Perceptions of Social Intelligence in Robots

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Abstract

As robots have become more common, humans interact with them more frequently. If these interactions do not go smoothly, people may reject robots. If robots are perceived as socially intelligent, this may improve human-robot interactions. However, people may vary in how they perceive robots. The purpose of this study was to compare men's and women's perceptions of the social intelligence of robots. A total of 296 participants were each paid $15 via MTurk to complete this study online. They watched five videos showing humans interacting with robots and rated the robots' social intelligence using the 20 Perceived Social Intelligence scales. Women scored significantly higher on the Identifies Humans scale, while men scored significantly higher on the Hostile, Conceited, and Rude scales. Future research could examine how changes in robot behaviors change these perceptions and how these different perceptions are related to robot acceptance.

Introduction

Robots can be used in a wide variety of ways that can make the lives of humans much easier. Robots do not need all of the benefits, like money and healthcare, that humans need in compensation for their work. AI have the ability to think and act in accordance to how they were programmed, which could be much faster than some humans. However, the incorporation of AI into workplaces or the general public could cause humans to feel less cared for if they are not receiving regular human-like interactions when socializing with these robots (Ebert & Henrich, 2002). For example, if robots were introduced into schools to teach children, the children or their parents could feel that their child is not receiving the individualized attention that may be sought after. It is essential that robots are able to have successful social interactions with humans because these newly acquired roles in the public (e.g., caretaker or teacher) could become a replacement to what is traditionally a human's role. Although most people are welcoming of AI into their domestic lives, people tend to perceive robots as a problem when it comes to the robots taking on human professional jobs (Ray, Mondada, & Siegwart, 2008). Successful HRI would lead to a greater acceptance of robots instead of being interpreted as a downgrade from the interactions they would receive from a human.

Given the importance of integrating SI in robots for successful HRI, our group compared the differences and similarities between men's and women's PSI (perceived social intelligence) of robots. This research aims to understand how AI is perceived by the different genders. Perhaps, different robot behaviors will be seen as more or less socially intelligent by men and women. It is notable to interpret how humans perceive robots because it is an indicator as to how AI can be incorporated into our lives. Thus, this study could impact the way robots are programmed and marketed in the future based on how humans perceive robots.

Method

Participants

There were 296 participants in this study, 150 identified as male and 145 identified as female, with 1 remaining respondent who preferred not to state their gender. The participants' mean age was 37.4 years-old, with the standard deviation of 11.5 years. The youngest participant's age was 19 years-old, the oldest

participant was 72 years-old. Participants were recruited via MTurk and were compensated $15 for completing the study online using Qualtrics.

Procedures

Participants provided informed consent. They watched five videos with robots interacting with humans. They rated each robot separately. Participants completed all scales for one robot before moving on to the next robot.

Measures

Using Perceive Social Intelligence (PSI) scales (add reference), participants' PSI in AI were measured based on their responses to survey questions on each robot video they watched. These questions were modelled off of the International Personality Item Pool (IPIP) format. The IPIP is a public domain set of 3000+ items designed to measure 250+ characteristics. However, IPIP scales are written in a first-person, declarative statement format (e.g., "Accept apologies easily"). We modified the verbs and pronouns of the scales in order to change the phrasing into third-person. We used the third-person format because using first person would require the robots to report their own social intelligence—which they cannot do. The PSI scales were developed in order to identify the abilities that a robot appeared to have, not the abilities the robot actually had. The names of the scales are listed in Table 1, with each of the scales consisting of four items.

Each item was rated using a five-point agreement scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). The principal investigator of the project decided that an accuracy scale was inappropriate when rating the PSI of robots. An accuracy scale measures how well the results agree with the true value of whatever is being measured. We are not trying to measure what abilities robots actually have. We are instead trying to measure what abilities robots appear to have. Therefore, the instructions emphasized that raters should answer based upon the impression that they have of the robot, and the items used in the agreement scale.

Scoring. To calculate scores for each of the 20 PSI scales, we averaged the scores on the four items that comprised that scale. Data were carefully screened to prevent univariate and multivariate outliers from distorting our results. For each item, univariate outliers (as indicated by a z-score greater than 3.29, corresponding to a p-value of .001) were moved one point closer to the mean, and multivariate outliers for each of the 20 scales (as indicated by Mahalanobis distances greater than the chi-square critical value associated with alpha of .001) were deleted. The sexual differences in perceptions of social intelligence were measured by comparing each sex's mean score per scale using independent sample t-tests.

Results

Men and women showed statistically significant differences in four different PSI scales: Identifies Humans, Hostile, Conceited, and Rude (Table 1). Women scored significantly higher on the Identifies Humans scale ($t(1414) = -4.69$, $p < .001$), while men scored significantly higher on the Hostile ($t(1407) = 2.94$, $p = .003$), Conceited ($t(1444) = 2.41$, $p = .016$), and Rude ($t(1395) = 2.14$, $p = .033$) scales. We did not find any significant differences between sexes on the remaining scales.

Discussion

We attempted to examine the sex differences in PSI of robots. We found that on particular traits, there were significant differences between men's and women's perceptions of robots' behaviors. Cultural, gender stereotypes appear to have an influence on men's PSI scores while barely influencing, if any, of the women's PSI scores.

Men scored higher on three scales: Hostile, Conceited, and Rude. These three scales can potentially be seen as "manly" traits. Culturally, men's SI favor masculine traits such as being assertive and competitive (Ran, 2018). They could seek these common traits in robots leading to higher scores on said scales. It has also been found that men were better at recognizing expressions of anger (Ran, 2018). Perhaps men are more likely to be threatened by robots or more likely to be sensitive to threatening behavior in general.

Culturally, women are to have positive social traits favoring femininity, such as gentleness and empathy (Ran, 2018). Women scored higher on only one scale: Identifies Humans. Surprisingly, women did not score

higher than men on traits that would be considered feminine such as Helpful, Caring, and Friendly. Perhaps, these traits are present in both sexes with no significant differences, but the gender norms exaggerate these to be feminine traits, prohibiting men from freely expressing their emotions.

The reader should keep in mind that, just because one gender scored significantly higher than the other, there is more overlap than difference when comparing the distribution of scores. This has been a consistent finding in other research done on sex differences in every domain. Just because men scored higher than women on hostile and rude scales does not mean that all men possess more negative traits in terms of SI than women.

The importance of developed SI in AI will lead to better HRI as technology advances. This would improve the quality of care received by humans from automated robots. Some examples include de-stressor robots present in hospitals and teaching robots in schools. Robots may be able to better assist people on a wider range of activities such as domestic chores, helping elders live independently, serving a therapeutic role to help patients in hospitals and much more (Breazeal, 2009). If we have a better understanding of men's and women's perceptions of certain behaviors as more or less socially intelligent, perhaps robot programmers will be able to build a way for people to adjust settings in regard to SI.

Socially intelligent robots may be adjusted to have particular traits depending on the preferences of the people that will be working with it and the environment it will be functioning within. If men are more rude, conceited, and hostile (compared to women who saw the same behavior), then it might make sense for robots that are being sold to be specifically polite and deferential. Robots could be customizable, such that the robots could be set to be more or less polite, depending on personal preference. Currently, some robots involved with children are made to be fuzzy in appearance and cheery in personality. Inventors designed the robots depending on their targeted audience as it may impact the interaction.

Table 1

Comparing Men and Women on Perceived Social Intelligence Scales

	Mean (Standard Deviation)		
PSI Scale	Men	Women	t-test
Recognizes Human Emotions	2.88 (1.04)	2.89 (1.03)	$t(1440) = -.108$, $p = .914$
Recognizes Human Behaviors	3.88 (.74)	3.94 (.73)	$t(1424) = -1.539$, $p = .124$
Recognizes Human Cognitions	2.87 (.94)	2.89 (.95)	$t(1459) = -.479$, $p = .632$
Adapts to Human Emotions	2.72 (.97)	2.71 (.95)	$t(1425) = .173$, $p = .862$
Adapts to Human Behaviors	3.57 (.90)	3.60 (.89)	$t(1434) = -.657$, $p = .511$
Adapts to Human Cognitions	3.04 (.90)	3.08 (.86)	$t(1463) = -1.007$, $p = .314$
Predicts Human Emotions	2.75 (.99)	2.71 (.98)	$t(1444) = .834$, $p = .404$
Predicts Human Behaviors	3.10 (.93)	3.15 (.93)	$t(1459) = -.864$, $p = .388$
Predicts Human Cognitions	2.55 (.99)	2.53 (.97)	$t(1448) = .358$, $p = .720$
Identifies Humans	**4.06 (.67)**	**4.22 (.62)**	**$t(1414) = -4.694$, $p < .001$**
Identifies Individuals	3.19 (1.10)	3.18 (1.17)	$t(1419) = .183$, $p = .855$
Identifies Social Groups	2.81 (.90)	2.83 (.93)	$t(1437) = -.476$, $p = .634$
Social Competence	3.09 (1.10)	3.12 (1.05)	$t(1445) = -.418$, $p = .676$
Friendly	3.39 (.84)	3.45 (.89)	$t(1458) = -1.247$, $p = .213$
Helpful	3.60 (.90)	3.59 (.97)	$t(1436) = .052$, $p = .959$
Caring	2.98 (.97)	2.96 (.99)	$t(1459) = .301$, $p = .763$
Trustworthy	3.15 (.97)	3.13 (1.03)	$t(1452) = .451$, $p = .652$
Rude	**2.01 (.81)**	**1.92 (.83)**	**$t(1395) = 2.136$, $p = .033$**
Conceited	**2.14 (.76)**	**2.04 (.76)**	**$t(1444) = 2.413$, $p = .016$**
Hostile	**1.70 (.74)**	**1.58 (.69)**	**$t(1407) = 2.941$, $p = .003$**

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