

Differences in Male and Female Perceptions of Robot Social Intelligence

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ABSTRACT

Socially intelligent robots improve human-robot interactions. 295 MTurkers rated five robots on 20 social intelligence scales. Men rated robots as more hostile, conceited, and rude; women rated robots better at identifying humans. Roboticians should examine causes of these differences to create social robots that work equally well with both genders.

INTRODUCTION

As society has progressed it is no surprise that technology has progressed as well. Robots are starting to interact more with humans in tasks such as being a companion for senior citizens, helping to teach children, and even helping in manual labor. Robots that engage in these interactions are classified as social robots (Anzalone et al., 2015). As human robot interactions (HRIs) have become more common, it has become crucial that these robots' function well in society (Wiltshire, Warta, Barber & Fiore, 2017). This is important because socially intelligent interactions could lead to greater social acceptance and stronger HRIs (de Greeff & Belpaeme, 2015). Identifying possible gender differences in the perceived social intelligence of robots could possibly play a role in allowing roboticians to design and improve robot behaviors, functions, and appearances to facilitate better human-robot interactions.

In robotics, social intelligence can be defined as an ability for robots to act socially with humans in order to communicate and interact with them in a human-like manner, follow human social behaviors, and learn and adapt their own behaviors throughout their lifetime (Anzalone et al., 2015). One recently developed measure of the perceived social intelligence of robots is the Perceived Social Intelligence (PSI) Scales, in which PSI is measured in four different ways (Barchard, Lapping-Carr, Westfall & Feil-Seifer, 2018).

As social robots have been steadily deployed into society, their interactions with humans have slightly varied based on gender (Kuchenbrandt, Häring, Eichberg, Eyssel & André, 2014). Different environments and tasks have varying amounts of males and females, as such, for social robots to be able to effectively interact in society they need to engage in positive HRIs regardless of these gender ratios. For example, the implementation of expressive features on social robots have been found to be a great asset in getting males to perceive social robots as being socially intelligent (Cameron et al, 2018). Other studies have suggested that females find tactile texture an important characteristic in their evaluation of robotic social intelligence (Shibata et al., 2012).

Understanding gendered perception and its social impact on robotics can be crucial in constructing a successful social robot that takes into consideration human gender rather than neglects its implications (Kuchenbrandt et al., 2014). The present study seeks to investigate the possible gender differences in the perceptions of social intelligence of robots.

METHOD

Participants

The participants in this study were recruited through Amazon's MTurk. There was a cumulative total of 295 (150 males, and 145 females) people that participated in this study. There was one participant that did not list their gender, so they were excluded from the analyses. The ages of participants ranged from 19 years old to 72 years old with the average age being around 37 years old ($M = 37.33$, $SD = 11.47$). Participants identified themselves as being either White (80.4%), African American (7.1%), Asian (5.1%), Hispanic (4.1%), Native American (0.3%), and other (3.0%). Restrictions were placed on the study to only include participants within the United States in order to improve data quality. Furthermore, participation in the study was confined to MTurk workers who had completed a minimum of 500 tasks on MTurk with at least a 95% acceptance rate.

Measures

Demographics. Each participant completed items in which they provided their demographic information such as their sex, age, and ethnicity.

PSI Scales. Participants rated their perceptions of social intelligence in robots using the Perceived Social Intelligence (PSI) Scales (Barchard et al., 2018). The PSI Scales are comprised of 20 aspects that make up perceived social intelligence. Each of the 20 scales are comprised of four items. The names of the scales and the sample items are listed in Table 1.

First, the scales measure nine componential information processing abilities related to people: the abilities to recognize, adapt to, and predict human behaviors, cognitions, and emotions. Second, the PSI scales measure the ability to identify people in three different ways: to detect human presence, to distinguish individuals from each other, and to determine which people are together. Third, the PSI scales measure the overall social competence. This scale can be used on its own or can be combined with the nine social information processing skills and the three identification skills to create a 13-scale composite called Social Information Processing (Barchard et al., 2018). Finally, the PSI scales measure social presentation, the ability to present oneself as a desirable social partner: someone who is friendly, helpful, caring, and trustworthy, and who is not rude, conceited, or hostile (Barchard et al., 2018).

The PSI Scales were answered based upon the impression that the participants had of the robots in the study. Each item was rated using a five-point agreement scale: 1 (*Strongly Disagree*), 2 (*Disagree*), 3 (*Neutral*), 4 (*Agree*), and 5 (*Strongly Agree*). The 80 PSI items were presented to the participants in a different order for each of the 5 videos that each participant watched. The randomization of the items reduced the possibility of order effects and carry-over effects.

Procedures

The study was completed by all participants after obtaining consent. This study only took one session and was completed over the internet, overall lasting 2 hours. The participants answered questions about demographics and their backgrounds with robots. Afterwards, the participants watched five videos depicting Human Robot Interaction. After watching each video, the participants completed the PSI Scales in regard to their impressions of the robot in the video. Finally, the participants were debriefed and rewarded \$15 for completing the study.

Data Analysis

Participants were first filtered out in the study if they did not state their gender because this study focused on the differences between males and females. To determine if there are differences in how men and women perceive the social intelligence of robots, a between-within analysis of variance (ANOVA) was conducted. The between subjects factor was gender, the within subjects factor was the PSI Scales. Mauchly's Test of Sphericity was used to determine if the assumption of sphericity was violated. Degrees of freedom were corrected using the Greenhouse-Geisser estimates. To determine where the differences are on the PSI Scales, 20 one-way ANOVAs were ran -- one for each of the 20 scales.

RESULTS

Mauchly's test indicated that the assumption of sphericity had been violated ($\chi^2(189) = 17848.74, p < .001$). Therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\epsilon = .22$). Results indicated that the interaction between gender and PSI scales was statistically significant ($F(4.26, 4933.96) = 4.81, p = .001$).

Results indicate there was a significant effect between the genders' mean ratings on four of the PSI Scales: Hostile ($F(1, 1407) = 8.65, p = .003$), Conceited ($F(1, 1444) = 5.82, p = .016$), Rude ($F(1, 1395) = 4.56, p = .033$), and Identifies Humans ($F(1, 1414) = 22.04, p = .000$). See Figure 1.

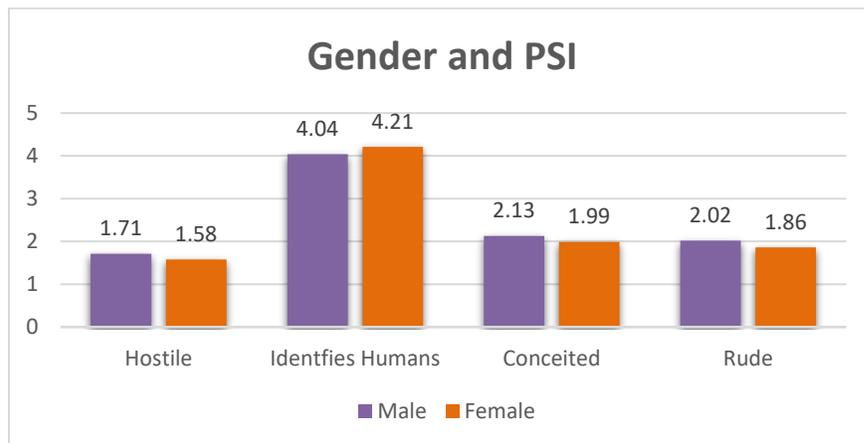


Figure 1 Significant effect between the genders' mean ratings on four of the PSI Scales

DISCUSSION

In the contemporary world, society has started to see an increase in robots. To ensure the advancement of robotics, and to push for more advantageous interactions between humans and robots, it is important to understand the role gender plays in the perception of social intelligence to create better social robots (Strossner, 2018). We discovered that there are four scales that significantly differed between men and women on the PSI scales. We found that there was a significant interaction between gender and PSI Scales on the ratings of Hostile, Identifies Human, Conceited, and Rude. These PSI scales all point to a different perception of the robot that the participants formed when interacting with the robot, this might be the result of differing components. It could be due to its behavior being off-putting, its appearance, or a combination of the two. Men may have rated the

robots as being more hostile, conceited, and rude because they found the robots as being uninviting based upon their rigid behaviors. Developing an understanding of the scales on the PSI Scales that differed between the two genders may facilitate in creating more positive HRI. For example, men found the robots as being ruder on the PSI scales, there could be underlying sex factor that causes this perception. The robot may not display a behavior that males typically pick up on to know that someone is listening thus males deem the robot as being rude.

Researchers should seek to see what behaviors promote higher ratings on the PSI scales for each gender. Robots may use head gestures to show they are listening and may be rated higher for females but not for males who may rate higher when robots use hand gestures. Our research shows that males rated higher on the scale of Hostile, Conceited, and Rude while females only rated higher on Identifies humans. This may be because females are more patient with the robot and saw it as being more thoughtful than males do (Koulouri, Lauria, Macredie, & Chen, 2012). Females being more patient may allow them to rate the robots on the PSI scales more carefully and have fewer misinterpretations about the robot's behavior than males. Females perceiving the robot as being more thoughtful than males may influence them to rate the robots higher on the PSI scales as they see the robot as being more human-like. In our study, it might be that the robots did display the behavior males were looking for when rating them on the scales of being rude, conceited, and hostile while females did not see the behaviors the robots exhibited to be in line to their gendered notions of what is rude, conceited, and hostile.

Future research should investigate the relationship between robot behaviors (such as gestures and voice), functions (such as speech and gesture recognition), and appearance (such as color, size, and exterior design) on perceptions of social intelligence. Next, researchers can determine if these relationships vary for men and women. For example, females are more patient with robots than males (Koulouri, Lauria, Macredie, & Chen, 2012), which may change their ratings of social intelligence. Females being more patient with the robots may allow them to better identify the robots level of social intelligence. Understanding the causes of perceptions of social intelligence may allow roboticists to design and improve robot behaviors, functions, and appearances to facilitate better human-robot interactions.

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Table 1

Perceived Social Intelligence Scales, Definitions, and Best Items

Scale Name	Definition	Single Best Item
	The robot appears...	This robot...
Social Competence	to have strong social skills.	is socially competent.
Recognizes Human Emotions	to detect people's emotions.	recognizes human emotions.
Recognizes Human Behaviors	to detect people's behaviors.	notices when people do things.
Recognizes Human Cognitions	to detect people's thoughts and beliefs.	can figure out what people think.
Adapts to Human Emotions	to adapt its behavior appropriately based upon people's emotions.	responds appropriately to human emotion.
Adapts to Human Behaviors	to adapt its behavior appropriately based upon people's behaviors.	adapts effectively to different things people do.
Adapts to Human Cognitions	to adapt its behavior appropriately based upon people's thoughts and beliefs.	adapts its behavior based upon what people around it know.
Predicts Human Emotions	to anticipate people's emotions.	anticipates others' emotions.
Predicts Human Behaviors	to anticipate people's behavior.	anticipates people's behavior.
Predicts Human Cognitions	to anticipate people's thoughts and beliefs.	anticipates others' beliefs.
Identifies Humans	to detect human presence.	notices human presence.
Identifies Individuals	to identify and recognize people as individuals.	recognizes individual people.
Identifies Social Groups	to discern which people are with each other.	knows if someone is part of a social group.
Friendly	to enjoy social interactions.	enjoys meeting people.
Helpful	to willingly assist in tasks.	tries to be helpful.
Caring	to care about the well-being of others.	cares about others.
Trustworthy	deserving of trust.	is trustworthy.
Rude	rude and disrespectful.	is impolite.
Conceited	overly proud of itself or its abilities.	thinks it is better than everyone else.
Hostile	antagonistic and violent.	tries to hurt people.

Note. Perceived Social Intelligence Scales, Definitions, and Best Items. Adapted from Perceived Social Intelligence (PSI) Scales Test

Manual by Barchard, K. A., Lapping-Carr, L., Westfall, R. S., Banisettey, S. B., & Feil-Seifer, D. (2018).