Short Duration Robot Interaction at an Airport: Challenges from a Socio-Psychological Point of View

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1 Introduction

This extended abstract concerns the FP7-project Spencer[1]. As part of the Spencer project, a demonstrator robot will be developed which provide services to passengers at a major European airport. Example services include (1) guiding transfer passengers from their arrival gate to the so-called Schengen barrier, and (2) assisting in the transfer process by printing boarding passes. The goal of the robot is to make sure that passengers will make their connecting flight, with our own focus being on the human-robot interaction. In the following, we describe a sample use case of the project scenario. Based on this we identify possible challenges that are of interest with respect to interactive robots in public spaces.

2 Use case

The Spencer project aims to develop and deploy a demonstrator service robot which can provide assistance to transferring passengers at a major airport in Europe. The industrial partner has about 25.000 transfer passengers daily. A large portion of these passengers transfer from (intercontinental) non-Schengen flights to (European) Schengen flights, requiring passengers to go through a passport control before arriving at their next departure gate. This process costs time, and is one of the major sources why passenger miss their connecting flights.

The Spencer robot is envisioned to collect a group of transfer passengers with a minimal connection time at the gate (for example they could make their connection if they hurry and go to the fast-track Schengen lane). The Spencer robot will guide them towards the fast-track Schengen lane, after which they can proceed to their departure gate. An average group of transfer passengers constitutes between 20-40 people, who do not necessarily know each other; their only common denominator is their next flight.

Scientific challenges for the Spencer project include (among others) socially intelligent navigation and the detection of groups of people and relations within these groups. The scientific challenge we are focusing on, is the *evaluation and design of (spatial) robot behaviors that are experienced as (socially) normative.*

[1] http://www.spencer.eu

3 HRI challenges for the Spencer robot

The use case as described above contains both technical and scientific challenges. In this section, we will focus on what we believe as being the most important challenges for the interaction between passengers and a robot.

3.1 Normative behavior: it is about intention recognition

Independent of the ways by which the robot conveys its intentions, the robot should be perceived as behaving in a normative way. Thus, the behavior of the robot should conform to the social norms expected by the *current* passengers. Examples of these normative behaviors could include adjusting the speed to the group, and giving way to people approaching from the right. While the implementation of these issues could be considered technical ones, we believe the identification of the norms is a socio-psychological problem.

We believe that because - for most people - flying is not considered to be an everyday activity; many people consider it to be hectic, and are sometime unsure of what (not) to do or where to go. This makes it especially important that the messages a robot transmit, for instance those which convey its movement, are clear and predictable.

At airports identifying normative behavior is particularly complicated in part because the robot will have to deal with people with different cultural backgrounds. These might even form part of one group that has to be guided at the same time. Also the fact that we have to deal with groups as such is a challenge for behavior planning and other technical requirements such as robust spoken language processing and person tracking.

Thus, there are two distinct different normative behaviors we consider in this extended abstract. One the one hand we argue that the movement of the robot should be legible and conveying towards the passengers. On the other hand, the robot has to behave in a normative way in the sense that it abides with the (un)written conventions of pedestrian traffic.

3.2 Communication Modalities

To address the issue of legible and conveying movement, one can think of different modalities which could be useful to communicate intent. Whereas humans can use non-verbal communications to exchange social signals when approaching one another [2], robots are not (yet) capable of this. We propose to evaluate two different communication modalities for the robot, each having pro's and con's in the context of an airport.

Speech or sound in general, could be one of these modalities. Due to the multicultural mix of passengers these messages would ideally be universal. A solution can be to implement a text-to-speech engine in the robot, or a noise-like level as described in [1]. Since an airport is a noisy environment, the robot has to repeat the messages.

A graphical interface could also be used to convey movement intentions, for instance a screen, indicating the robot's speed or acceleration. This would be limited in that it can only supply information to those who can see the screen; people who are moving behind, or next to, the robot.

Both modalities could be used to communicate intent to passengers. We intend to test both modalities synchronous and asynchronous in order for the robot to communicate as effective as possible.

3.3 Research approach

The Media Equation states that people treat computers, and related media, as if they were people [3]. Based upon this work of Nass and colleagues, our approach is to first identify what people do, implement similar behaviors on a robot, and evaluate whether human norms hold for human-robot interaction.

We do not expect that human normative behavior will unequivocally carry over to normative robot behavior, however, we will use it as a starting point.

Based upon a literature review and a contextual analysis (systematic observation of what really happens), we will design and implement normative behaviors for a robot. These behaviors will first be tested in lab studies, followed by experiments at the site of the industrial partner; the airport in order to get an idea of the experiences of the passengers.

To get insight in the experiences of passengers at the airport, we can employ several methods for user studies. Examples include self-reported questionnaires, coding of video data and analysis of one's galvanic skin response.

For our experiments, we will primarily collect video data, as well as subjective questionnaires or -interviews. Objective video data makes it easy to capture certain behavioral responses from multiple people in a short time. However, legal and organizational issues (such as privacy and security) could hinder this method when used outside the lab. Interviews and questionnaires should be able to capture the required data in only a few questions, given that passengers will be likely be in a hurry. These languages should be unambiguous for passengers with different cultures; this raises the question if the language should be native, or universal (read: English). Different languages would require multiple iterations of translation and back translation to ensure the questions truly ask the same.

In light of the issues described above we may have to rethink our data collection methods. This also holds for the data the robot collects for its own perception. Prior to evaluation in a real-world setting, behavior will be evaluated in a more controlled setting. This could be in a lab setting as for example in [1, 4], but also by other ways, for instance by using videos of a robot interacting with people [5].

4 Conclusion

In this extended abstract we have described challenges from a socio-psychological point of view when a robot interacts with users at an airport. We argue the it is especially important to convey the robot's intentions toward users in an appropriate manner with respect to social norms while taking into account constraining environmental factors (such as noise levels). In part due to their safety-critical nature, airports in general cause specific challenges with regards to data collection practices.

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