Sex Differences in the Perceived Social Intelligence of Robots

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Abstract

Robots are becoming more common, creating additional opportunities for human-robot interaction, both positive and negative. People are more accepting of robots exhibiting social intelligence. However, people vary in how they perceive the same robot behaviors. Therefore, this study examined possible sex differences in the perceived social intelligence of robots.

295 MTurk workers (150 males, 145 females) watched five videos of robots interacting with people, then rated each robot on the 20 Perceived Social Intelligence scales. To determine if there are sex differences, we conducted a between-within ANOVA. The interaction was significant; therefore, we performed 20 one-way ANOVAs to determine where these differences lie.

Males rated the robots as slightly more rude, conceited, and hostile. Females rated them as slightly better able to identify humans. To better integrate robots into society, researchers should examine the relationship between perceptions of robot social intelligence and their social behaviors (e.g., greeting, smiling).

Introduction

As technology advances rapidly, people are increasingly using robots to satisfy human needs. People are utilizing robots in many areas, including home activity, healthcare, building, and other assistive tasks (Broadbent, Stafford, & Macdonald, 2009). One example of using robots as therapeutic tools is PARO, a robot seal designed to act as a companion for older adults. Due to how this robot responds to touch, many individuals find the robot therapeutic (Shibata, Kawaguchi, & Wada, 2011).

However, a study in Europe found that attitudes towards robots have become more negative over time, which suggests the integration of robots into society is being met with reservations (Gnambs & Appel, 2019). With the growing concern of the public on the one hand and these promising utilizations of robots on the other, scientists are increasingly taking an interest in human-robot interactions (HRIs; de Graaf & Allouch, 2017). HRIs are defined as robots and humans influencing one another through collective action (Marin, Issartel, & Chaminade, 2009).

Social intelligence is an important contributor to successful HRI: when robots are perceived as more socially intelligent, this facilitates smoother HRIs and successful integration into society (Dautenhahn, 2007; Anzalone, Boucenna, Ivaldi, & Chetouani, 2015). Social intelligence is the ability to recognize relevant social behaviors and utilize them appropriately in social circumstances (Ford & Tisak, 1983). Social intelligence can be measured using the Perceived Social Intelligence (PSI) Scales (Barchard, Lapping-Carr, Westfall, Banisetty, & Feil-Seifer, 2018). These scales measure PSI in four different ways: information processing abilities related to people, the ability to identify people, social presentation, and overall social competence.

While research has been done on the role gender plays in the perception of robots (Eyssel, & Hegel, 2012; Lin, Liu, & Huang, 2012; Kuchenbrandt, Häring, Eichberg, Eyssel, & André, 2014), and the role of social intelligence in perceptions of robot functioning (van der Woerdt & Haselager, 2019), there is little research on sex differences in the perception of robot social intelligence. Examining if the sexes vary in how they perceive the social intelligence of robots may assist with the creation of better robots. The current study contributes to this growing area of research by examining possible sex differences in the perceived social intelligence of robots.

Method

Participants

Participants were recruited for this two-hour study using Amazon's MTurk. To improve data quality, we limited the pool of participants to MTurk workers who had completed at least 500 MTurk tasks and had a minimum task acceptance rate of 95%. In addition, we limited the potential participants to those who were in the United States: Participants needed to have a US social security number to register for MTurk and needed to have a US IP address as identified by Qualtrics. Finally, we screened participants' devices to ensure that they were not using cell phones, because the videos we used might not display properly on cell phones.

A total of 295 participants (150 male, 145 female) participated in this study. They ranged in age from 19 to 72 (mean 37, standard deviation 11.5). Participants identified themselves predominantly as White (80.3%), followed by African American (7.1%), Asian (5.1%), Hispanic (4.1%), and Native American (0.3%). Nine participants selected other for their ethnicity. Participants were paid $15.

Procedures

Participants completed the study online. After completing the consent form, they filled out some demographic questions. Participants were then shown five videos displaying situations with HRI. The first robot, Robovie, convinces a woman to lie about seeing an aquarium during their tour of a research lab (Kahn et al., 2015). The second robot, NAO, stole batteries from a bike light, and this resulted in a crash (de Greeff et al., 2014). The third robot was an ottoman that coaxed people to put their feet up (Sirkin, Mok, Yang, & Ju, 2015). The fourth robot, PR2, stacked blocks with two people while adjusting its actions to account for unexpected human behavior (Devin, Clodic, & Alami, 2017). The fifth robot, Dragonbot, was a fluffy dragon-shaped robot that both told and listened to children's stories while displaying visuals of the stories on an iPad (Kory, 2014). After viewing the videos, the participants responded to measures asking for their impressions of each robot. At the end of the study, participants were debriefed.

Measures

Demographic variables. Participants filled out a survey requesting their sex, age, and ethnicity.

Perceived Social Intelligence (PSI) Scales. The 20 PSI scales (Barchard et al., 2018) were designed to measure four aspects of social intelligence: (a) overall social competence, (b) the ability to identify humans, individuals, and groups, (c) the ability to recognize, adapt to, and predict human behaviors, cognitions, and emotions, and (d) the ability to present oneself as a desirable social partner (someone who is friendly, helpful, caring, and trustworthy, and not rude, conceited, or hostile). Participants responded to the PSI items using a 5-point scale, with responses *1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree*. The PSI items were presented to participants in varying orders for each of the five robots in an effort to reduce carry-over effects and effects related to item order.

Data Analysis

To determine if there were differences in how males and females perceive the social intelligence of the five robots, we planned to run a between-within analysis of variance (ANOVA). Our between-subjects factor was gender, and our within-subjects factor was the PSI scales. Mauchly's test showed that the assumption of sphericity had been violated (χ^2 (189) = 17848.74, $p < .001$). Therefore, we corrected the degrees of freedom for the ANOVA using the Greenhouse-Geisser estimate (ε = .22). We used the Greenhouse-Geisser estimate because epsilon was lower than 0.75 and it is more conservative, which reduces the risk of a Type 1 error. We found a significant interaction between the PSI scales and gender; therefore, we ran 20 one-way ANOVAs to determine which specific scales had gender differences.

Results

The differences between men and women varied across the PSI scales ($F(4.26, 4933.96) = 4.81$, $p = .001$). The 20 one-way ANOVAs revealed significant gender differences on four of the PSI Scales: Hostile ($F(1, 1407) = 8.65$, $p = .003$), Identifies Humans ($F(1, 1414) = 22.04$, $p < .001$), Conceited ($F(1, 1444) = 5.82$, $p = .016$), and Rude ($F(1, 1395) = 3.05$, $p = .033$). Males rated the robots as slightly more Hostile, Conceited, and Rude. Females rated the robots as slightly better at Identifying Humans. See Figure 1.

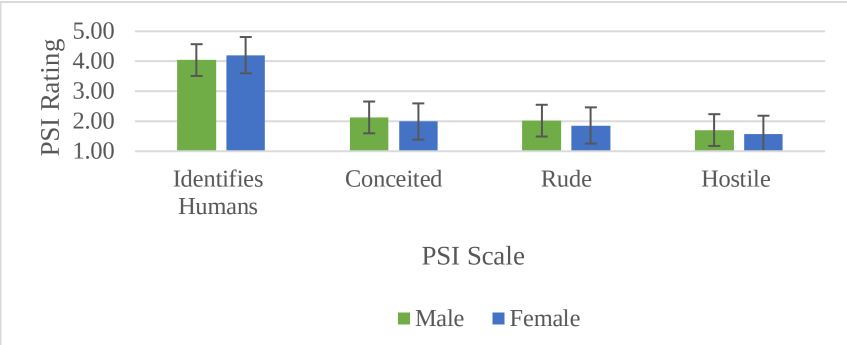

Figure 1. Means of the four PSI scales with significant differences between males and females. Error bars represent standard error of mean scores.

Discussion

The purpose of this study was to determine if there are differences in how males and females perceive the social intelligence of robots. There were differences between males and females on four of the 20 PSI Scales. Males rated the robots as slightly more hostile, conceited, and rude compared to females, while females saw the robots as slightly better able to identify human beings. All of these differences were small. Moreover, there were no significant differences on the remaining 16 PSI scales. We conclude that males and females perceive the social intelligence of robots similarly. However, there were wide differences in individual's perceptions.

As robots become more prevalent in society, it is important to design robots to suit human needs. Robots displaying social intelligence have smoother interactions with humans (Dautenhahn, 2007). Creating robots that display social behaviors will make interactions between humans and robots easier (Anzalone, et al. 2015) and may ease the integration of robots into society. Future research could examine which robot social behaviors have the greatest impact on the perceived social intelligence of robots.

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