Studying Drink-Serving Service Robots in the Real World

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Field studies where robots are tested in real life settings bring different challenges for researchers, robotics scientists and users. We focus on challenges that researchers and robotics scientists face during preparation and the on-set deployment phase, point to difficulties that may arise and present some practical solutions to these issues.

EXPERIMENT 1

- at a Danish elderly care facility
- participants were staff and residents
- ethnographic fieldwork and pilot tests for the deployment of a service robot
  - ethnographic observation, focus group interviews and co-design workshops
- the focus was on three use cases; transportation of laundry, serving beverages, and guiding users within the building

Furthermore, we tested different functionalities of the SMOOTH robot, such as its navigation and dialog system, as well as the use case implementations.
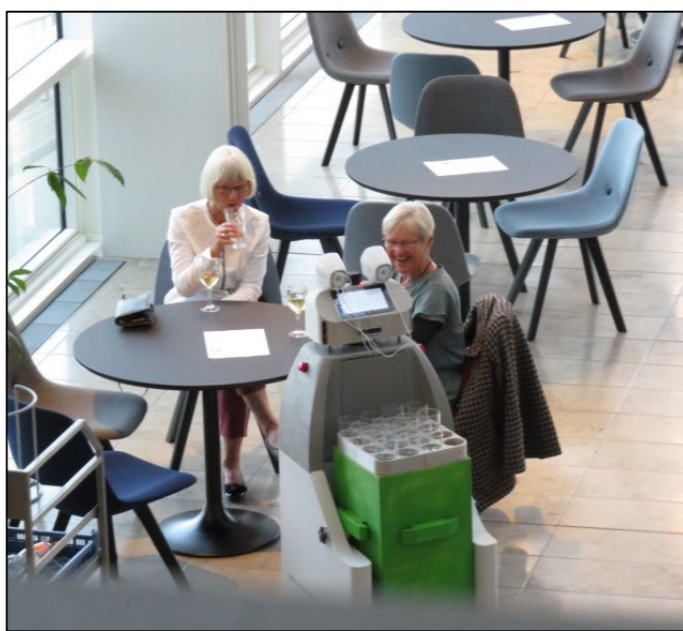
The SMOOTH robot which was used in EXPERIMENTS 1 and 2.

EXPERIMENT 2

- in the university canteen and in the lobby of the concert hall
- participants were university staff and students (during the day), and members of the public (in the evening)
- we collected about two hundred interactions with the robot
- navigation controlled by a wizard, the dialogs pre-scripted

We created a set of functionally equivalent utterances so that overhearers wouldn't witness the same dialogs over and over again. The robot greeted people, offered water, told jokes and persuasive facts about water intake and finally closed the interaction with 'cheers' or a 'goodbye'.

Studies in the 'wild' impose considerable practical challenges on researchers

EXPERIMENT 3

- at a German elderly care facility
- participants were residents and staff
- the field study lasted one week
- the same robot functionalities as in EXPERIMENT 2
- the robot drove around the common room to serve water, apple and orange juice
  - the common room includes tables, chairs, and a kitchen so that people can come together, eat and enjoy their drinks

During the day, there are "rush hours" for the robot, after breakfast and lunch. Additionally, there were some social activities during which the robot attracted people's attention and served some drinks.

The Robotic Service Assistant developed by Fraunhofer IPA was used in EXPERIMENT 3.

Challenges in the preparation phase

Interaction with Testing Facility

Extensive discussion with the management and informing the staff is required to successfully conduct the experiment. The challenge is when personnel is changing due to different shifts and thus not everyone is supporting the deployment of the robot. In spite of extensive discourse with the management, not all staff were involved in the preparation, which led to some staff not giving full consent.

Collecting Consent Forms

Collecting consent forms turned out very time-consuming, especially in elderly care since many elderly suffer from dementia, and their legal guardians need to give consent on their behalf. We needed to collect consent forms repeatedly, since the average time of stay in the Danish elderly facility is about a year. Researchers also need to explain the importance of consent forms repeatedly because the relevance of these forms was not obvious to many people of the general public.

Different Types of Participants

We collected consent forms from residents in the testing area, but residents from other areas came to visit the testing area, too. We needed to handle these unforeseen participants by e.g. letting them fill out a consent form on the spot. In interactions involving more than one person, group members often differed regarding the consent they gave, i.e. some signed the consent forms whereas others refused to do so, which complicates the data analysis.

Technical Aspects

The robot needs a certain maturity and dependability level to go outside the lab. Extensive in-house testing is therefore required. Some robots need network usage to work effectively and not all facilities provide this; communicating with the facility to prepare necessary hardware for networking before deploying the robot is essential. The robot needs sufficient error handling capabilities in case of unexpected changes in the environment.

Challenges on-set

Problems in Understanding the Robots' Voice

Older participants had problems understanding the robot, probably due to hearing difficulties. We needed to repeat the sentences the robot produced for the residents to understand. In a very noisy environment, it was hard to understand the robot as well. Robots may need to adjust their loudness in crowded situations depending on the ambient noise. Thus, robot design needs to support the needs of older users and crowded spaces.

Safety vs. Performance

If researchers go into the 'wild', they need to design a risk mitigation concept. According to safety standards such as ISO 13482, the robot needs to be equipped with red emergency stop buttons, which are quite visible, and we experienced that people have an urge to press them. In the experiments with the public, we had to stop kids from pressing it. The Robotic Service Assistant has a wireless emergency stop, but it sometimes lost connection to the robot and the robot's operations were temporarily terminated.

Refill Process/Serving Drinks

Several practical issues occurred regarding refill and serving processes. With the Robotic Service Assistant, the beverages are safely stored inside its body, which made it hard to see when the robot needs a refill. The SMOOTH robot has the beverages in full view, and we observed that people place their empty glasses back on the tray. When serving larger groups the robot may not have enough beverages for all participants. People may be disappointed because they didn't get a drink, and this may lead to the perception of inequality. It is desirable if people can see why the robot doesn't serve them, or if the robot could let them know that it needs to be refilled. A big issue in Danish elderly care are the different types of personalized drinks in special containers. This is not the case in the German elderly care facility.

Ethical Challenges

Since the robots in the experiments were remotely controlled, this may lead to an inadequate understanding of robots' real capabilities. Therefore, debriefing is important, but was not always possible in the situations studied.