Building Bridges from (Ivory) Towers: Combining Academia and Industry for Cognitive Research

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Keywords: methods; basic and applied research; industry

Objectives

This half-day workshop will discuss how to enrich research by marrying academic and industry-based work. Attendees will learn the theoretical, practical, and logistical complexities involved in advancing cognitive science across these distinct research sites.

This topic is relevant to the cognitive community because academia and industry often have common goals but distinct capabilities. For example, academics have the freedom to study almost any quantifiable question, and typically run small-scale studies performed in highly controlled settings with limited sets of participants. This approach results in high internal validity, but low statistical confidence, external validity, and limited replicability. Industry researchers are also often interested in human behavior (that of their users or clients) but typically need to further a company's business objectives with their work. However, these researchers have access to large-scale data sets and resources unmatched by the academic sector (Griffiths, 2014). This workshop will help attendees identify cases where cross-site collaborations might be useful, along with the methods necessary for carrying out such research.

Workshop Outline

The workshop will begin with a series of talks highlighting a) the use of cognitive theory in industry contexts, b) the methodological considerations necessary for undertaking industry-centered research, and c) how to build holistic networks that pass information gleaned from industry activity back into academia-centered research. It will provide examples from the following industries in order to deliver a broad perspective.

Education Thinking, reasoning, and learning are central to cognitive science, however little attention is given to applied education. That said, a number of researchers have realized that watching how people process information in real learning contexts can not only help to shape better educational programs (e.g., Weitnauer et al., 2016), but also provide insights into cognition (e.g., Goldstone et al., 2008). This workshop will provide examples of how research in real learning settings can provide access to diverse research participants, and an ability to 'cache-out' learning theories.

Data Science and Machine Learning Cognitive science is broadly interested in observing human behavior to make claims about mental mechanisms. While data science and machine learning can leverage any data, many companies are specifically interested in describing, understanding, and predicting their human users. This data can be important to basic research since, as Jones (2015) points out, social media, web-tracking, search-logs, and consumer reviews are huge sources of behavioral data that are typically inaccessible to academic researchers. This workshop will use data science and ML as examples of how industry is using cognitive science to model user behavior, as well as how those models can provide insights into cognition.

User Experience (UX) Cognitive science often specifies how cognitive mechanisms interact with external stimuli. While these interactions are typically described in terms of high-level principles, they govern real-world interactions such as those between a user and a product. UX focuses on applying these principles to optimize usability (Kujala et al., 2011). As a result, it relies on both cognitive research and methods. For example, it can consider work about perception and attention in order to lessen cognitive load on a human worker (e.g., Zheng et al., 2011), and it can be evaluated using measures such as eye-tracking, EEG, and reaction times (Oviatt, S.L., 2006). This workshop will use UX as an example of how academic learnings can be directly translated into concrete products, and how the development of those products can provide cognitive data.

The workshop will then provide participants with an opportunity to develop their own cross-site methodologies, with guidance from the facilitators. Finally, there will be a round-table discussion with both the facilitators and speakers where participants can ask further questions, get group feedback on their ideas, and further develop their understanding of cross-site research.

Audience

This workshop will appeal to the broad cognitive community. As Jones (2015) states, 'Cognitive research is increasingly coming out of the laboratory', and increased interest has been demonstrated in past CogSci workshops, such as Mason & Suri (2011). Thus, this workshop will be useful for experimentalists, who will learn about the methodological and operational considerations necessary for completing studies in industry contexts, as well as computational modelers who will learn how their models may be applied or developed through industry applications.

It will also benefit researchers at various stages in their careers. Graduate students may be interested in a window into research-oriented job trajectories outside of academia.

Likewise, younger professors interested in building academic/professional research networks, and professors attending to the flow of students into industry will value a venue for considering the positive benefits of increased connections across research sites.

Presenters

This workshop will include speakers who have experience in both academic and industry research.

Facilitators

This workshop will be run by Katherine Livins and Jay Martin. Livins's academic research focused on reasoning and perception, while Martin's focused on models of causal reasoning and categorization. They both now work as Data Scientists, leveraging cognitive science for the purpose of optimizing human decision-making in online working environments.

Additional Speakers

David Landy - *Indiana University, Department of Psychological and Brain Sciences*. Landy's research focuses on computational and theoretical approaches to formal reasoning, mathematical cognition, and perception. He used this research to create an application called "Graspable Math", which teaches mathematical concepts by exploiting perceptual and gestural processes. He will speak on how real-world situations challenge academic research by providing richer contexts to develop and test the robustness of theories, with examples grounded in Graspable Math.

Noah Goodman - *Stanford University, Advisor to Geometric Intelligence (now Uber AI Labs), Co-founder and advisor to Gamalon Labs and Ought Inc*. Goodman's academic work spans cognitive modeling, probabilistic programming languages, categorization, and social reasoning. He also recently began working with Uber on applied AI and machine learning projects. He will speak about how these projects are interacting with his pre-existing academic research.

Robert Rauschenberger – *Exponent.* Rauscehnberger's academic work focused visual attention in displays. He now works as a Managing Scientist on human factors and industrial engineering, applying his knowledge about the visual system to product design and human-product interface interaction. He will speak on the role of cognitive psychology in user research and experience design.

Nick Gaylord - *CrowdFlower.* Gaylord's academic research focused on the application of experimental design principles to the collection of training data for NLP models, and the role of domain-general decision making processes in human language comprehension. He now works as a Senior Data Scientist on how to curate human-generated data sets for algorithm consumption. He will speak on how skill sets and methods can translate between academia and industry.

Workshop Structure

Livins will open by introducing and framing the workshop. Each speaker will then present a 25-minute talk (including questions), before Martin closes by identifying consistent themes. Livins and Martin will then engage participants to identify cross-site opportunities in their own work, and help them develop a list of necessary methods and resources. The session will end with a 20-minute round-table discussion.

Table 1: Schedule.

Event	Time
Opening Remarks: Livins	20 minutes
Speaker 1: Landy	25 minutes
Speaker 2: Goodman	25 minutes
Speaker 3: Rauschenberger	25 minutes
Speaker 4: Gaylord	25 minutes
Closing Remarks: Martin	20 minutes
Guided research development	20 minutes
Round-table discussion	20 minutes
Total time	180 minutes

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