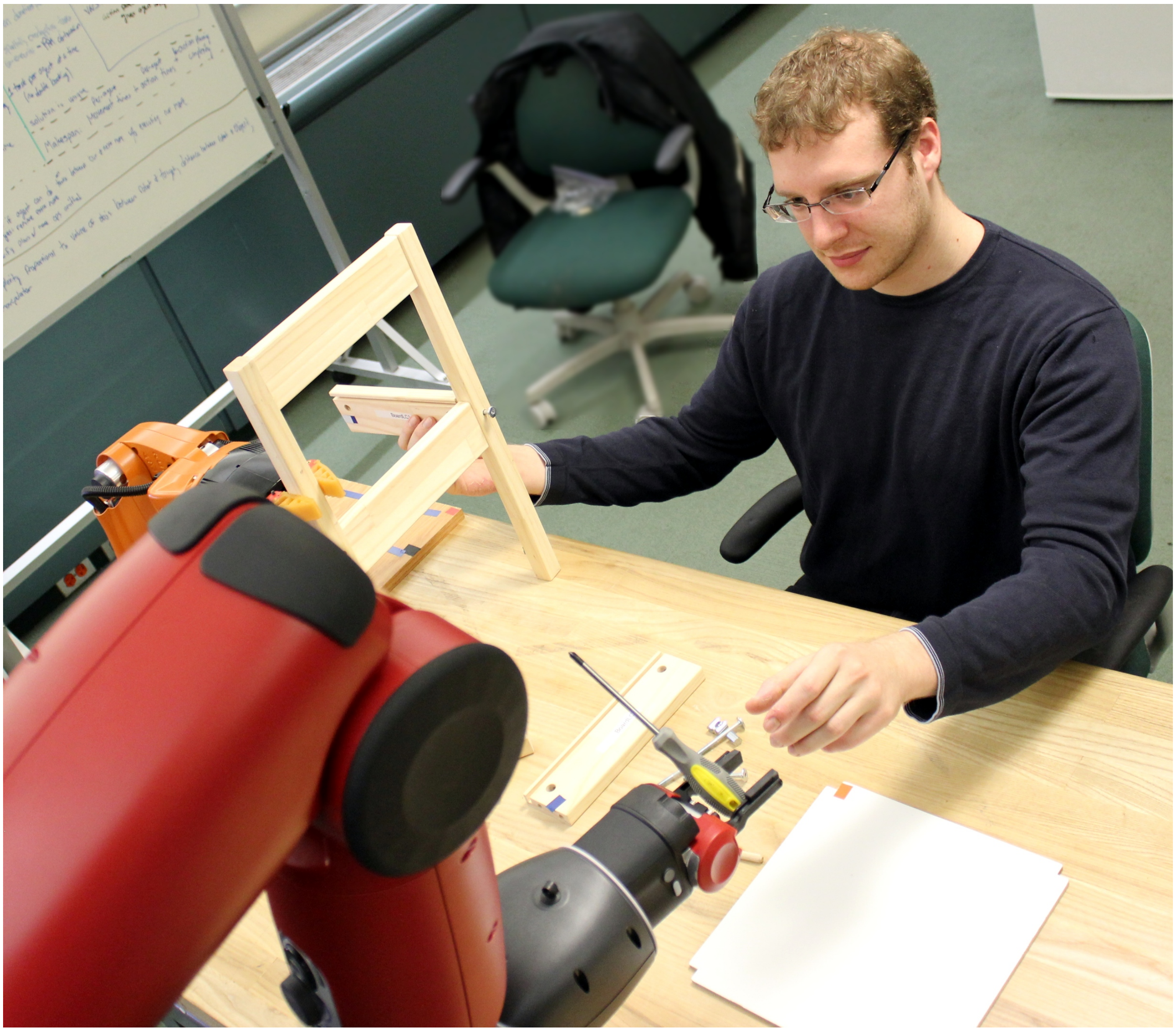
V Human-Robot Collaboration

Brian Scassellati (Dept. of Computer Science, Yale University; scaz@cs.yale.edu)
Bradley Hayes (http://www.bradhayes.info/; bradley.h.hayes@yale.edu)

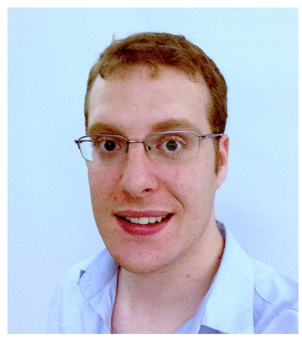
DOI: 10.1145/2685328.2685335



Shared environment human-robot teaming scenarios, such as this photo of a collaborative furniture assembly task, are at the center of a growing field of robotics and AI research: Human-Robot Collaboration. This domain combines a variety of technical areas within Human-Robot Interaction, with the goal of enabling safe, seamless, effective teamwork between groups of humans and robots. Central to this research are a host of challenges in task planning, motion planning, intention recognition, user modeling, scene recognition, and human-robot communication. These systems are expected to safely and efficiently perform complex actions, assisting humans and independently completing tasks, in a diverse range of scenarios with highly dynamic and uncertain environments.

In this picture, a human collaborator interacts with two robot teammates to assemble a wooden chair. At the current phase of the task, the rear chair frame is unstable and must be actively held to stand, significantly increasing the difficulty and dexterity required to attach a board on the side that will connect to the front frame. By grasping and stabilizing the rear frame, the orange manufacturing arm in the background substantially reduces the effort required for the human to achieve his goal. Simultaneously, the red manufacturing arm has identified an anticipated, required resource for the human. By retrieving the tool, the robot minimizes context switching penalties incurred by the human having to search for the screwdriver. In other tasks, these robot partners may have to reason about the trade-offs between working independently on their own task-relevant goals and devoting time and effort towards simplifying another agent's tasks. This work is funded under ONR grant #N00014-12-1-0822 ("Social Hierarchical Learning").

Brian Scassellati is a Professor of Computer Science, Cognitive Science, and Mechanical Engineering at Yale University. He received his Ph.D. from MIT in 2001, a CAREER award in 2003, and a Sloan Fellowship in 2007. He currently leads an NSF Expedition in Computing on Socially Assistive Robotics which aims to develop educational and therapeutic robots that supplement the efforts of educators, therapists, parents and clinicians to teach social, emotional, and cognitive skills to children, including those with social or cognitive deficits.



Bradley Hayes is a sixth year Computer Science Ph.D. student at Yale University, where he is a member of the Social Robotics Lab. His research focuses on designing and evaluating algorithms to support multi-agent, human-in-the-loop teamwork, leveraging social signals and hierarchical structure to create safe, robust, autonomous collaborators.