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Human-Robot Teamwork: Fluency and Embodiment in AI

Abstract

For personal robots to play a long-term engaging role in untrained humans' lives, they need to display the kind of efficient and satisfying performance that humans are accustomed to from each other. We propose a notion of human-robot fluency, in particular as it relates to meshed action timing and motion path quality. To this end we explore computational perception and cognition architectures, as well as experimental studies of user's responses to timing of nonverbal acts.

In a collaborative construction task, we find participants to prefer anticipatory action, even at the cost of errors and without increase in task efficiency. In another study we show priming through embodied perceptual simulation to have significant effects on both the efficiency of a human-robot team, and on humans' perception of the robot's intelligence, fluency, and gender.

In the field of entertainment robotics, we present a robotic theater control system using insights from acting theory, which enables robotic nonverbal behavior that is both reactive and expressive. We then discuss an interactive robotic Jazz improvisation system that uses embodied gestures for musical expression, enabling simultaneous, yet responsive, joint improvisation.

Finally, we present the design of a new smartphone-based media companion robot. Human-subject studies show effects on music enjoyment and social presence when the robot responds to music that participants listen to, but no apparent sensitivity to the beat-alignment of the robot's motion.