Researchers have evaluated interactions between humans and robots in order to include an implicit layer of communication within human-robot interaction (HRI). The majority of existing work has placed an emphasis on aiding robots to accurately assess implicit signals sent from humans. Most of these efforts hope to aid robots in becoming better assistants, or tools, to humans (Goetz & Kiesler, 2002). Research has also evaluated implicit communication within robot-robot teams. However, little work has examined implicit modalities of communication for HR teams. Effective communication between humans and robots will only benefit the team if they share a mutual understanding of implicit cues.

The benefits of implicit communication in team communication have been documented as reducing communication and coordination overhead (Entin & Serfaty, 1999); providing information to indirectly guide teammates' actions when explicit communication is unavailable (Serfaty et al., 1993; Shah and Breazeal, 2010), and aiding teams to achieve communication goals more quickly (Carston, 2009). These benefits greatly aid any military unit communicating silently, in harm’s way, or with damaged communication devices. The aim for this work was to evaluate a model for human-robot implicit communication. Specifically, the primary goal for this research was to determine whether humans can assign meanings to implicit cues received from autonomous robots as they do for identical implicit cues received from humans. Although results revealed instances in which participants more accurately interpreted human implicit cues, there were also instances in which there was no difference in their ability to interpret either entity. By the last experimental trial, differences in performance based on the two entities were insignificant. But even with experience, there remained a significant difference in participants’ confidence level while interpreting human cues versus when interpreting robot cues. Subjective measures showed no significant differences for stress or mental workload across entities. Physiological measures were not significant for the Engagement Index across entity, but robots resulted in significantly higher levels of the Index of Cognitive Activity for participants. The results of this study show that humans had more confidence interpreting human implicit cues than interpreting robot implicit cues. However, increased familiarity with robot implicit cues resulted in increased performance, although more cognitive resources were expended. Proper training should boost confidence as humans begin to work alongside autonomous robots as teammates.

Major: Industrial Engineering

Educational Career:
Bachelor’s of Industrial Engineering, BS, 1998, Georgia Institute of Technology
Master’s of Industrial Engineering, MS, 2002, Wright State University

Committee in Charge:
Waldemar Karwowski, Chair, Industrial Engineering & Management Systems
Peter Hancock, Psychology
Randall Shumaker, Institute for Simulation and Training
Lauren Reinerman-Jones, Institute for Simulation and Training

Approved for distribution by Waldemar Karwowski, Committee Chair, on May 16, 2012.

The public is welcome to attend.