Introduction

We now live in a world where robots have become a part of our daily lives. Whether it is Siri in your pocket or the recently released Jibo in your home, robots have moved from a purely functional space to an interactive and social space. With this new movement, there is a pressing need to understand the social effects and impact of robots, particularly humanoid or anthropomorphized robots. Understanding the social effects of a robot will thus provide us with new information on how to better design robots for human interaction, how to create environments for human robot interaction, and how robots will impact our society moving forward.

In trying to understand the social effects of robots, robotics must look to the field of psychology. Psychology can provide us a framework and a baseline to assess human robot interaction. This is done by taking social constructs and effects from human-human interaction and mapping them to robots. This has been done with a variety of different psychological effects, particularly in the Social Robotics Lab at Yale University. An example of this is the study that first highlighted human reaction to robot cheating in games. This space of human-human effects mapped to human robot interaction is still largely unexplored, and my proposed study hopes to illuminate a new part of it: automatic mimicry.

Background

Behavioral mimicry- the automatic imitation of gestures, postures, mannerisms, and other motor movements, is pervasive in human interactions (Chartrand & Lakin 2013). Automatic mimicry in particular is often unconscious and unintentional. Chartrand & Bargh 1999 ran a study that showed participants more often tapped their foot when a confederate did so and more often touched their face when a confederate did so. Furthermore, Chartrand & Bargh 1999 also showed that participants found a confederate more likeable when their postures were mimicked by a confederate. There are several reasons why such a behavior exists. From a neurological standpoint, there exist certain parts of the brain responsible for this mimicry, known as mirror neurons or “mirror system” in humans, first highlighted in macaques in 1992 at the University of Parma. Chartrand & Bargh 1999 further notes an actual perception-behavior link behind automatic mimicry. This means that actions seen can trigger the mirror system in humans. Beyond the neurology, there is a social component and possible evolutionary explanation for mimicry. “Mimicry creates liking, empathy, and affiliation between interactants. It has been
called the “social glue” that brings people together and bonds them” (Lakin et al. 2003). Furthermore, research by Bavelas et al. 1986 suggests that mimicry serves a prosocial communicative purpose.

This effect has not been explored in human robot interaction, yet there is evidence that shows a robot could elicit automatic mimicry in humans. Oberman & Pineda 2007 demonstrated through EEG that activation of the mirror neuron system in humans can occur through the perception of robot behavior, even without objects. Bailenson and Yee 2005 successfully demonstrated that liking, rapport, and affiliation can be increased with mimicry even with a digital agent, which they showed using a virtual person on a computer screen mimicking the head posture of the subjects. In light of this evidence, I propose a study that asks if a robot can elicit automatic mimicry in human participants.

Significance

This study could provide new understanding on an unexplored part of the space of robotic social effects. In many ways, this study will raise more questions than it will answer. Seeing a human mimic a robot would raise questions regarding how humans view robots as social partners and as agents. Given that research on mimicry has highlighted questions about mimicking the “right” people (Chartrand & Lakin 2013), mimicry could highlight how humans view robots as social actors. Also, Stel & Vonk 2010 have shown that mimickers, and not just mimickees, also have smoother interactions and more likeability with their partners, so finding out if automatic mimicry exists in humans could give us information on how to shape interactions between humans and robots. On the flip side, not seeing mimicry or some kind of adverse social effect would raise questions about why the perception-behavior link does not extend to human robot interaction.

Experimental Design

There are several important decisions to be made for the design of the experiment and several potential stumbling blocks to deal with. The robot to be used will be the Nao (pictured below). Of the robots present in the Yale Social Robotics Lab, the Nao has the following advantages: there are multiple of them (in the event of a malfunction or lack of access in the lab), it is easily programmable, is very mobile and easy to manipulate, and is humanoid. There will be some limitations in terms of what behaviors can be used, but that would be present with any robot. I will be borrowing the setup from Chartrand & Bargh 1999. Participants and the Nao will alternate describing paintings as the “activity”. Halfway through the trial, the Nao will execute a posture (such as hands behind its back). The time the participant does the posture before the Nao does it will be compared with the time the participant does the posture after the Nao does it. Postures will be used instead of gestures because they are persistent and more feasible on the
Nao. Piloting will determine smaller details such as number of paintings, number of postures, etc. Video cameras will be set up in the room to record the participant doing the gestures. I hope to have 50 participants and it will be a within-subjects setup.

Deliverables

The timeline for this study is a little strange. I hope to have it done by October 3, 2014 so I can submit it for the Human Robot Interaction (HRI) conference. It will become apparent by the last week of September if this is feasible or not. If it not, then I will extend the timeline further into the semester.

- Obtain IRB approval (done)
- Final setup of the experiment post-piloting, approved by my advisor
- Recruit and schedule 50 participants
- Run all the participants through the study
- Video code the trials
- Analyze the data
- Write the Paper for the HRI conference
- Submit other materials for CPSC490