Expectation vs. Reality: Perceptions of Social Robots

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***Abstract*—Robots are social because we give them identity and perceive them as social. In this paper I present a Venn diagram abstraction to explore the relationship between perceptions of social robot identity and the reality of the robot's design. This visualization provides a structured way to discuss the interplay between robot design and social impacts, analyze existing social robots, and propose open questions around social robot identity.**

I. Introduction

Robots are social because humans make them social, both through how we design them and how we interact with them. Media representations of social robots explore what it means for a machine to be social and have identity. Robots fall in love, experience loss, react with violence [1]. Following Clark and Fischer's conceptualization of social robots as depictions of social agents [2], we can think of social robots as physical manifestations of fictional characters.

The relationship between social robot design and human-robot interactions has been widely studied [3], [4]. This work includes studies with specific robots in specific contexts to broader classifications of perceptions of robot identity (such as warmth and competency [5], [6]), and theories for understanding how people anthropomorphize or perceive robots as social agents [2]. This research shows that humans can perceive robots as social agents, and provides information about *how to make a robot social*.

However, more work is needed to understand how perceptions of social robots varies between users and interaction contexts and how these perceptions impact users and communities. This raises questions including:

- How do humans perceive robot identity?
- What does robot identity say about the robot's creators and how does society inform robot design?
- Who benefits from social robots and who is harmed?
- Should we create social robots?

II. Visualizing Expectations vs Reality

Fig. 1 shows an abstract visual representation of difference between user's perception of robot identity versus the actual capabilities of the robot. Fig. 2 shows two starting examples of the Venn diagram representation. The abstractions can be applied to any robot and content included inside the circles. This rough abstraction is useful because it allows us to think generally about perceptions of social robots.

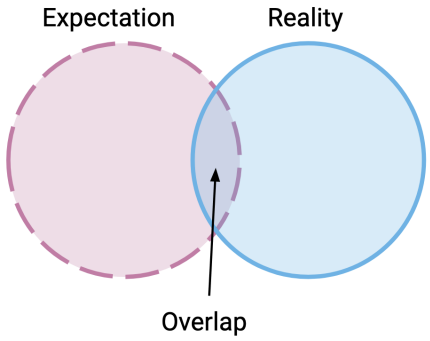

Fig. 1: Visual representation of a user's assumptions about a robot versus the actual capabilities of the robot.

A. User expectations of robot identity and ability

The **expectation circle** represents all of the things a user assumes that the robot can do. For example, a user might assume a remotely controlled robot in a Wizard-of Oz study can speak and make decisions autonomously. The relative size of the expectation circle indicates how socially capable or skilled the user perceives the robot to be. A robot vacuum would likely have a smaller expectation circle than a remotely controlled, but seemingly autonomous, guide robot.

The expectation circle is dynamic, changing in response to a person's interaction with the robot and observation of the robot's actions. Every person has a different expectation circle that is informed by factors including their attitudes towards robots, past experiences with robots, exposure to media representations of robots, and observations about the robot [4], [7].

B. Reality of robot design and function

The **reality circle** represents the actual capabilities of the robot as understood by the robot creators (e.g. designers, engineers). This circle includes the robot's physical and computational capabilities, including it's maximum speed, level of understanding, and decision making processes. The relative size of the reality circle indicates the complexity of the robot, in terms of both software and hardware. In contrast to the expectation circle, a seemingly complex robot controlled

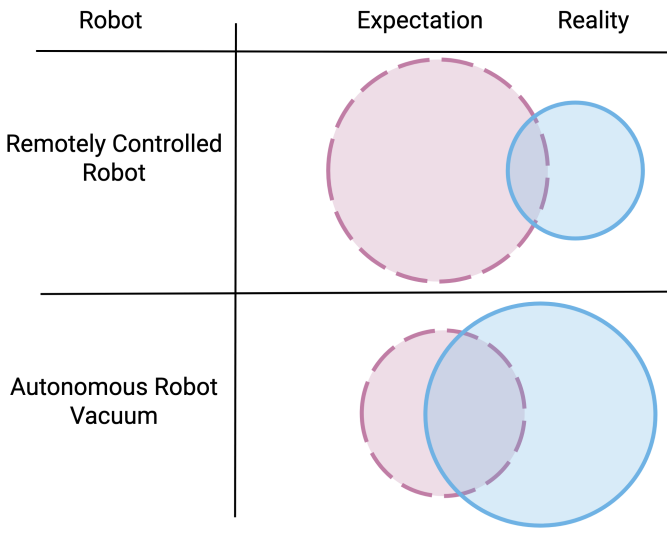

Fig. 2: Chart showing possible relationships between expectations and reality.

through remote operation might have a much smaller circle than an autonomous robot vacuum.

The reality circle is static, although a robot's capabilities at any given time are impacted by factors such as battery level, external environment, and current goal.

C. Understanding the Overlap

The amount of overlap between the expectation and reality circles represents the accuracy of the person's perception of the robot.

The percentage of the expectation circle that overlaps with the reality circle indicates the degree of realism in the human's perception. A small percentage of overlap indicates that the human assumed the robot has many more abilities than it actually does. This could be the case for many wizard of oz style studies.

The percentage of the reality circle that overlaps with the expectation circle indicates the amount of information the human knows about the inner workings of the robot. A robot designer is likely to have a larger overlap than a non-expert.

D. Open Questions to Explore

This abstraction highlights the following key points and open questions.

- How can we measure these circles and overlaps in the real world?
- How can we increase the level of overlap between the circles?
- What level of overlap is acceptable or not? Does this change based on application or user groups?

The expectation circle, and therefore the overlap, is dynamic, both over time and between users based on identity and context. Therefore: **interaction context matters for social robots**.

Robot designers, engineers, and operators **have power in human-robot interactions** (previous work includes [8], [9]). They make decisions (eg. how much information to implicitly and explicitly share with users) that directly impact the overlap between the circles.

- How accurately does the robot's appearance and behavior design represent the cognitive abilities of the robot?
- How is the social robot presented to users through advertising?

III. Conclusion

Robots are social because users perceive them as social. As a result, there is an inherent **disconnect between the user's perception of a robot's abilities and the reality of the robot's design**. The complexities of social robot identity design and perception make it challenging to reason about the degree of disconnect and the potential consequences to users. The visual expectation versus reality abstraction provides a tangible way to compare and discuss social robot designs and potential impacts.

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