Performative Approaches for Robot Design

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***Abstract*—Social robots become more prevalent in our daily lives. However, little is known about how best to design them or what far-reaching consequences they might have. Since robot development is time-consuming and costly, there is a lack of studies that examine their impact on social realities. In this position paper we argue for performative methods that allow embodied knowledge about social robots and their futures without the need for actually constructing them. We outline and compare three performative approaches for robot design, that (1) negotiate "superpowers" of robots, (2) explore social innovation by robots and, (3) anticipate ethical challenges and chances of robots.**

Keywords—robot design, performative design methods, anthropomorphism, design fiction

I. Introduction

Social robots are on the brink of entering our daily lives. Some of them are already commercially available to share our living space with us, such as Astro [1] and many more are being developed for different private and public domains, such as hospitals, supermarkets or train stations [2][3]. The introduction of social robots into diverse domains comes with many challenges, and the impacts can be far-reaching but hard to predict without directly engaging within the future domain of deployment. Different domains mean different stakeholders with different needs, fears, and preconceptions about robots, which designers and roboticists have to react to.

Unfortunately, there is not much knowledge available about how best to design or to interact with social robots. Neither is it clear what role they should play in the everyday of the near future. Aiming at user acceptance, one of the most established approaches for robot design is anthropomorphism or biomorphism [4][5]. Thus, robots often copy the already existing in shape and behavior – from butlers to pets. Further, most developments are motivated by problems and pragmatic goals, for example shortage of nurses [6]. A bold exaggeration for a stereotypical social robot built on these principles, could be a two-eyed and two-armed nurse robot. With its extensively developed voice control it is able to speak the human language. However, similar to a tool, this stereotype of a robot performs just pragmatic tasks, such as turning patients around in a hospital bed. This robot may (poorly) replace humans, but offers barely new added value to its social environment.

Especially with this pragmatic approach, there is the risk that researchers and developers lose sight of the fact that social scenarios are complex and that robots with their own strengths and weaknesses change the entire social setting relationally. We believe, that current approaches to the design of social robots (anthropomorphic design, problem orientation) fail to take into account the complexity of interrelations between the future robot, its users and stakeholders, and therefore do not lead to convincing social innovation. There is a need for methods that enable to explore alternative robot concepts/designs and to anticipate a robot's impact on its future social ecosystem. Consequences of robots need to be experienceable before robots are elaborately produced and released into real life.

In this position paper we allow a preview into several contributions of a soon-to-be-published book [7]. We present three performative approaches that enable designers to gain embodied knowledge about their robots and about the potential stakeholders surrounding them. These approaches do not aim at data of robots as such, but they reveal a relational understanding of robots in comparison to humans or as part of complex scenarios – now or in future.

II. Embodied, Relational Knowledge

In most studies about robot design, participants are asked to evaluate robots in isolation. They observe the product design of a robot or rate pictures of robots, to make researchers understand, for example, if human-looking robots are accepted better than machine-looking robots [8]. Here, researchers do not involve themselves. They certainly try to be as neutral as possible towards their object of study. These – often quantitative – studies prove to be insightful to test established hypotheses. However, they are, while absolutely necessary in robotics, less successful at exploring or even designing technology that does not yet exist or assessing technology consequences in the future.

To respond to these challenges, we made use of the advantages of performance: the ability to evoke embodied, relational knowledge. Our approaches complement the existing field of performative methods in design, such as "object theater", "stakeholder drama'", "bodystorming" [9][10]. However, they can be specifically tailored to robotics. Here, researchers do not investigate isolated robots as such, but explore them in their social ecosystems. Researchers are neither neutral nor do they observe others. Instead, in autoethnographic explorations, they involve themselves creatively and become part of scenarios. They do not only become aware of their own subjective perspectives but get to understand perspectives of others at the same time. They themselves slip into the roles of diverse stakeholders and allow other participants to role-play scenarios or they even become the robot itself.

III. Techno-Mimesis – Becoming the Robot

The technique Techno-Mimesis [11] allows robot designers and developers to embody the specific robots, they plan to develop and act out use scenarios the robots are developed for. For example, a developer becomes a cleaning robot at a train station and tries to communicate with passengers, who get in its way (Figure 1). This, of course, requires other participants to act as people (e.g., passengers).

Practicing Techno-Mimesis involves a transformation of one's own human body. We created "prostheses" (Figure 2) to enable humans to move and sense in the same technologically determined way as a robot. Typical input and output modalities (e.g., voice recognition) and familiar hardware decisions (e.g., a platform with wheels) serve as rationales for the prostheses. All prostheses are low-tech or simply made from cardboard, such as eyeglasses to change the visual sense, or headphones to focus one's sense of hearing. None of the prostheses copies robotic sensing and movement completely, and this is not the goal. Techno-Mimesis aims to produce an imperfect imitation to allow designers to experience being human and being robot at the same time, thereby centering on the relation and comparison between the two rather than favoring a human- or technology-centric perspective. For example, a cleaning robot equipped with a distance sensor only, might feel embarrassed when bumping into a group of women – after all, he is still a man sitting underneath a blanket with human emotions (Figure 1). However, since the developer experiences being robot and human at the same time, he realizes the possible advantage of not being able to differentiate people due to sex, age or heritage. As long as the robot has not the same abilities as a human, it might not be able to discriminate others, a so-called "superpower" [12] designers might want to highlight and not to correct and remove.

In Techno-Mimesis the developers becoming the robot and the participants acting people of the scenario are interviewed after the enactments. In what situations did it feel positive to be a robot in comparison to being human? When did it seem advantageous to interact with a robot instead of a human, and when would you have preferred a human partner?

Fig. 1. Robot developer imitates a cleaning robot for train stations. He uses a "laser sensor" to identify obstacles.

With Techno-Mimesis designers and developers negotiate the distinctions and unique strengths of both humans and robots. The contrast allows a new consciousness of one's own humanity vis-à-vis the specific nature and benefits of robots. The approach aims at discovering and utilizing particular strengths, robots have because of their mechanistic, non-human nature. Follow-up design questions rise, such as: should we design robots with human-like politeness, or could we make use of the fact that robots can't feel offended? Should we make humans say 'thank you' to robots, or are there benefits of not having to show gratitude? Techno-Mimesis enables designers and developers to reflect on already existing design concepts and gain new insights into robotic advantages instead of just copying human behavior and abilities. This way Techno-Mimesis allows to discover alternatives to the well-established approach of anthropomorphism in robot design. It allows designers to understand why and in what situations robots should behave and perceive the world differently from humans.

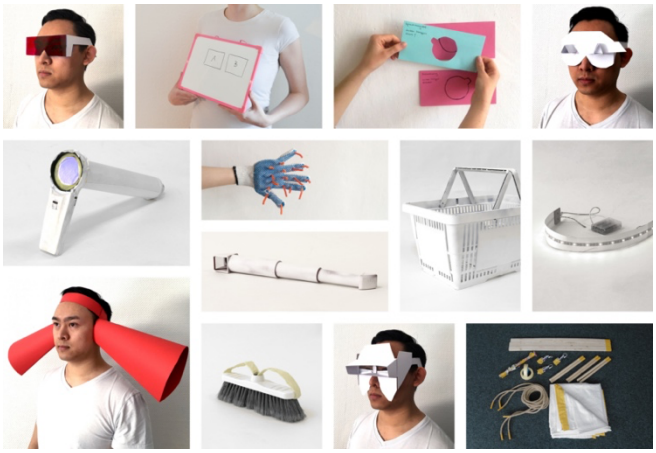

Fig. 2. A selection of prostheses used for Techno-Mimesis—from infra-red glasses and voice recognition stencils to a focused hearing headband.

IV. Enacting Utopia – Becoming other humans

Enacting Utopia [13] is a performative ideation method that negotiates social innovation instead of technological innovation. This approach aims towards positive futures and human wellbeing. Enacting Utopia involves three steps. In step one participants are asked to imagine a desirable future setting (utopia), for example, in a positive future work situation. They define what makes them happy in this future and then imagine technology that allows these feelings, for example a consulting artificial intelligence called *Two Bugs for One's Ears*. This robotic product is supposed to secretly give advice in business negotiations. One bug focuses on finances, and the other on social aspects. In step two of the approach, the participants start to enact the scenario while at the same time reflecting on it and changing it continuously. In the case of *Two Bugs for One's Ears*, it was not only the roles of two businesspeople which had to be played, but the two technological bugs as well (Figure 3). During the enactment, the two bugs turned out to give positive and helpful advises to their user. However, sometimes they caught up in contradictory and disorienting discussions, leading to confusion. In step three, the former utopia is evaluated from within the fiction. This means, the participants are asked to step in front of a camera and talk about their positive and negative experiences with the fictional technology while staying in their fictional character and perspective (Figure 4). For example: "I am Mr. X, and when I used *Two Bugs for One's Ears* for the first time, I had high expectations. However..."

Enacting Utopia as a method enables researchers to anticipate a technology's impact on everyday life for diverse

important stakeholders, not necessarily just the potential users. Even fictional politicians, manufacturers and children of users can be part of the enactments and are given a voice in the evaluation. Utopia always transforms when turned into reality. Unpredictable dynamics and even conflicts between the set roles are at the bottom of this creative approach. It is possible to do "live-prototyping" during the enactment – that is, to modify and adapt the interaction design to the specific dynamics and demands of particular situations. Furthermore, embodying future technology allows interaction concepts to be experienced even if they are not yet feasible technology-wise. In sum, Enacting Utopia allows for a decentered design process. It points to new challenges and opportunities in the interactions between humans and robots, aiming not only to create functional technologies, but to better understand how technology may support meaningful and enjoyable futures for all humans involved.

Fig. 3. A fictitious business negotiation supported by the artificial intelligence *Two Bugs for One's Ears*, embodied by two designers (right).

Fig. 4. Two fictional businessmen (top) and an artificial intelligence embodied by two designers (bottom) express the experiences from their point of view.

V. Fictional Probes – Experiencing a Future

Fictional Probes is related to Enacting Utopia. However, it takes a different entry point. Instead of creating new concepts of technology while enacting desirable futures, possible, preferable, or probable futures of already developed robots are anticipated and evaluated using fictional probes (i.e., diegetic prototypes [14]). First of all, different futures are imagined in dialog with robot developers. The already existing developed robot and its application scenario merely serve as a starting point for imagining this future of the robot, which is independent of today's technological limitations or the current appearance of the robot. That is, new functions, a different appearance or another usage can (and even should) be imagined. This approach aims at wishes, imagination, and fantasy and not at technical feasibility. Extraordinary ideas are encouraged. In a second step, one or more futures are made graspable: One of the design researchers creates fictional probes, meaning various artifacts from the future e.g., texts about future scenarios or fictitious product flyers (Figures 5 and 6). Each artifact conveys the created future in an appropriate way and assumes that the presented robot is already widely used. In the next step, these artifacts are used to speculate and discuss the futures with participants and how people might live in them. Participants (i.e., laypeople, other researchers, or robot developers) use the artifacts to immerse themselves in the different futures and to discuss their thoughts about them. Subsequently, participants imagine different people whose lives might be affected by the robot in the future (e.g., a family father, a janitor, a health insurance representative, a candy maker, a pet). The subsequent process resembles that of Enacting Utopia. The participants put themselves in the shoes of one or more fictional characters and represent the likely emotions, attitudes, opinions, and everyday experiences of those characters. Instead of speaking in front of the camera, however, the participants discuss with each other from the character´s point of view. For example, a robot antagonist and a customer are discussing with each other. While the robot antagonist complains about the shopping robots in the mall, which in his opinion are just a waste of resources and limit social contact with humans, the customer enthusiastically reports how the robots have more time than human staff and are more competent making the shopping experience pleasant. By imagining and discussing "their" interests (the interests of the represented stakeholders) and on how a future life with a robot feels from "their" perspective, social and ethical issues as well as conflicts and questions are raised in a broader sense long before a robot actually enters everyday life. Different perspectives, issues and potentials become visible. While the robot is a waste of resources for one person and inhibits social interaction, it can be an enrichment for another person that leads to a new joyful experience.

Fig. 5. Fictional product flyer showing future vision for a shopping robot.

Fig. 6. Fictional product flyer showing future vision for a social domestic robot.

The approach Fictional Probes makes use of the design competency to visualize the not yet existing by means of prototyping or image creation (e.g., designing a realistic flyer of a not yet existing reality). This visualization places the technology presented in a broader context and simulates its widespread use and does so in an easily digestible manner. The artifacts thus allow for easy access to a fictional world and encourage discussion. Even provocative ideas and their prospects can be visualized and brought up for discussion without much effort. Without having to think about the concrete design of the robot, insights into future life with a robot can be gained (both through the creation of the artifacts themselves as well as through the exchange with participants about them). Further, the approach focuses on ethical implications. Critical issues can be communicated through the artifact and at the same time its impact on potential stakeholder can be experienced through the role-playing.

VI. Discussion & Conclusion

All three approaches presented are based on embodied knowledge. Due to performative enactments and role-play, researchers and participants are able to experience possible futures with the help of their own bodies and emotions. However, the approaches aim at different findings. Techno-Mimesis is an evaluation method for already existing robot concepts. These concepts can be directly experienced in use scenarios from the perspective of the robot itself to identify robotic superpowers. Of course, these findings then serve to further develop the robot. Enacting Utopia, on the other hand, exists explicitly to come up with new robot concepts. It is an ideation method with a special focus on positive experiences and social innovation. The creation process is conducted by several designers simultaneously that are acting diverse stakeholders. Fictional Probes is based on role-play as well, however the goal of this method is evaluation rather than ideation. Probes from the future are used to make participants immerse themselves into a defined future scenario and to discuss its ethical implications with each other. This method anticipates possible conflicts between stakeholders but also identifies not yet realized opportunities of the future with robots.

In summary, performative methods are excellent for experiencing social situations that do not yet exist in everyday life. Thus, these methods are a good starting point to go beyond anthropomorphism and problem-solving and to identify alternative desirable robot designs and develop a clearer understanding of a possible shared future with social robots. We have seen, performance can be used to prototype social dynamics. This is especially relevant for social robotics. After all, robots need to be explored, evaluated and further thought out in social settings before their time-consuming development starts. Due to costly development of robots, technology assessment with performative methods is particularly lucrative here. Ultimately, we believe that the use of performative methods can help to develop robots that do not only pragmatically function and are safe for use, but also robots that one would enjoy share their everyday life with and which have the potential to lead to enriching experiences.

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