Research Abstract

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My current research aims to develop socially competent robotic guides and companions for older adults. Unlike currently available hospital and nursing care robots that simply deliver medications [2] or that can only lead people [7], I wish to develop robots that can accompany people side-by-side, interacting with them socially. In a nursing home, for example, such a robot could help guide a person who has difficulty way-finding, guide and encourage residents as they walk for exercise, or support more social interaction among residents by accompanying them to common areas. I believe that such a robot will need to travel next to a person rather than leading in front of him, and must follow the same social conventions as another human would. Obeying such human conventions is particularly important for robots that operate among older adults who are unfamiliar with robotic technology and may resent or even fear technology that behaves unpredictably. As I enter my fourth year in the Robotics doctoral program at Carnegie Mellon University, I am preparing to study these social conventions, which I intend to apply to the development of robots that can accompany people socially.

When two people walk together, they coordinate their movements with each other while observing many social conventions, such as what distance to keep from each other and how to indicate when to turn or stop. Furthermore, if either partner fails to use or respond to such conventions, the interaction becomes difficult and awkward. Despite the complexity of such interpersonal coordination, extremely little research has been done to determine exactly what people do and what social conventions they follow [1]. In order to develop robots with the ability to move naturally with people, I must first study how people (particularly older adults) walk together. I have just begun observational studies of older adults at a local retirement community, Longwood at Oakmont[1], using ethnographic methodologies borrowed from social anthropology.

[1] http://www.longwoodatoakmont.com

From these observations, I intend to derive key aspects of side-by-side walking that I can use to develop a person-accompanying model for a mobile robot. Such a model will need to account for issues such as maintaining a comfortable distance from the person, giving and responding to social cues of movements, and smoothly handling bottlenecks where side-by-side travel is impossible. Additionally, the robot will also need to have some understanding of the person's behavioral intentions; for example, the robot may need to respond differently if an elderly person has stopped because she is tired and needs to rest rather than if she has merely stopped to chat with a passer-by, though both of these events may appear as the same behavior to the robot. Finally, in conjunction with the development of the model as described above, I intend to analyze the robot's behavior as it travels next to untrained users in experimental studies. Such studies are necessary to determine whether the robotic technology can meet the needs of the people it is intended to assist.

Much of my belief that robots must follow human social conventions results from my previous work with social robots. Recently, I performed a study analyzing people's perceptions of two different person-following behaviors [4]. In the first behavior the robot always drove toward the person's current location, while in the second behavior the robot attempted to follow the exact path that the person walked. While both behaviors had similar performance on quantitative measures (such as distance maintained and tracking performance), a pilot study found that people qualitatively preferred the "direction-following" behavior over "path-following," rating the former as more natural and as closer matching their expectations. This work, which I believe will serve as a foundation for the side-by-side travel described above, showed that people do interpret a robot's behavior according to human social conventions and, furthermore, that people expect a robot to behave in a human-like manner. In previous research on the Roboceptionist Project [3], I have worked toward modeling human-like affect—emotions, moods, and attitudes—on a social robot, and analyzing people's responses to the robot's expressions [5, 6]. In this work, I again found that people respond to the robot's social cues and expect that the robot will follow human conventions. I intend to build on these prior experiences in developing an appropriate person-accompanying model for social robots.

All of my research to date has been highly multidisciplinary. I am co-advised by both Reid Simmons (robotics) and Jodi Forlizzi (human–computer interaction and design), and my own background is in both computer science and philosophy. On the Roboceptionist Project, I have worked with not just robotics and human–computer interaction researchers, but also

with students and researchers in the Drama Department at Carnegie Mellon University. In researching assistive robots for older adults, I am collaborating with the local retirement facility mentioned above as well as faculty from the School of Nursing at the University of Pittsburgh. I firmly believe that such multidisciplinary collaboration is essential not only to socially assistive robots, but also to all aspects of human–robot interaction.

References

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