Including Front-Line Workers as Primary Stakeholders in Public-Space HRI

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ABSTRACT

When a robot is deployed in a public space, that space is almost always an existing workspace, with front-line workers who will need to work alongside the robot when it is deployed and who are crucial to the success of the overall project. We show how these front-line workers have been included alongside other stakeholders in three recent social robotics projects: a socially assistive robot for use in paediatric emergency departments, a guidance robot for visitors to a large university building, and a robot social worker designed to help international students and other new arrivals to navigate processes in a new country. We argue that the contributions of these front-line workers are crucial to the success of any such public-space and should always be taken into account at all stages of the project life cycle.

KEYWORDS

Co-design, User-centred design, Public-space robotics

ACM Reference Format:
Mary Ellen Foster, Shaul Ashkenazi, Andrew Blair, Andrés A. Ramírez-Duque, Samina Ali, Patricia Candelaria, Summer Hudson, Jennifer Stinson, Lauren Harris, Sasha Litwin, Fareha Nishat, Ronald P. A. Petrick, Alan Lindsay, David Harris Smith, Ahmet Dumlu, and Frauke Zeller. 2024. Including Front-Line Workers as Primary Stakeholders in Public-Space HRI. In *Proceedings of 1st International Workshop on Worker-Robot Relations.* ACM, New York, NY, USA, 4 pages.

1 INTRODUCTION

Although much initial work on social robots was lab-based, an increasing number of social robots are now being deployed and evaluated in public spaces [24, 30]. For example, Pepper has been deployed in a wide range of contexts including shopping malls [12], museums [10], restaurants [34], libraries [25], and train stations [35]; recent deployment contexts for Furhat have included it as a barista [21], as a receptionist [23], and in an airport [16]; while in Japan, Robovie has been successfully used for a series of shopping-mall deployments over several years [8, 17, 20, 31, 32]. Social robots are also increasingly being used in hospitals and other healthcare contexts [1, 4, 5, 26, 33].

A common factor in all of these deployment contexts is that they are existing workplaces, with stakeholders including management, visitors (patients, customers, tourists), and front-line workers who should all be consulted to develop the details of the system to be deployed [27]. The managers are clearly influential in this process: no deployment can ethically be carried out in such a space without the permission of the management, who also exercise significant control over the time and place of the deployment, as well as the topics that the robot might discuss and the way in which it engages with visitors. When it comes to the building visitors, who are normally the target end-users of any such deployed robot, user-centred design processes are common in the HRI community [9, 36], and the success of most interactive robot systems is also normally assessed through studying user behaviour and subjective responses [2].

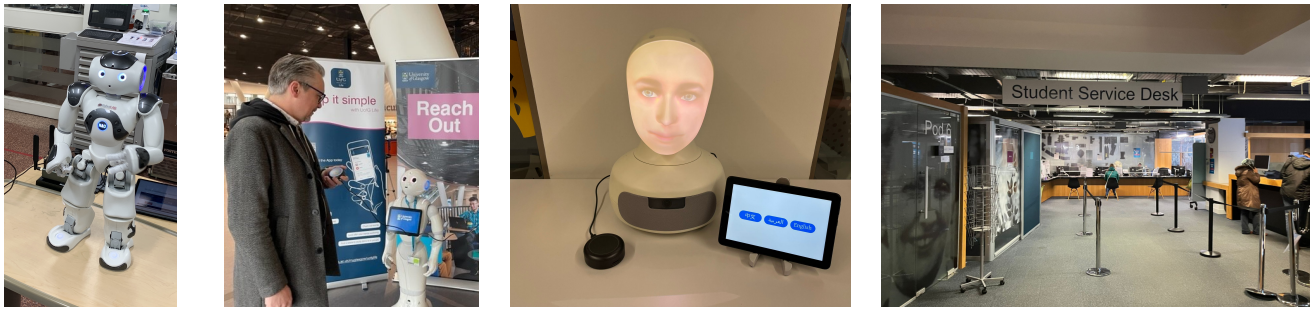
Front-line workers often need to continue to do their jobs alongside the robot during the deployment, and may even be called on to provide hands-on technical support for the robot, especially if the deployment site is remote from the developers [e.g., 11]. Nevertheless, it is rarer for these stakeholders to be considered either in the design or evaluation processes, despite their needs and opinions being paramount to the overall success of deploying social robots in their work environments. For example, in a study conducted in a Japanese care home, the staff had more complaints than praise: *"staff stopped using Hug after only a few days, saying it was cumbersome and time consuming to wheel from room to room—cutting into the time they had to interact with the residents"* [37].

We present three projects where we develop a robot and deploy it in an existing workspace. For each project, we discuss how we engage with the front-line workers and other stakeholders throughout the design and development process of each robot.

2 EMERGENCY DEPARTMENT ROBOT

In this project, we are developing a social robot, based on the Nao platform (Figure 1a), to be deployed in two children's emergency departments to help patients cope with medical procedures that may be painful and distressing [13]. In the specific clinical scenario that we are targeting, the robot is placed in a small room together

1st International Workshop on Worker-Robot Relations, March 11, 2024, Boulder, CO, USA 2024.



(a) Hospital robot **(b) Guidance robot** **(c) Student support robot** **(d) Student services desk**

Figure 1: Details of all robot systems

with the patient, along with one or more carers and a Health Care Provider (HCP), during the course of a single clinical procedure. Intravenous Insertion (IVI) was identified as an appropriate procedure: this is one of the most commonly performed procedures in the context of children seeking medical care, and also one that can be painful and distressing for the child and for their parents or caregivers. In a previous study [1], a social robot was found to be effective in this context; however, the behaviour of that robot was fully scripted, significantly limiting its ability to respond to the child's state during the course of the procedure. To address the limitations of previous studies, our robot system is designed to use AI planning techniques to allow it to adapt flexibly during an interaction [22, 29], and incorporates as well as a user-centric framework for ethics and Equality, Diversity, and Inclusion (EDI).

2.1 Stakeholder engagement

Stakeholder engagement has been a significant task throughout this project, involving staff, patients, and caregivers at two large teaching hospitals. We began with a set of interviews and focus groups with healthcare providers including nurses, doctors, and child-life specialists [19], along with parents, caregivers, and children [28], who gave insights into matters such as the appropriate role for the robot in the different phases of the procedure, the details of the robot's behaviours, as well as risks and constraints to consider when developing and deploying the robot. In a second round, workshops were held between technical team members and a set of HCPs at both sites to convert the co-design insights into concrete, implementable specifications and decision points for the system to allow us to meet the goal of an adaptive and flexible system that also meets the goals of the use case; details of these insights are provided in [14]. Subsequently, members of the clinical teams conducted extensive testing of the system in the hospital and, more recently, usability testing has been conducted with HCPs and families at both clinical sites to confirm system feasibility and acceptability. Collaboration is ongoing between the technical team and these stakeholders to develop the final version of the system, which will be evaluated in a two-site randomised clinical trial.

Additionally, as a dedicated user-centric ethics and EDI dimension, we added an exhaustive literature study on integrating ethics and EDI in healthcare settings with social robots. The literature overview focused on the three dedicated parties involved instead of merely focusing on those receiving treatment. Thus, we directly integrated the insights from the front-line worker (here, HCPs) as well as those of the and caregivers. We also aim to develop an applied and adoptable framework for integrating ethics and EDI in future social robot deployment in hospital settings. This framework will be integrative in terms of including patients, their caregivers/parents or other companies, and workers.

3 UNIVERSITY GUIDANCE ROBOT

In large public buildings, it can often be difficult for visitors to find their way or to determine what resources are available. We have developed a social robot [6] with the goal of helping university students to navigate and interact with a large, recently-built learning and teaching building at the University of Glasgow. The design of the building means that there is no dedicated reception desk; instead, members of a dedicated "Reach Out" student support team are deployed in the building throughout the day to help with any queries that might arise. The robot was built to be deployed in the building to help answer questions similar to those that are given to the support team, providing an additional point of contact for students and other visitors. The system was implemented on the Pepper robot, with a back-end chatbot based on Rasa. Figure 1b shows a user interacting with the robot. Over the course of a week-long, supervised deployment, we collected long form questionnaire results (N = 59) on attitudes and feelings towards the robot from students and staff. We observed an overall positive response to the robot, but with a wide variety of specific opinions [7].

3.1 Stakeholder engagement

At the start of the project, we consulted members of the University Services team to confirm that they were supportive of the overall robot project and to agree on the robot platform and the conversational domain, which they said should be based on the IT Helpdesk. We also gathered general feedback on the robot concept from building visitors, using a non-interactive version of the robot to prompt responses. Finally, we shadowed two members of the "Reach Out" team for a three-hour period each in order to understand the typical queries that they needed to handle, which included a large number of questions about the building itself (e.g., directions, toilet locations, instructions for using printers): the system design was

updated to include these features as well as the IT Helpdesk content required by University Services.

Following the user study during the week-long deployment, we returned to the other stakeholders to gather their feedback. The University Services team had all interacted with the robot during deployment and had appreciated the chance to see the technology hands-on, with some saying that they had been surprised how enjoyable it was to interact with it. They also identified potential process improvements to their workflows, independent of the robot, and proposed that a future direction might be a chatbot deployed on an app or a website rather than the robot. The feedback from "Reach Out" team members in the main building was similar to that expressed by the building visitors during the study; however, feedback from some staff in the Library (where the robot was deployed for one day) was more negative, with one staff member expressing concern: *"It is threatening my job. I definitely would not want [it] as a team member."*

4 ROBOT SOCIAL WORKER

The goal of this project [3] is to develop a social robot to work alongside human support workers who help new arrivals in a country to navigate the necessary bureaucratic processes in that country. The ultimate goal is to develop a robot that can support refugees and asylum seekers in the UK. As a first step, we are targeting a less vulnerable population with similar support needs: international students at the University of Glasgow. As both groups of target users will be in a new country and may be in a state of stress when they seek support, forcing them to communicate in a foreign language is likely to fuel their anxiety [18] and also affect their sense of identity and belonging [15]. The robot system (Figure 1c) includes the Furhat robot head alongside a tablet which is used to initiate the interaction, to scan a QR code to take away information, and to complete a short survey once the interaction is done. Figure 1d shows the target deployment location for the student services robot at the University of Glasgow.

4.1 Stakeholder engagement

The process of developing the university support robot included a lengthy consultation with the student support team in order to ensure that the robot meets the needs of all the parties involved. We observed the support officers while they were interacting with international students on several occasions and also held meetings with the managers of the student support centre regarding usefulness and data safety. Ultimately, the system was built around four frequently asked topics: financial aid, council tax exemption, official documents, and navigating the campus.

As part of developing the next version of the robot, which should help refugees and asylum seekers, it is crucial to engage with them to fully understand their needs and preferences. Our first step will be to carry out interviews with refugees where we will present the Furhat robot and see how it can meet their needs and be of help. We are already engaging with local organisations that support refugees and asylum seekers, and will also seek their input on developing both the content of the interaction as well as the interaction style that will make them feel more at home and more welcome in their new host countries.

5 DISCUSSION

Deploying a robot in a public space requires contributions from numerous stakeholders. Owners and managers of the space are crucial to the deployment happening at all, while end-users (visitors) are most often the main ones involved in measuring the success of the deployment once it happens. However, public deployment locations such as those we discussed in the three examples generally involve front-line workers who will need to work alongside the deployed robot and possibly help with the deployment. Arguably, the input of said workers should and must be included throughout the project. If not, there is a risk that the workers may jeopardise the success of any deployment study, whether for fear of losing their own jobs (as expressed by one of the library workers), due to the extra work involved (as with the example from the Japanese care home), or for other reasons. Moreover, on-site workers can be a rich source of relevant contextual information regarding work procedures, routines and the skill sets needed to complete a job or routine successfully. This experience, as well as explicit and implicit knowledge, should be used in the robot's overall design to achieve optimal complementarity and co-working routines.

ACKNOWLEDGMENTS

This work was partially supported by the UKRI Centre for Doctoral Training in Socially Intelligent Artificial Agents, Grant Number EP/S02266X/1. The authors also wish to thank the SSHRC-UKRI Canada-UK Artificial Intelligence Initiative (ES/T01296/1) for financial support of this work, and would like to acknowledge all patient partners, research and clinical staff as well as the youth and families who have made this project possible.

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