

Workshop Proposal: Contemporary Cognitive Approaches to Decision-Making

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Overview and significance

The study of how people make judgments and decisions began in cognitive science (the primary JDM conference literally was founded as a workshop at the Psychonomics conference). However, over time the area of judgment and decision-making (JDM) has moved apart from its cognitive roots, despite the high overlap in underlying research questions. However, greater interaction between cognitive and JDM research could yield benefits to both from cross-pollination (Bartels and Johnson 2015), including in terms of methods, types of relevant data and underlying questions. This workshop is designed to foster such interaction. The talks will explore some productive areas of overlap between cognitive research and judgment and decision-making research.

Workshop structure. We plan a one-day workshop comprising 12 talks, each approximately 25 minutes. We also plan to have a one-hour panel discussion with all speakers on opportunities for leveraging cognitive and computational approaches to make new advances on long-standing questions in judgment and decision making.

Organizers and Presenters

Daniel Bartels (Organizer) is Associate Professor of Marketing at the University of Chicago.

Todd Gureckis (Organizer) is Associate Professor of Psychology at New York University.

Jennifer Trueblood (Organizer) is Assistant Professor of Psychology at Vanderbilt University.

Oleg Urminsky (Organizer) is Professor of Marketing at the University of Chicago.

Presentations

Neil Stewart (Warwick Business School, Behavioral Science) will discuss **how machine-recorded data can be used to study cognitive questions.** One project uses transactions from 180,000 individuals on a stockbroking platform, to show that people frame outcomes at the level of individual days, splitting new investments $1/N$ over purchased stocks. Despite $1/N$ purchasing, the $1/N$ pattern is obscured by aggregation at the portfolio-level frame---revealing that the frame is the individual purchase and not the portfolio. Another project uses supermarket purchase history from millions of customers to explore the attraction, similarity, and compromise effects in real, every day purchases, and the implications for process models of multi-alternative choice.

Daniel Bartels will discuss how anchors and target values differ, and how they relate to credit card payments. Reference points serve as targets, with motivational properties, whereas anchors act as neutral starting points for subsequent judgments. This distinction can lead to meaningful differences in interpretation and generalization of results. Through several experiments and examination of a large credit card data set, we investigate this difference and find that values on credit card statements can serve as motivating target values that can be effective at increasing monthly payments when constructed wisely. We find that credit card users are able to select effective goals for themselves.

Sudeep Bhatia (University of Pennsylvania, Psychology) will discuss **a project on the structure of decision models.** We take more than 50 models of risky choice and more than 50 models of intertemporal choice, and computationally measure model mimicry between each model pair in each domain (2000+ computational tests, each with 100+ model fits). With this we are able to uncover a metatheoretical structure for the universe of risky and intertemporal decision models, with discrete model clusters as well as complex model hierarchies. The project is still underway but has already revealed a number of interesting results. It is also a commentary on the current state of decision modelling, and suggests a number of new directions for the field.

Oleg Urminsky will discuss what factors make decisions seem more similar or different. While academic researchers categorize decisions into literatures, less is known about how lay people view types of decisions. We develop a framework to predict when people will see decisions as similar or different. Participants rate decisions on attributes identified in an initial exploratory study as reasons for perceiving decisions as different. Relating these attributes to perceived similarity of decisions, we identify the key factors that make decisions seem similar or different. We develop a framework for thinking empirically about generalizability in research, and discuss the implications for people's choices of decision strategies.

Falk Lieder (UC Berkeley, Psychology) will discuss **an integrative framework for modeling and improving people's decision strategies.** A substantial literature has demonstrated systematic violations of expected utility theory, but the underlying cognitive mechanisms are not well understood. I present a theoretical framework that integrates the psychological realism of heuristics and biases with the unifying power and mathematical precision of normative principles. The assumption that decision-makers should make optimal use of their finite time and limited cognitive resources (resource-

rationality) yields an automatic method for deriving rational heuristics from first principles. Combining this method with process tracing allows us to answer descriptive, normative, and prescriptive questions about people's strategies for multi-alternative risky choice and planning. I illustrate its utility for characterizing and quantifying the irrationality of decision strategies relative to a realistic normative standard. Preliminary results suggest that deriving and teaching rational heuristics is promising for improving decision-making.

Paula Parpart (University College London, Computational Decision Making) will reinterpret heuristics as Bayesian inference. Simple heuristics are typically regarded as tractable decision strategies because they ignore a great deal of information in the input data. One puzzle has been why simple heuristics can outperform more complex full-information models, such as linear regression. I will demonstrate that these *less-is-more* effects do not portray any inherent advantages of ignoring information, but rather that discarding information is never optimal (at the computational level). I place heuristics into a Bayesian inference framework, where popular heuristics are equivalent to Bayesian inference under the limit of infinitely strong priors. Interestingly, down-weighting information with the appropriate prior is always preferable to entirely ignoring it. I will discuss recent work on the idea that high covariance environments may be responsible for the success of many heuristics.

Jennifer Trueblood will present work on computational models of dual process theory. Many phenomena in judgment and decision-making are often attributed to the interaction of two systems of reasoning. While these so-called dual process theories can explain many types of behavior, they are rarely formalized as mathematical or computational models. Rather, dual process models are typically verbal theories, which are difficult to conclusively evaluate or test. We present a dynamic dual process model framework of risky decision-making that provides an account of the timing and interaction of the two systems and can explain both choice and response time data.

Jared Hotaling (University of New South Wales, Psychology) will discuss the effects of outcome information during sampling on decisions from experience. We investigated the roles of attention and memory in decisions from experience by comparing decision procedures where monetary value information is (a) present during sampling versus (b) revealed after sampling. In three experiments participants made a series of choices between pairs of risky gambles represented as urns containing different mixtures of blue and red balls, starting with a sample task before making a consequential decision, and varying visual and auditory salience. Individuals placed greater weight on rare events when outcome values were absent during sampling. Highlighting a rare reward increased its salience when outcome values were present, but not when they were absent. Parameter estimates from a hierarchical Bayesian prospect theory model supported the conclusion that value-absent choices involved greater overweighting of rare events.

Nick Reinholtz (University of Colorado Boulder, Marketing) will discuss reasoning about numeric distributions. To make optimal decisions, people often need to know aspects of a numerical distribution beyond its central tendency. For example, optimal stopping requires understanding the dispersion of potential payoffs. I discuss how people learn (or don't learn) and use (or don't use) distributional information in simple tasks. We find that participants learn the central tendencies of two simultaneously encountered distributions with high accuracy, but show predictable biases in learning about dispersion. This suggests a puzzle about how people represent distributional information.

Stephen Spiller (UCLA, Marketing) will discuss the distinction between beliefs about quality and preferences. Two individuals considering the same set of alternatives often hold discrepant beliefs about whether one alternative is objectively better than the other as a matter of fact (an objective value comparison), or whether the difference reflects a matter of personal preference (a subjective value comparison). I examine how these beliefs relate to the attribute structure of the underlying alternatives. This helps to address when choices requiring tradeoffs may be regarded as objective value comparisons, which alternative comparisons are likely to covary, and suggests individual differences that may account for common judgments across attributes.

Abby Sussman (University of Chicago, Marketing) will present work on causal scope and judgment. Often, we must make decisions about how to bring about a desired outcome. Making these decisions, we frequently have information about how broad a range of potential outcomes that particular action could cause (e.g., a cold could cause sneezing while the flu could cause sneezing, headache and fever). We find that beliefs about which action will lead to a stronger outcome varies predictably based on the action's intentionality and valence. People believe the narrow scope action is more powerful when it is intentional (vs. unintentional) and when it is a cure (vs. a cause), and there is no interaction between the two. This research opens a line of inquiry into how the scope of a cause can influence judgments and decisions.

Hang Zhang (Peking University, Psychology) will present a decision-theoretic model for the temporal dynamics of visual priming effects. In visual priming tasks, participants respond to the identity of a visual target following a prime. Three priming effects—positive priming, negative priming, and oscillated priming—were observed and considered by previous theories as consequences of automatic sensorimotor processes. Here we developed a decision-theoretic model for the response time of visual priming tasks. The basic idea is that the brain has a constantly updated, probabilistic expectation for the arrival time and identity of the incoming target, which determines the motor preparing rate at each moment and thus the response time in an adaptive way. The model could quantitatively predict all three priming effects and how they vary with the temporal structure of the environment. It also offers new insights to a range of related phenomena.