

Artificial Agents for Social Neuroscience and Social Good:

Progress, Challenges and the Road Ahead.

Social interactions are fundamental to the human experience, shaping how we live, learn and work. The COVID-19 pandemic – which has changed the way millions of people coordinate, cooperate and connect with others – highlights the intensifying importance of investigating the neurocognitive mechanisms that allow us to interact with others, and the consequences of achieving social connection. The last decade has seen significant progress in this empirical pursuit with the advent of new technologies enabling the full complexity of spontaneous, dynamic and reciprocal interactions to be scrutinized with scientific rigor and objectivity.

This symposium brings together researchers from intersecting fields of social neuroscience and ecological psychology to discuss new approaches, challenges and insights gained in interactive cognition research. Presentations showcase diverse yet complementary methods for studying how social information is perceived, processed and signaled by individuals to navigate social encounters. They also explore human and technological factors that shape the outcomes of social interactions in various contexts, including *in situ* physical interactions, online interactions, embodied virtual interactions and human-robot interactions. Together, this symposium aims to stimulate discussions about the future of interactive cognition research, given the ever-evolving nature of social interactions in our modern world, and the technologies available to both study and support them.

social cognition; social neuroscience; artificial intelligence; virtual reality; social robotics

The Role of Beliefs and Expectations during Interactions with Artificial Agents

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Artificial agents – avatars in a virtual game or assistant robots in the shopping mall – are becoming increasingly present in our worlds. They are also becoming a commonly used tool in social neuroscience research. Whilst research on the application of artificial agents in social settings has extensively interrogated the role of aesthetics and behavioural function on how humans perceive and interact with these non-human agents, less attention has been paid to the psychological factors that impact how humans engage with artificial agents – and the extent to which this can promote or hinder the agent fulfilling its intended purpose. In this talk I review recent work exploring how our beliefs and expectations about artificial agents shape (1) our behaviours towards them; (2) how we process social information they display; and (3) our subjective experiences during interactions with them. I will also discuss the importance of this knowledge when designing

artificial agents for social applications – such as using social robots as a learning aid for children with reading difficulty and reading anxiety. I will propose that understanding each user's beliefs, expectations and psychological context is key to determining whether the application of this technology is likely to help or hinder.

Interactive Virtual Reality for the Study of Collaborative Problem-Solving

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Living systems have the extraordinary capacity to structure their activity not only in isolation, but in coordination with other members within larger group structures. The resultant behaviors that emerge at the collective level not only demonstrate key features of self-organizing systems, whereby interactions at the individual can give rise to qualitatively distinct patterns of collective behavior, but also illustrate that the patterns of behavior groups exhibit show similitude spanning biological phylogeny. I investigate corralling

and containment behaviors, commonly observed amongst apex predators in group hunting, to investigate the development of cooperative strategies amongst humans. I will provide an overview of research findings investigating naïve human dyads, comparisons to the behaviors observed in non-human systems, as well as the efficacy of using artificial agents in steering the emergence of task-optimal behavior. I will also provide an overview of the tools used to investigate these questions, in particular, the use of consumer-grade hardware (HTC Vive), free industry-standard software (Unity3D) and open-source networking solutions (Mirror Networking).

Promoting Interpersonal Interaction and Connectedness Through Social Motor Coordination

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Social isolation and loneliness are at critically high rates across the globe and have been directly associated with poorer cognitive, emotional, and physical outcomes across all age groups. Although many countries have identified this as a public health issue, the recent global health crisis emerging from COVID-19 has made the challenge of connectedness more salient than ever. Despite decades of research on the negative outcomes stemming from social isolation and loneliness, little attention has been paid to the ways in which the scientific understanding of human behaviour can inform interventions to increase feelings of social connectedness and reduce the impact of social isolation. Given previous research has demonstrated how the coordinated timing of movements between individuals, either unconscious or intentional, directly promotes positive interpersonal and emotional outcomes (Marsh et al., 2009; Miles et al., 2009), the research presented here will explore ways in which our understanding of social motor coordination (SMC) provides both the theoretical and methodological foundation necessary to test and implement more subtle behavioural ‘nudges’ toward social interaction. More specifically, the data presented in this talk represents the first of three studies designed to establish how SMC manipulated in both laboratory settings and ‘in the wild’ can not only increase an individual’s feelings of social connectedness and willingness to interact with others, but also reduce an individual’s feelings of social isolation.

Establishing a Role for Embodied Artificial Agents in Exploring Human Social Cognition

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Understanding how we perceive and interact with others is a core challenge of social cognition research. This challenge is poised to intensify in importance and complexity as the ubiquity of artificial intelligence and the presence of humanoid robots in society grows. My group’s research applies established theories and methods from psychology and neuroscience to questions concerning how people perceive, interact with, and form relationships with robots. In doing so, we are able to gain more in-depth insights into the human side of human-robot interaction. Equally importantly, we can also address fundamental questions about the flexibility and adaptability of human social cognition, using robots as tools that enable us to run tightly-controlled social cognition experiments. In this talk, I review recent evidence from behavioural and brain imaging studies using social robots to explore how long-term socialising interventions, as well as other interventions designed to bolster social relationships, shapes people’s attitudes and behaviours towards robots, as well as the supporting brain systems. Examples from work examining how we perceive and interact with social robots highlights the importance of examining how perception of and interaction with artificial agents in a social world is revealing fundamental insights about human social cognition.