

Service Robots: Interpretive Flexibility or Physical Appropriation?

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ABSTRACT

The position presented in this paper is that in order to understand how service robots shape, and are being shaped by, the physical and social contexts in which they are used, we need to consider both work/organizational analysis and interaction design. We illustrate this with qualitative data and personal experiences to generate discussion about how to link these two traditions. This paper presents selected results from a case study that investigated the implementation and use of robot vacuum cleaners in Danish eldercare. The study demonstrates interpretive flexibility with variation in the perceived nature of technology, technology strategy, and technology use between key stakeholders in eldercare. The case study approach and results is then briefly contrasted to the authors' first hand experiences with appropriating robot vacuums in the home. The aim is to generate discussion of how to conceptualize how robot vacuums shape, and are being shaped by, the physical and social contexts in which they are used.

INTRODUCTION

For decades, robot technology has been heralded as bringing about fundamental changes to the industrial work environment. Robots promise to transform work processes and bring about productivity increases [1]. Advances in robot technology also appear to offer an alternative to traditional labour for providing routinized tasks and services in public sector health and eldercare. This includes services and socially assistive robots and robots for re-training and assisting patients in their own homes rather than receiving such help in hospitals or rehabilitation centres. While robot use is increasing driven by expectations of a radical shift in *automation and possible new service tasks*, empirical knowledge about the interplay with physical work processes and how key stakeholders react towards robots is sparse. Furthermore, due to the novelty of the technology and lack of examples of use in everyday life, researchers doing this type of research may try out the technologies on their own body, in their own homes, to grasp how these technologies may be appropriated.

POSITIONING THE PAPER

We take the position in this paper that contrasting own first hand knowledge of appropriation of service robots to systematic studies of service robot perception in public institutions is worth a discussion. Two of the authors of this paper have for years lived with service robots in their homes and offices. They have first hand experience with appropriation of robot vacuum cleaners, and point out that a) they require a lot of maintenance, b) you need to adapt the

environment to the robot, c) robot use needs to fit the family patterns and attitudes, d) robots make noise, e) robots are not durable enough, f) robots become family 'pets'. In particular, g) robot-human interaction is a down-to-earth practice, see: <https://1drv.ms/v/s!AkkwqMZaIMsanO4OfFCWMvZaV3RrhA>

THEORY

Emphasizing the 'interpretive flexibility' of technologies, Orlikowski and Gash [2] divide *technological frames* into three main categories: *Nature of Technology*, referring to how actors perceive technology, including its suitability and function; *Technology Strategy*, capturing the desired impact supporting organizational goals; and *Technology in Use*, including the actors' understanding of how technology is used and will become important in daily routines. The three categories reflect what the technology is (nature of technology), why it is introduced (technology strategy), and how it is used to create changes in work (technology in use) [2]. The three categories are our analytical tool for assessing similarities and differences in how actors understand technology. Technological frames are flexible in nature, as perceptions of a given artefact robot may change over time.

While technological frames may concern the organization level, *appropriation* focus on how end-users of technology tweak and twist the technologies to their own purpose and context. Salovaara et al. [3] discusses possible theoretical foundations for the concept, and how work analysis and interaction design should be linked to study appropriation [4]. Appropriation is different from the idea of adoption, since it implies that it is the users who are active in shaping the role that a technology will come to play, while adoption theory uses a more static version of an innovation. A key question is if there are ways for designers, builders, or implementers of technology to anticipate appropriation or even facilitate appropriation?

CASE STUDY CONTEXT

We have reported the full case in a journal paper [5] and will here bring key findings only. The research context of the case study is public sector-provided eldercare in a specific municipality (Billund) in Denmark. The context is very important of the following reasons. Basic eldercare is a universal service in Denmark provided free of charge to all eligible citizens, regardless of personal income. The eldercare is very costly due to the amount of services

provided and the relative high labor costs for personal services in Denmark. Within the legislative umbrella, two forms of eldercare exist at local levels of government: (1) care in municipally owned and operated assisted living facilities, and (2) municipality funded home care delivered to senior citizens in their private homes. In both settings, personal services (e.g., bathing) and practical services (e.g., cleaning) constitute the core of the delivered services.

The case municipality, Billund Municipality has systematically used robot vacuum cleaners to substitute manpower. Billund has a population of 26,367 citizens (pr. 1.1.13) and is a mid-sized Danish municipality covering 541 km². In 2013, 219 clients lived in Billund Municipality assisted living facilities and 583 clients received home care services. When the municipality took the formal decision to acquire robot vacuum cleaners, new standards for cleaning prescribed that the ‘municipal standards for vacuuming imply that vacuuming is done by robots’. Accordingly, the allocated time for each home care cleaning visit was reduced by 12 minutes (20%). As part of this strategy, home care clients were told to either buy their own robot, switch to a private provider (using traditional vacuum cleaners) or use the municipality’s own robots once every second week. Thus, the case represents what can be labelled as a push strategy with a possible exit strategy for the envisioned users.

Most of the citizens living in their own home (65%) have chosen to invest in a robot themselves (as recommended by the municipality). Residents in assisted living facilities are not expected to buy their own robots. Instead, Billund Municipality has replaced traditional vacuum cleaners with 12 robots (iRobot) for cleaning in assisted living facilities.

RESEARCH DESIGN

The case study was designed to emphasize the perceptions of key stakeholders. 18 semi-structured interviews with four key stakeholder groups: the managers of social service, eldercare, and operation management (3); the IT-manager (1); care workers in assisted living facilities (3) and in home care (4); and clients living in assisted living facilities (3) and in their own houses (4). The interviews took about 1–2 hours each and were conducted at the workplace or the clients’ home. All of the interviewed clients were between 70 and 80 years old. In addition, observation of care workers ‘at work’ with robots was done to better understand their use in everyday practice. These observations took place in two assisted living facilities and were documented using field notes. Inductive data analysis was more directly linked to the research question and theoretical framework.

KEY FINDINGS FROM THE CASE STUDY

The findings showed that regarding the nature of technology, the Billund managers were enthusiastic about robot innovation as a promising way to modernize eldercare. They were confident that robots could cut costs and clean just as well as traditional vacuums. They also stressed how the cost of acquiring the robots was affordable for clients and that their being able to vacuum as often as they like represented

an important improvement (as opposed to every third week, which they had been approved for). One manager noted:

It’s a win-win situation. We can save money while the citizens receive good service. In my opinion they get vacuumed just as well with the robots.

This optimistic view was echoed by technologists. The IT manager saw robots as an obvious means to transform service delivery. Similarly, robot suppliers also praised the new technology. One of the suppliers wrote:

A robot vacuum cleaner does exactly what it promises – it vacuums automatically so you don’t need to. With a robot vacuum cleaner you free up time for other work. The robot does a thorough job and gets completely into the corners (www.roboteksperten.dk).

As we turned to the other stakeholder groups, however, incongruence in the technological frames between groups became clear. In contrast to the optimistic perspectives of the managers and technologists, the frontline staff and eldercare clients had more mixed views on the robots. In particular, the staff initially had a somewhat negative attitude towards the robots. A care worker explained:

In the beginning there was nobody who cared about this new, odd thing. The staff would rather vacuum the old way so that we get into the corners!

Although scepticism seemed to wane over time, the debate on robots continued.

CONCLUDING REMARKS AND DISCUSSION ITEMS

In the workshop, we would to discuss how we can stimulate more cross-disciplinary studies. We find it relevant to raise this discussion based on the variance in findings and observations derived from our use of the robots and the case study findings. There is a golden opportunity to push the relevance of human-computer interaction (human-robot interaction) in the potential booming introduction of robots in eldercare. The question to discuss is identifying how to move forward and take a pro-active role in the development and adoption in government run eldercare services.

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