Putting it together: Interactions between domains of cognition

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Overview

One of the oldest and deepest questions across the cognitive sciences concerns the architecture of the mind (Fodor, 1983). Which cognitive capacities are supported by domain-general computations that apply to a broad set of inputs, and which are supported by domain-specific computations, that are specialized for a particular mental function? This question has motivated a broad set of research programs, ranging from the evolution and development of human knowledge (Tomasello, Melis, Tennie, Wyman, & Herrmann, 2012), to the specialization of neural functions (Kanwisher, 2010), to building machines to think and learn in the same ways that we can (Lake, Ullman, Tenenbaum, & Gershman, 2017).

Work from the last few decades has led to the proposal that in addition to our capacities for domain-general processing, the human mind and brain have 'domains of cognition' (Gelman & Noles, 2011): that is, computations that operate on a limited set of inputs, that represent those input in terms of causal and abstract content, and that guide learning and thinking in virtue of specific functional goals. For example, researchers have proposed a range of candidate cognitive domains, including objects, agents, number, space, social relationships, and language (Spelke, 2022; Carey, 2009).

Here, we raise an understudied question: Granting that human minds have some domain-specific systems of cognition, *how do these domain-specific systems work together*? For example, how do human adults bring together information about minds, actions, spatial relations, and objects to make sense of the sentence "Alice saw three keys on top of the table, and knew that one of them must open the door"? How do humans and other animals represent and make decisions in a spatially extended world with enumerable entities like physical objects and conspecifics? One simple answer to this question is that while domain-specific systems operate in parallel and relatively independently of each other, domain-general cognitive systems (on some accounts 'central cognition', Fodor, 1983; on other accounts, natural language; Spelke, 2022) flexibly combine the outputs of each of these systems, delivering representations that integrate information cross domains. Yet, it is also plausible that the functions of domain-specific systems depend on each other in more direct ways, for example to represent an agent as an object with a mind (Liu, Outa, & Akbiyik, 2024), or to represent an agent as the cause of physical objects' features (Jara-Ettinger & Schachner, 2024). In this example, where does that leave the status of and relationship between these two cognitive domains: agents and objects?

In this workshop, we will bring together researchers who work at the intersection of two or more cognitive domains, and to consider the following questions:

- What are ways that domains of cognition could in principle interact with each other?
- How does evidence for specialization of a cognitive system bear on the question of its independence from other domains?
- Are these domains (objects, agents, number, space, social relationships, and language) the right ones? What's missing and how could we tell?
- What do alternative hypotheses about mental architecture predict about the development, neural basis, and evolution of the human mind? What sorts of studies on young children, the human brain, and non-human animals would help us to adjudicate between these hypotheses?
- What facilitates the integration of information across domain-specific systems? Do the representations within and/or outputs of domain-specific systems share a common format? How do such representations interface with language?

Intended Audience

Inspired by the theme of **CogSci 2025** (Theories of the Past, Theories of the Future), this workshop aims to pay homage to domain-specific accounts of the human mind (Hirschfeld & Gelman, 1994), and to shine a light on an important future direction for this topic: how domain-specific cognitive systems interact with each other, in principle and in practice. Therefore, we believe that this workshop will be of broad interest to conference attendants, including psychologists, neuroscientists, computational cognitive scientists, and philosophers. We hope that this workshop will facilitate lively debate, future collaborations, and spark broad interest in this topic.

In D. Barner, N.R. Bramley, A. Ruggeri and C.M. Walker (Eds.), *Proceedings of the 47th Annual Conference of the Cognitive Science Society*

Confirmed Speakers

The following scholars have agreed to present in person at this workshop as a facilitator, speaker or discussant.

Nadia Chernyak is an Associate Professor of Cognitive Sciences at UC Irvine. She studies the cognitive foundations of our understanding of equity, justice, fairness, equality, and social group cognition.

David Menedez is an Assistant Professor of Psychology at UC Santa Cruz. He studies how children and the adults in their lives think about concepts like death, evolution, illness, and religion.

Shari Liu (Organizer) is an Assistant Professor in Psychological and Brain Sciences at Johns Hopkins University. She studies the developmental, neural, and computational origins of social and physical reasoning.

Joseph Outa (Organizer) is a graduate student in Psychological and Brain Sciences at Johns Hopkins University. He studies the nature and origins of our abstract knowledge of objects and agents.

Lindsey Powell is an Assistant Professor of Psychology at UC San Diego. She studies the developmental and neural origins of cognition, with a focus on social cognition.

Adena Schachner is an Associate Professor of Psychology at UC San Diego. She studies how children derive social meaning from the things other people create or choose (e.g. music, art, tools).

Tianmin Shu is an Assistant Professor of Computer Science at Johns Hopkins University. He studies the computational basis of social intelligence, including its interactions with language, planning, and physical intelligence.

Elizabeth Spelke is the Marshall L. Berkman Professor of Psychology at Harvard University. She studies the nature, development of human knowledge, and explores how cognitive science can inform learning in formal settings.

Natalia Vélez is an Assistant Professor of Psychology at Princeton University. She studies the computational, cognitive, developmental, and neural origins of collaboration.

Lio Wong is a Stanford Human-Centered Artificial Intelligence Postdoctoral Fellow. They study the computational basis of language, perception, intuitive physics, and theory of mind.

Fei Xu is a Professor at UC Berkeley. She studies a range of topics in cognitive development including language, belief revision, and probabilistic reasoning.

Sami Yousif is an Assistant Professor of Psychology and Neuroscience at UNC Chapel Hill. He studies the nature and development of our understanding of number, space, and time.

Workshop Structure and Schedule

This half-day workshop will consist of 3 sections of 15-minute talks, followed by a discussant (Xu, Liu, and Spelke). We will end the day with a brief panel discussion to reflect on, compare, and synthesize perspectives on the status of domain-specificity in theories of cognition and human intelligence.

Below is a tentative schedule for the workshop. More information is available at **https://sites.google.com/view/cogsci2025-domains/home**.

Section 1: Number, space, and biology
Sami Yousif - topology, number, and space
Nadia Chernyak - social evaluation, fairness, number
David Menendez - illness as a biological and social domain
Discussant: Fei Xu

Section 2: Psychology and sociology
Lindsey Powell - instrumental and social agency
Adena Schachner - intuitive archaeology: social reasoning from the physical world
Natalia Vélez - social cognition at scale
Discussant: Shari Liu

Section 3: Language
Lio Wong - language and vision
Tianmin Shu - language and theory of mind
Discussant: Elizabeth Spelke

Section 4: Panel Discussion

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