Stigma and Service Robots

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ABSTRACT

Service robots hold the potential to assist both specific user populations with tailored support while also serving the broader public domain. As the demographic shift towards an older population continues, the increasing diversity of accessibility needs means that service robots will need to accommodate a broader range of users, necessitating the integration of lessons from the domain of Assistive Technology (AT). However, the assistive nature of service robots necessitates consideration of stigma, which has historically hindered the adoption of AT and robots, especially among populations susceptible to societal biases or discrimination. In this paper, we delve into how stigma manifests and operates in the context of service robots, identifying open research questions that warrant further exploration. We explore the relationship between assistive and service robots, critically analyze existing research on stigma and robotics, and examine known solutions for reducing stigma through design. We lay the groundwork for innovative solutions and strategies to confront the challenges posed by stigma and the acceptance of service robots.

KEYWORDS

universal design, stigma, self-stigma, service robotics, technology adoption

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Figure 1: Perceived and self-stigma with a service robot acting as a robotic shopping assistant in a grocery store.

1 INTRODUCTION

As service robots become increasingly integrated into various aspects of daily life, it is necessary to reassess our preconceptions about their purpose and user base. Service robots may range from personalized aids for specific user groups to robots serving in the public domain, such as a greeter [11]. The demographic trends forecast a substantial increase in individuals with impairments and disabilities, signifying a pressing need for inclusive design and innovation. For example, the number of individuals with visual impairments in the United States alone is projected to reach up to 7 million by 2050 [16]. In order for service robots to provide service for the majority of the future, then, they need to be designed with lessons from the domain of AT.

One important factor of creating AT that is welcomed and adopted by users is the consideration for stigma. Just like with AT, stigma effects can influence societal acceptance and the adoption of robotic services we aim to provide. For instance, a service robot deployed in a store to assist individuals with mobility or visual challenges may inadvertently reinforce stereotypes or feelings of inadequacy, contributing to perceived stigma among observers and potentially exacerbating self-stigmatization among users (Figure 1).

In this paper, we explore how stigma can manifest and operate in the context of service robots and identify open research questions that require further investigation. We first explore the relationship between assistive and service robots (Sec. 2). We then critically analyze existing research on stigma and robotics (Sec. 3). Finally, we examine known solutions to reducing stigma by design (Sec. 4). By exploring stigma considerations in the design of service robots, we aspire to pave the way for innovative solutions and strategies to develop service robots that garner acceptance and ultimately enhance the quality of life for all individuals.

2 ASSISTIVE VS. SERVICE ROBOTS

Service robots, distinct from assistive robots, are designed for communal use and cater to diverse users regardless of their abilities. We can think of service robots as public-facing robots that have assistive features. For this reason, it becomes crucial to examine the stigma associated with service robots, as it is a prominent challenge regarding the acceptance of AT. Stigma can significantly impact the acceptance, usability, and effectiveness of the technology, particularly among populations that may already face societal biases or discrimination [7, 15, 20].

On the other hand, many assistive robots have been specifically designed for particular user groups, including robots for elderly care, educational robots for children with autism, and robots for mobility, such as prosthetics and exoskeletons. While designing robots for specific user groups is common, designing robots that cater to a diverse range of users with different abilities and needs is relatively uncommon. For example, the existing literature on universal design and robot accessibility primarily focuses on designing environments to accommodate robots and addressing how robots can assist individuals with visual or auditory impairments [14]. There is a noticeable gap in research addressing how universal design principles can be effectively implemented in service robots, leaving the question: *What does universal design entail when applied to service robots?*

3 STIGMA IN ROBOTICS

Understanding both perceived and self-stigmatization is essential to address the acceptance of service robots. Perceived stigma refers to negative perceptions held by members of the public towards individuals with stigmatized attributes, while self-stigma manifests when individuals internalize these societal attitudes [4]. An example highlighting the existence of perceived and self-stigma can be found in a study where participants without disabilities generally perceived AT positively, acknowledging its role in fostering independence and empowerment. Conversely, individuals with disabilities recognized the drawbacks of AT, including its potential to attract unwanted attention and overshadow individual identities [1].

Stigma associated with AT, including assistive robots, has been observed in various studies [1, 2, 6, 7, 13, 15, 20]. Older adults, in particular, may perceive the use of assistive robots as indicative of dependency or declining abilities, a stigma they find unacceptable and thus a substantial barrier to assistive robot acceptance [7, 15, 20]. Given that service robots will use assistive features, it is reasonable to predict that they will face challenges regarding their acceptance. This prompts the question: *Will service robots encounter the same degree of stigmatization as assistive robots?*

Within the field of Human Robot Interaction (HRI) and robotics, the assessment of stigma upon robot use is notably sparse and inadequately represented. The Technology Acceptance Model (TAM) [5] is a widely recognized framework utilized to assess the acceptance of assistive robots in various studies [3, 9, 15]. However, this framework does not consider stigma at all, despite its recognition as a significant obstacle to robot acceptance. Some efforts have been made, such as the Unified Theory of Acceptance and Use of Technology (UTAUT) [17], which incorporates a stigma category, and the inclusion of a single stigma-related question within a robot-acceptance questionnaire [20]. However, there is potential to enhance these methods to comprehensively encompass the diverse dimensions of stigma, such as distinguishing between self-stigma and perceived stigma. Extensive measures for identifying self-stigma do exist within the psychology field [10, 19]. Their applicability and relevance to the domain of robotics and HRI requires further exploration. Thus, there is a compelling need for more comprehensive and nuanced metrics to effectively evaluate and address stigma associated with the utilization of robots.

4 REDUCING STIGMA

Universal design has been proposed as a promising approach to address the stigma surrounding assistive robots and technology [13, 20]. By adhering to universal design principles, products, environments, and systems are crafted to be accessible and user-friendly for individuals with diverse abilities and disabilities, eliminating the need for specialized adaptations. This approach not only normalizes the use of the service robot but also diminishes the visibility of disability-related accommodations, potentially mitigating stigma.

Efforts to mitigate stigma associated with robot use have also led to design approaches such as hiding the robot or making it blend in with the environment [8, 12, 18]. While hiding the robot addresses perceived stigma by integrating it inconspicuously into the environment, it may not effectively tackle the main issue of self-stigma, which is arguably more critical for technology adoption.

Marketing strategies have also been proposed as a means to destigmatize images of assistive robotics to increase their acceptance for older people, suggesting that targeted campaigns and educational initiatives could play a pivotal role in reshaping societal perceptions and reducing stigmatization associated with the use of assistive robots [7].

Despite efforts to address stigma through various strategies, the effectiveness of these approaches in reducing stigma and fostering acceptance remains a pertinent question. *What is the efficacy of each method in mitigating stigma associated with service robots?*, *Do certain strategies outperform others?*, and *What could be the potential outcome of combined approaches?* Further research and implementation are necessary to comprehensively understand and leverage the potential of these approaches in tackling stigma and promoting inclusivity within the domain of service robotics.

5 CONCLUSION

Through an exploration of the assistive and service robot relationship, a critical analysis of existing research on stigma in robotics, and an examination of solutions to mitigate stigma, we identify key areas for further investigation.

In light of the open questions we have identified, we propose a research agenda aimed at addressing key aspects of service robot design and stigma mitigation. This agenda entails investigating how service robots can be effectively designed to cater to a diverse user group while simultaneously minimizing stigma. Furthermore, research efforts should delve into quantifying the degree of stigmatization associated with service robots and developing standardized metrics to evaluate stigma upon robot use. Additionally, exploring optimal strategies for reducing stigma in the context of service robots is crucial for enhancing their acceptance and utilization. By investigating these questions, we can pave the way for a more inclusive and accepting society where service robots fulfill their promise of enhancing quality of life and addressing societal needs.

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