dynamics observed among key memory-relevant regions. Further, for virtually all brain regions we studied, gamma power rises as that region desynchronizes with gamma activity elsewhere in the brain, establishing gamma as a largely asynchronous phenomenon. Concurrently, a brain region's gamma power is positively correlated with its general theta connectivity, suggesting a low-frequency mechanism for interregional communication.

Jim Nairne

Adaptive Memory: An Update on Work in Progress

Our capacity to remember evolved, subject to the constraints of natural selection. For the past decade our laboratory has been investigating whether the footprints of nature's criterion—the enhancement of fitness—are reflected in the current operating characteristics of remembering. We have shown, for example, that processing information in terms of its fitness value produces better retention than most other known encoding techniques. We have shown as well that whether an item is animate or inanimate is an important determinant of whether it will be recalled. I'll be discussing some recent experiments, all unpublished, that extend and reinforce the view that remembering is adaptive and "tuned" to dimensions that ultimately enhance fitness. I'll also hint at some possible applications for training.

Alina Nazareth, Steven M. Weisberg, Kate Margulis, and Nora S. Newcombe

Developmental origins of cognitive maps: Examining age-related differences in navigation proficiency in a virtual environment

Siegel and White's (1975) review of the development of spatial representation sparked a great deal of research on children's navigation. However, recent spatial development research has primarily focused on other topics, in part due to controversy about the nature of adults' abilities, i.e., whether or not people have a cognitive map. A recent approach to the problem has emphasized individual differences, and has developed a virtual environment (VE) assessment of spatial learning and judgments (Weisberg & Newcombe, 2015). We used this tool to investigate the developmental trajectory of cognitive mapping, with 106 participants, ranging from 8 to 16 years. Even 8-year-old children could estimate directions and construct schematic maps at above-chance rates. Around 12 years of age, participants performed at adult levels. Like adults, children showed clear individual differences, and could be grouped into three categories: imprecise navigators, non-integrators, and integrators (who arguably do form cognitive maps). The VE paradigm offers a practical approach to testing navigation skills even in school-age children and should allow investigation of longitudinal stability, the origins of individual differences, and navigation skills in children at risk for spatial deficits.

Rob Nosofsky

High-Dimensional Category Representations

We conduct extensive similarity-scaling and dimensions-ratings studies to characterize the high-dimensional structure of the natural-science categories of rock types. The derived similarity-scaling representations are then used in combination with a formal exemplar model of human classification learning to help guide the search for teaching techniques that result in effective learning and generalization of the rock-category instances. The long-term goal of the project is to translate progress in formal models of similarity representation and human category learning to the real-world science classroom.

Jeff Rouder

Elements of Constraint: A Bayesian Approach to Defining and Assessing Invariances, Order Constraints, and Mixtures

Model comparison in Bayesian mixed models is becoming popular in psychological

science. Here we develop a set of nested models that account for order restrictions, equality restrictions, and mixtures across individuals in psychological tasks. An order-restricted model addresses the question 'Does Everybody', as in, 'Does everybody show the usual Stroop effect', or 'Does everybody respond more quickly to intense noises than subtle ones.' The crux of the modeling is the instantiation of 10s or 100s of order restrictions simultaneously, one for each participant. The mixture model addresses the compliment question, 'Does Anyone Not,' as in does anyone not Stroop. To our knowledge, the problem is intractable in frequentist contexts but relatively straightforward in Bayesian ones. We develop a Bayes-factor model-comparison strategy. We apply the methodology to seven data sets from Stroop, Simon, and Eriksen interference tasks. Not too surprisingly, we find that everybody Stroops---that is, for all people congruent colors are truly named more quickly than incongruent ones. But, perhaps surprisingly, we find that this statement is not true for Simon. Some people seemingly truly do not show Simon interference. Implications of the modeling and conjectures about the differences in task dynamics are discussed.

Rich Shiffrin and Suyog Chandramouli

Issues concerning reproducibility in science

The current so-called 'crisis of reproducibility' often focuses on a reported result and its attempted replication or reproduction. We have been developing a Bayesian assessment tool designed to produce a posterior probability that both studies and prior knowledge indicate there exists a 'true' effect that is 'large enough to matter'. Time not allowing coverage of technical details, we will discuss conceptually both this approach and the major issues surrounding this 'crisis'. Scientists are presently engaged in a worthwhile attempt to see that we engage in better practices that will produce reports that have a higher likelihood of being valid. We will discuss some of the problems, remedies, and problems with remedies, but also discuss reasons why the present hand-wringing may be overblown: Science is producing major advances, many of which benefit society, in ever more rapid fashion; if science is to work well, a certain degree of non-reproducible results is inevitable; many non-reproducible results may be among the huge proportion of reports never cited or read, and/or otherwise have no effect upon scientific progress. We emphasize the critical role of prior knowledge and good scientific judgment, and the increasingly fundamental role of scientific social networks, particularly critical as the flood of yearly scientific reports seems to grow toward infinity.

Tom Zentall

In the *ephemeral reward task* animals are given a choice between two distinctive stimuli, A and B, each containing an identical bit of food. If they choose A they get the food on A and the trial is over. If they choose B they get the food on B and they are allowed to get the food on A before the trial is over. Thus, it is optimal to choose B. Although cleaner fish (wrasse) and parrots acquire the optimal response easily, several primate species do not. Furthermore, pigeons and rats also appear to be unable learn to choose optimally. To account for these paradoxical findings, we proposed that certain species may have difficulty with this task because they tend to respond impulsively to the initial choice having similar outcomes and do not associate the choice and reinforcement with the second reinforcement. To test this hypothesis, we temporally separated the initial choice from the first reinforcement by imposing a 20-s delay between the choice and its outcome.

Under these conditions both pigeons and rats acquired the optimal choice response. We suggest that impulsive choice may make it difficult to acquire certain tasks and imposing a delay between choice and outcome may decrease impulsivity and allow for optimal task performance.