ASSESSING DIGITAL EMPATHY IN HUMAN-ROBOT INTERACTIONS: A LAB STUDY WITH TELEROBOTIC PILOTS

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Abstract

Empathy, the ability to understand and share the feelings of another, is a crucial component in human interactions. This study explores digital empathy in the context of Human-Robot Interactions (HRI) by measuring state empathy levels with Telerobotic Pilots (TRPs). Conducted in the Leadership Garage Lab with university students, the study involved participants engaging in conversations, randomly assigned to either person-robot or person-person groups (N=64). Empathy was measured using the State Empathy Questionnaire by Shen (2010). The study found no significant difference in average state empathy levels towards TPR pilots compared to in-person participants, a result consistent across all sub-components of the state empathy scale.

Keywords: telepresence robots, human-robot interaction, state empathy

Digital Empathy in the Context of Human-Robot Interactions with Telepresence Robots

Empathy plays a pivotal role in human interactions, influencing social dynamics and relationship quality. Following Cuff et al. (2018) the term 'empathy' can be defined as:

> "an emotional response (affective), dependent upon the interaction between trait capacities and state influences. Empathic processes are automatically elicited but are also shaped by top-down control processes. The resulting emotion is similar to one's perception (directly experienced or imagined) and understanding (cognitive empathy) of the stimulus emotion, with recognition that the source of the emotion is not one's own" (ibid, p. 150).

As technological advancements integrate robots into social contexts, understanding the dynamics of digital empathy becomes imperative. This study investigates the levels of digital empathy in Human-Robot Interactions (HRI), specifically with Telerobotic Pilots (TRPs).

Existing literature guides our exploration into whether individuals exhibit similar levels of empathy when interacting with robots as they do with fellow humans. An early field study by Lee & Takayama (2011) evaluated the implementation of telepresence robots in three different companies for the collaboration with remote team members. The results of a mixed-methods study design show an overall good performance of the robots including a good social presence and more casual and social interactions. A recent experimental study by Schouten et al. (2022) with university students also shows that telepresence robots users experience a stronger social presence compared to videoconferencing, but also emphasizes the importance of considering robomorphism in human-mediated robot interactions, where robotic characteristics are attributed to the pilots. Another experimental study with university students by Stoll et al. (2018) suggests potential negative effects of telepresence robots on collaboration, when the TRPs were rated less trustworthy by their collocated team members in a puzzle-solving task.

Overall, these studies show that telepresence robots have great potential to enable high-quality interpersonal collaboration. Empathy plays an essential role in the quality of cooperation, especially in leadership (Gentry, Weber & Sadri, 2007). To gain further insights for the context of virtual collaboration, we want to learn, if the state empathy (Cuff et al., 2018) in the human-robot interactions with telepresence robots differs from the empathy in direct human interaction.

Following the media richness theory by Daft & Lengel (1986) the telepresence robot as a communication medium is supposed to possess a relatively high 'richness' in the meaning of its ability to change understanding between people within a time interval, compared to other mediums like telephone calls, but the robots would still be inferior to the face-to-face communication.

The main hypothesis of our study posits that average reported levels of state empathy would be lower towards Telerobotic Pilots compared to in-person participants. Additionally, we explored whether this difference extended to the three sub-components of the state empathy scale from Shen (2010): affective empathy, cognitive empathy, and associative empathy.

Method

Sample

The study involved 64 Bachelor students with a mean age of 21. The sample included significantly more female (n=47) than male (n=17) students. A majority of 70 percent of students major in psychology, with the remaining 30 percent studying other majors with a focus on economics.

Instrument

The questionnaire adapted measures from the State Empathy Questionnaire by Shen (2010). It encompassed three aspects: affective empathy (4 items), cognitive empathy (4 items), and associative empathy (4 items). Sample items:

- Affective empathy: I could feel the other participant's emotions.
- Cognitive empathy: I could recognize the other participant's situation.

- Associative empathy: I could identify with the other participant during their vacation.

Design

Conducted at the Leadership Garage Lab, participants engaged in a 20-minute conversation about their last vacation, with active listening and a post-conversation task. A warm-up task familiarized participants with the robot, followed by a 60-item questionnaire. Participants were randomly assigned to two groups: person-robot (N = 30) and person-person (N = 34). For the person-robot interaction the GoBe Telepresence Robot was used (see Fig. 1).

Figure 1. The study setup for the person-robot interaction using the GoBe Telepresence Robot

Results

The reliability of the State Empathy Scale was assessed with Cronbach's Alpha (N=64) and showed good results for the overall scale with $\alpha = .85$ and sufficient reliability for the sub-scales: .72 (affective empathy), .77 (cognitive empathy) and .75 (associative empathy).

Since we had a relatively small sample size, determining the distribution of the State Empathy Scale was important for choosing an appropriate statistical method. A Shapiro-Wilk test was performed and showed that the distribution of the overall State Empathy Scale departed significantly from normality ($W = 0.92$, p-value < 0.01). The same results showed for the three sub scales affective empathy ($W = 0.93$, p-value < 0.01), cognitive empathy ($W = 0.81$, p-value < 0.01) and associative empathy ($W = 0.91$, p-value < 0.01).

Based on this outcome, the non-parametric Mann-Whitney U test was conducted to determine whether there is a difference in State Empathy between the in-person participants from the person-robot groups and the participants form the person-person groups. The results indicate non-significant difference between groups, [$U = 301.00$, $p = .545$]. We also see no significant differences between the two groups for the subscales: affective empathy [$U = 287.00$, $p = .751$], cognitive empathy [$U = 338.00$, $p = .154$] and associative empathy [$U = 267.00$, $p = .916$].

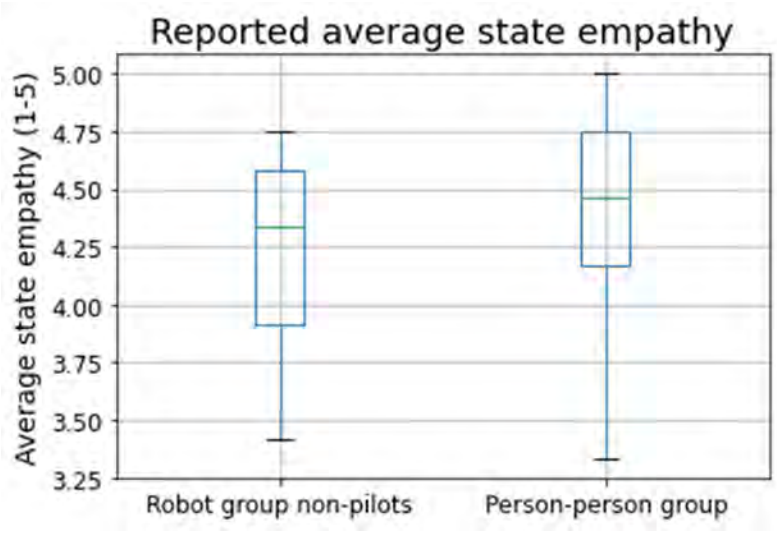

Figure 2. Reported State Empathy compared between in-person participants from the person-robot groups and the participants form the person-person groups

In conclusion, we fail to reject the null hypothesis and conclude that there is no difference in the State Empathy between the in-person participants from the person-robot groups and the participants form the person-person groups.

Discussion

The study found no significant difference in average state empathy levels towards TPR pilots compared to in-person participants, a result consistent across all sub-components of the state empathy scale. However, caution is warranted due to the small sample size in in-person participants from the person-robot groups (n = 15) compared to participants form the person-person groups (n = 30).

Conclusion and Implications for Practice

This study contributes to the evolving field of Human-Robot Interaction, shedding light on the nuanced dynamics of digital empathy and paving the way for future research in this domain.

Understanding that TPRs do not elicit lower empathy levels than human counterparts suggests a promising avenue for the integration of robots into social contexts. This has implications for the design and implementation of socially interactive robots, contributing to the ongoing discourse on the societal

acceptance of robotics. The results of this study show the high potential of telepresence robots for use in settings where interpersonal empathy is of particular importance. however, further research is undoubtedly needed to further understand the exact mechanisms of digital empathy in the use of telepresence robots.

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