Virtual Conference in Decision Neuroscience

June 5, 2020

Organized by Center for Applied Research in Decision Making, Fox School of Business, Temple University

10:00 Welcome and Opening Remarks

10:15 Session 1

Chaired by: Vinod Venkatraman

10:15 **Cendri Hutcherson**

When every glance counts: A rational model of attentional allocation explains why time constraints enhance framing effects

10:45 **Amitai Shehnav**

Neuroeconomic signatures of overall choice value: Neither choice, nor value?

11:15 **Gidi Nave**

Genetic Underpinnings of Risky Behavior Relate to Altered Neuroanatomy

11:45 Social Break

12:30 Session 2

Chaired by: Crystal Reeck

12:30 **Joseph Devlin**

Theatre is "best live"

13:00 **Brian Knutson**

Neuroforecasting political campaign survival

13:30 **Christin Scholz**

Practical implications of neuroimaging: Using brain data to understand, predict, and influence the success of media content

14:00 Social Break/Breakout discussion

14:30 Session 3

Chaired by: Uma Karmarkar

14:30 **Nicolette Sullivan**

Neural changes across the lifespan are associated with changes in temporal discounting

15:00 **Joseph Kable**

Using mobile eye-tracking to capture the effects of choice set size on information processing during purchase decisions in the field

15:30 Panel Discussion: Impact of Covid-19

Moderated by: Uma Karmarkar
Panelists: Scott Huettel, Ale Smidts, Carolyn Yoon

16:00 Wrap up, Socializing, Happy hour

Abstracts

When every glance counts: A rational model of attentional allocation explains why time constraints enhance framing effects

Cendri Hutcherson, Canada Research Chair in Decision Neuroscience, University of Toronto

Competition between a quick, affective System 1 and a slow, analytical System 2 constitutes the theoretical backdrop for much of decision science. A major assumption of this work is that time constraints limit the influence of System 2. Thus, alterations of choice under time pressure reveal processing associated with System 1. However, other research has shown that decision-makers also adapt their choice strategies to accommodate serial processing constraints. We hypothesized that such strategic adjustments, in the form of attention allocation, might account for some effects previously attributed to dual-systems. To test this idea, we conducted a direct-replication of a recent set of studies showing that constrained decision time amplifies the framing effect (Guo et al., 2017), while also recording participants' eye movements. In line with an adaptive decision-maker account, time constraints induced strong shifts in attention allocation that accounted for previously-observed behavioral effects. We further develop a novel computational model of rational attention that accounts for both the attentional and behavioral shifts. Overall, our findings are consistent with decision-makers as proactive agents who adapt their choice process in anticipation of limitations imposed by the environment and raise potential challenges to dual-systems models of choice.

Neuroeconomic signatures of overall choice value: Neither choice, nor value?

Amitai Shehnav, Assistant Professor, Brown University

Neural correlates of the overall value of a set of options are often interpreted as reflecting inputs into a comparison between potential rewards. I will present two sets of studies that suggest revisions to this account. First, using EEG and fMRI, we show that overall value signals can reflect a process of option set appraisal that is independent of choice comparison. Second, using model-based analyses of behavior and fMRI, we show that the contribution of overall value to behavior (i.e., speeding choices) has little to do with reward per se, but rather the extent to which those rewards facilitate our task goal (typically to choose the best option). Collectively, these results suggest that some of the common neural signatures associated with value-based choice may reflect cognitive and affective processes that occur outside of the choice process.

Genetic Underpinnings of Risky Behavior Relate to Altered Neuroanatomy

Gidi Nave, Assistant Professor of Marketing, The Wharton School, University of Pennsylvania

Previous research points to the heritability of risk-taking behavior. However, evidence on how genetic dispositions are translated into risky behavior is scarce. Here, we report a genetically-informed neuroimaging study of real-world risky behavior in a large European sample (*N*=12,675). We found negative associations between risky behavior and grey matter volume

(GMV) in distinct brain regions, including amygdala, ventral striatum, hypothalamus and dorsolateral prefrontal cortex (dlPFC). Polygenic risk scores for risky behaviors, derived from a genome-wide association study in an independent sample (*N*=297,025), were inversely associated with GMV in dlPFC, putamen, and hypothalamus. This relation mediated ∼2.2% of the association between genes and behavior. Our results highlight distinct heritable neuroanatomical features as manifestations of the genetic propensity for risk taking.

Theatre is "best live"

Joseph Devlin, Professor of Cognitive Neuroscience, University College of London

Being in a live audience is a real buzz. Listening to Ozzy perform "Crazy Train" in concert is a totally different experience than hearing it on Spotify. Watching the Eagles at the Linc beats Fox's coverage every time and there is something special about attending theatre in London's west-end. In each case, being part of a live audience enhances the experience. Here, we investigated the effect of social context on audience engagement by measuring autonomic nervous system responses while different groups of volunteers experienced the musical *Dreamgirls*. Participants watched either a live performance of the show at a west-end theatre (n=22) or the movie version (n=44), half of whom saw it in small groups (n=21) or alone (n=23). Although there were no differences in self-reported enjoyment across groups, average heart rates were highest among those in theatre group, followed by small groups watching the movie and then individuals. The same pattern was seen for heart rate variance, with the highest highs and lowest lows seen in the theatre group. Finally, heart rate synchrony was highest among the theatre audience as well. In other words, when heart rate was used as an implicit measure of audience engagement, there were clear differences between being at live theatre relative to watching the same show in a movie format. The current findings help to explain theatre's enduring appeal despite the fact that consumers now have an almost endless supply of movies and high-quality digital content at their fingertips.

Neuroforecasting political campaign survival

Brian Knutson, Professor of Psychology, Stanford University

Can the fate of political campaigns be forecast? Some theorists claim that rapid implicit responses to candidates themselves drive eventual campaign success, while others argue that the course of campaign events determine their viability. In this research, we set out to determine whether neural activity in a group of subjects (n=46) could forecast the survival of the political campaigns of 15 nominees over a year during the Democratic primary of 2019-2020. Consistent with a partial scaling account of neuroforecasting, we predicted that individuals' Nucleus Accumbens (NAcc) and Medial PreFrontal Cortex (MPFC) activity might predict individuals' candidate endorsement, but only group NAcc activity would forecast candidates' campaign survival months later. We also tested whether neural measures could outperform more conventional forecasts (e.g., from concurrent polls). As predicted, not only could group NAcc activity forecast political campaign survival, but it did so as well as polling

data, and more potently than other conventional measures. Theoretically, these findings support a partial scaling account of neuroforecasting by demonstrating that neural activity can forecast political as well as market outcomes. Practically, by demonstrating added value, the findings hold implications for enhancing the efficiency and impact of political campaigns by suggesting that candidate selection plays a significant and early role in campaign survival.

Practical implications of neuroimaging: Using brain data to understand, predict, and influence the success of media content

Christin Scholz, Assistant Professor of Persuasive Communication, University of Amsterdam

Functional neuroimaging data has advanced our understanding of how people process and respond to media content like news and advertisements. A common approach in this line of work is to observe neural activity while participants are exposed to the media stimulus and subsequently use this activity to predict how impactful the stimulus is, for instance, to what extent a news item becomes popular on social media or to what extent an ad campaign generates sales. Examining the brain allows researchers to make inferences about the relevant psychological processes that underlie decision-making in response to media stimuli. An important next step is to use what we learned from prior neuroimaging work to not only understand but actively influence decision processes, behaviors and, ultimately, the impact of media content. This talk summarizes a line of studies on the neural correlates of online news sharing which illustrates this progression from basic science to practical interventions based on insights from functional neuroimaging. In this research program we began charting brain regions that were active when participants considered whether to share news items with others and demonstrated that these neural indicators predicted real-world impact of the media content in form of objectively logged numbers of social media shares by hundreds of thousands of readers. In a next step, we translated insights from this work about the psychological drivers of sharing into a causal manipulation designed to engage neural and psychological drivers of sharing and, ultimately, sharing behavior.

Neural changes across the lifespan are associated with changes in temporal discounting

Nicolette J. Sullivan, Assistant Professor of Management, London School of Economics and Political Science

As evidenced by low savings rates, consumers consistently struggle to defer small rewards in favor of larger ones later – i.e., to successfully delay gratification. In this study, we combine modelling of inter-temporal monetary choices with structural and functional neuroimaging, in a community sample spanning 13 to 70 years old to estimate how changes in temporal discounting track functional and structural changes in the brain. Participants chose between monetary outcomes payed at different delays while we measured brain activity using functional magnetic resonance imaging (fMRI). Controlling for income and financial security, delay of gratification increased with age, while both grey matter density and neural response to value in the ventral striatum (VS) decreased with age. The DLPFC, often found to be related to

successful self-control, increased its functional connectivity with the vmPFC with age. These age-related structural and functional changes were significantly correlated with the participant's level of delayed discounting, potentially providing a neural mechanism through which increased self-control is executed.

Using mobile eye-tracking to capture the effects of choice set size on information processing during purchase decisions in the field

Joseph Kable, Baird Term Professor of Psychology, University of Pennsylvania

In a lab-in-the-field study, we measured eye gaze with a mobile eye-tracker while participants moved through a professional mock grocery store and selected items for purchase from several provided categories. There were three main categories of interest, including a utilitarian (bread), hedonic (chocolate) and neutral (sugar) good. Across participants, we manipulated whether the facings in each category contained 3, 6 or 12 different options. We found that, as the number of options increases, shoppers used brand information to simplify the choice set. Though all options were looked at in smaller choice sets, in the largest choice set participants were more likely to look at items that match the brand of their eventual choice and skip over items that do not match their chosen brand. This reduction-by-attribute strategy mirrors what has been found in laboratory studies; as the number of options increases, people stop evaluating every option and instead focus on a subset of options that are strongest on the most important attribute. Our results demonstrate the utility of mobile eye-tracking for testing hypotheses about information processing in more naturalistic settings.