“Nice surprise, more present than a machine” – Experiences evoked by a social robot for guidance and edutainment at a city service point

ABSTRACT

Social robots are emerging as potentially useful tools for customer service in various contexts including retail, healthcare or education. Their capacity for human-like interaction could provide a satisfactory customer experience in simple and repetitive tasks, while allowing human staff to focus on issues that are more complex. In this paper, we report the initial findings of a two-day field study of using a social robot Pepper for guidance and edutainment at the service point of a medium-sized city. We collected observations and semi-structured interviews of altogether 89 customers visiting the service point. Fifteen specific experiences evoked by the interaction with the robot were identified and categorized under five basic needs of Autonomy, Competence, Relatedness, Stimulation and Security. We discuss implications for an experience-driven design process of applications for social service robots.

CCS CONCEPTS

• Human-centered computing → Field studies; Empirical studies in interaction design • Computer systems organization → Robotics

KEYWORDS

Social robots; customer service; public services; user experience; experience-driven design; human-robot interaction; human-centered robotics.

1 INTRODUCTION

Social robots communicate and interact with people according to the norms associated to the role they are given [1]. In customer service, social robots have the potential to enhance the customer experience and service efficiency by assisting customers in simple and repetitive tasks, thus allowing human staff to concentrate on issues that are more complex, and by providing a rich communication experience [2]. Social robots have been trialed in several customer service contexts, e.g. as entertainers at shopping malls [3, 4], guides at airports [5] and hosts guiding visitors [6]. They have also been utilized in assistive roles such as teachers’ assistants in language learning at schools [7] and companions in elderly care [8]. Still, most studies so far have been small and exploratory, and while many acknowledge the importance of user experience (UX), it is often treated superficially, focusing on robots’ performance rather than interaction quality [9]. While some frameworks for designing for positive UX in human-robot interaction (HRI) exist [10], determining the actual experience goals that specify the intended interaction quality is a challenge [9, 11].

In our ongoing research, we focus on user experiences of social robots in public settings that are official or pragmatic in nature. The aim of the present paper is to report an initial exploration to experiences that a social robot Pepper evokes on people visiting an official public service context, namely a city service point. The research approach is based on experience-driven design (EDD), which means designing for particular experiences evoked by the usage of everyday products [12, 13]. The mindset of the customers visiting the service point is usually pragmatically oriented, as they come there in official matters such as retrieving a bus card or applying for construction permissions. As the physical location and the tasks conducted there are assumedly very practical in nature, people visiting the service point do not probably expect any entertainment or hedonic experiences, such as experiences of relatedness or specific positive emotional reactions [14]. However, hedonic attributes have a strong potential for pleasure and well-being [15, 16].

The ultimate goal of our research is to identify a variety of target experiences in HRI, utilize them in robotic concept design and evaluation for customer service contexts, and thus contribute to both HRI research and development from the perspective of user experience. We aim to answer the following research questions in this paper:

1. Which experiences does a social robot Pepper evoke at an official setting such as a city service point?
2. What are suitable tasks and contexts for a social robot in public services?

2 RELATED WORK

2.1 Social robots in customer service

Various organizations, including public services, are looking for technology-enabled ways to streamline their customer service processes. Organizations and public service bodies have complemented and sometimes completely replaced traditional in-person service channels (face-to-face, phone and mail) by electronic service and self-service channels such as website forms, email and chat [17]. While the new channels can increase efficiency from both customer and organizational perspective, many citizens still prefer human assistance and face-to-face interaction [18]. Social robots with a physical appearance and humanoid form could partially fulfill this purpose in contexts where a physical service point exists but the human staff need to focus their limited resources on more challenging duties [2].

When developing behaviors and applications for a social robot for a particular service context and purpose, the robot’s

personality and identity principles should be formed at the same time [10]. It has been proposed that more animate and humanlike robots are perceived as more warm and competent, leading to higher customer satisfaction [19]. These perceptions can also nourish the basic human need of relatedness [16], especially among customers with a communal orientation, i.e. who expect the service staff to have genuine concern for their welfare [19, 20]. We can thus infer that in order to create a positive social connection and an experience of relatedness, a robot that carries out customer service related tasks should act in a similar manner as a human would in the same situation – including e.g. friendly gestures, phrases and eye contact. However, a robot too closely resembling a human in appearance can backfire, as customers may perceive it as creepy (and thus less warm) or expect it to have higher intelligence than it really does, resulting in dissatisfaction when the robot fails to fulfill their expectations [19].

2.2 Experience-driven design

Experience-driven design (EDD) is an approach that focuses on designing for particular experiences that a technology or a product aims to evoke in its users [12, 13]. In EDD, the first step is to define user experience (UX) goals that guide the entire design and implementation process. Through experience goals, the designers can communicate what they intend the users to experience before, during or after interaction with technology [12]. While a lot of research has focused on acceptance and utility of social robots, an EDD approach has scarcely been used, and many studies do not define what experiences they intended to achieve [9].

When designing a new robotic concept and evaluating its user experience, using existing frameworks or experiences discovered by prior research to define the UX goals could increase the contribution to the field. Hassenzahl et al. [16] suggest a set of six basic needs as a way to characterize and categorize experiences. Furthermore, the playful experiences framework (PLEX) is a model that consists of 22 playful experience categories [21]. Many experiences presented by PLEX are applicable the design of social robotic concepts, e.g. *Discovery* (finding something new or unknown) – especially when meeting a robot for the first time; *Humor* (fun, joy, amusement, jokes, gags) – especially in entertainment situations with the robot; *Nurture* (taking care of oneself or others) – especially concerning the care robots. However, we assume that concerning the interaction with the social robots, novel and specific experiences may emerge. Previously, specific target experiences have been explored in different contexts, e.g. in a study on workspace design [22]. In the study, many specific experiences were identified, such as *Concentration*, *Formality* and *Peace of mind*.

In terms of utilitarian or pragmatic experiences influencing the use and acceptance of self-service technologies, prior research suggests that ease of use and perceived usefulness are key factors in general [23]. Some studies have also examined UX factors relevant to the user acceptance of social robots [24, 25]. Usefulness and adaptability, defined as the perceived ability to adapt to the changing needs of the user, appear to be important pragmatic factors, whereas enjoyment, sociability and companionship have been identified as important hedonic factors [24]. In long-term use, one study discovered that essential factors include usefulness, social presence, enjoyment and attractiveness of the robot [25]. There are also indications that humanlike features in robots increase perceptions of trust and sociability [20]. We can infer that in the design of a social robot for a particular context, ease of use and usefulness are necessary but not sufficient pragmatic experience goals; appropriate hedonic experience goals may be more context-dependent, although the broad categories of enjoyment and sociability are important to factor in.

3 METHODS

3.1 Design of the robot's functions

The robot platform used in our study was Pepper, a social humanoid robot developed by SoftBank Robotics. The robot (Fig. 1) is 1.2m tall, wheel-based, and equipped with cameras, microphones, touch sensors and arms for gesturing in a human-like manner. It also has a tablet connected to its chest, allowing user interaction via touch and display of images and text. Pepper was chosen as the platform for the study because of its suitable degree of human-likeness and attractiveness in appearance, its sufficient size to interact with people, its capability to engage in conversation and, importantly, the possibility to use the tablet as an alternative means of input in noisy surroundings.

Figure 1: The Pepper robot.

We underwent a participatory design process to develop Pepper's applications and behaviors for this study. First, the researchers ideated application concepts with city representatives. Then, the proposed concepts were prioritized in a workshop with customer service personnel. The aim was to have Pepper working in the role of a guide, with tasks of assisting customers in finding the right service inside the service point and informing them about interesting locations in the city region. Tentative experience goals (stimulation and discovery) were determined as proposed in [12] based on *Vision* (the aim of helping customers accomplish their tasks at the service point), *Technology* (Pepper's capabilities and existing applications) and *Empathy* (a brief survey for 15 customers at the service point to evaluate concept ideas). The applications were developed, tested and iterated with city personnel.

The application created for the study consists of two different sub-applications: quiz and guidance (see Fig. 2). In the beginning, the user is asked to select the language in which Pepper then speaks and displays text on its tablet. Both quiz and guidance applications relay on Pepper's tablet displaying HTML files, through which the user is able to give button inputs to Pepper. Dialogue and spoken input were intentionally left out of the application to avoid frustration caused by Pepper's poor hearing and understanding in noisy environments.

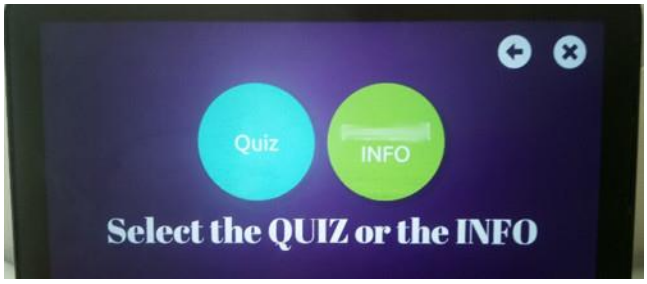

Figure 2: Sub-application selection screen on Pepper's tablet. (Blurred for blind review.)

The purpose of the quiz application was to provide entertainment to the customers and, at the same time, give information about various attractions and locations in the city region. In the quiz application, each question displayed on Pepper's tablet has a background image from the location, providing the primary hint for the question (Fig. 3). The user is given three choices to choose the answer from. After each answer, Pepper offers to tell more about the location or to move to the next question. Questions are presented in random order and in each quiz, there are 8-10 questions selected from the pool of 15 questions. Once the user has answered all questions, Pepper displays the result and gives spoken feedback with an encouraging gesture (e.g. cheering). The feedback always has a positive tone despite the result.

Figure 3: Question, hint and answer options in the quiz application. (Answer options blurred for blind review.)

In the guidance application (Fig. 4), the user is able to select from a set of services to find where the service desk is located and learn more about the selected service. Pepper speaks a brief description about the selected service and displays more information on its tablet at the same time. The service desk location is shown as an indoor map. As recommended by prior research [26], we designed Pepper also to use its arms to point at an appropriate direction when guiding the user towards the requested location.

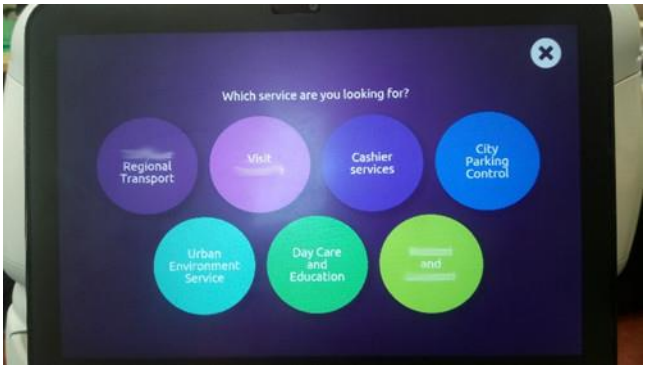

Figure 4: Selection of services in the guidance application. (Some service options blurred for blind review.)

3.2 Study design

Our field study that followed the principles of *contextual inquiry* [27] took place on two subsequent weekdays, Monday and Tuesday, in the beginning of summer. The study context was a service point of a medium-sized city, where the customers can deal with several different kinds of tasks, such as purchasing and re-charging public transportation cards, getting printed bus timetables and tourist information, applying for construction permissions etc. The Pepper robot was located next to the waiting area inside the service point (Fig. 5). We chose to place the robot in the more quiet inner part of the room instead of the entrance because of its intended role as a guide/entertainer and the expected length of the interaction (several minutes). The entrance to the service point was expected to be crowded and noisy with people passing by, and our aim was to allow customers to interact with the robot in somewhat more peaceful surroundings, while keeping it clearly visible and approachable. A sign informing the customers about the study was initially placed behind the robot, but moved next to the entrance during the first day to make it more salient to the people coming in.

Data collection followed the mixed method research approach [28], where semi-structured interviews and observations complement each other. Three researchers were present at the service point during the study. One researcher was mainly responsible for observing customers who interacted with Pepper, one for interviewing said customers after the interaction, and one for making general observations and intervening if Pepper malfunctioned or if users needed technical support.

Observations were conducted by utilizing a structured observation sheet. Observational topics included e.g. a person's apparent mood (hurried, calm, curious etc.), accompanying persons, how they made contact with Pepper and emotional reactions during interaction with Pepper. There were total of 16

observational topics on the sheet, and a section for writing down open-ended observations.

Semi-structured interviews targeted voluntary users of Pepper and lasted for 5-10 minutes per participant. A semi-structured discussion guide was utilized on the interviews. The interview included in total seven questions related to interaction with Pepper (e.g. description of Pepper with own words; how did the participants feel about the meeting with Pepper) and two background questions (age group and the purpose of coming to the service point).

Figure 5: The Pepper robot at the city service point during a quiet moment.

3.3 Participants

Table 1 summarizes the characteristics of the study participants. Roughly half of the participants were adults between 25-64 years of age, a bit over half were female, and majority were visiting the service point for a purpose related to public transportation. Other purposes for the visit included, for example, filing a complaint about a parking ticket, attending a meeting, work-related matters, or specifically coming to see Pepper.

Table 1: Participant characteristics (N=89).

Characteristic	Number (%)
Age group	
Child (under 15)	27 (30%)
Youth (16-24)	3 (3%)
Adult (25-64)	47 (53%)
Elderly (65+)	12 (13%)
Gender female	49 (55%)
Purpose of visit	
Public transportation	62 (70%)
Tourist information	6 (7%)
Other	21 (24%)

3.4 Data analysis

Interview data was analyzed with the content analysis method [29]. The researchers first transcribed the interview notes and went through the data. Then, they tracked the themes of the experiences evoked by the social robot in an unexpected context, as well as the suitable roles and meaningful tasks of the robot at a public service context. The identified target experiences were tentatively categorized based on six basic needs [16] and compared with the PLEX framework [21] and other relevant studies [22] for finding possible similar experiences. After that, the researchers labeled the identified novel experiences with descriptive names.

Observational data was coded from observation sheets into a spreadsheet. The open-ended notes were transcribed and the themes related to experiences, suitable roles and meaningful tasks for the robot were identified and marked down. The occurrences of different types of observations were calculated. The spreadsheets containing interview and observational data were combined and cross-checked for consistency.

4 RESULTS

We present the results of the overall interaction activity between the customers and the Pepper robot, the identified experiences evoked by the robot, and the suitable tasks and meaningful contexts for the robot. Citations from participants are provided in italics, and the participant code with their gender and age group information is marked after the citation.

4.1 Interaction activity

The first day of the study (Monday) was a busy day at the service point. New public transport timetables for the summer period had just come into effect and many people came to get printed timetables. Moreover, the nearby market square had a shopping day that drew people to visit also the service point. The second day (Tuesday) was calmer, a *"normal day"* according to the customer service personnel. The number of customers present at the service point at the same time ranged from a few to almost thirty on Monday, and from a few to around fifteen on Tuesday. The influence of the temporal context was also evident: in the afternoon, people appeared more relaxed, unhurried and open than in the morning, even when the service point was crowded.

In total, 44 interaction sessions between customers and Pepper were recorded during the study: 23 (52%) during Monday and 21 (48%) during Tuesday. Out of the 44 sessions, 19 (43%) happened between one person and Pepper, and the rest of the sessions involved two or more people interacting with the robot together, often with one person actively engaged in the interaction and the other(s) observing and commenting next to them. The total number of participants was 89 and the duration of sessions ranged from less than one minute to almost ten minutes. In 86% of the sessions, participants used the quiz function, and in 20%, they tried out the guidance function.

While a majority of participants took their own initiative in starting the interaction with Pepper, a significant portion (27%) of the participants did not approach the robot until a researcher asked them to. Some of them were unsure or even shy to make contact with the robot on their own: *"I wouldn't have tried this out if I hadn't been asked to."* (U11, F/Adult). It also seemed that it was easier for the customers to approach the robot if someone else was already interacting with it, which raised their interest and gave them courage to come to see what was happening: *"I enjoyed*

seeing how you did the quiz, but I wouldn't have dared to touch [the robot] myself." (U37, F/Elderly).

We observed that many customers who passed by the robot practiced "active ignoring", i.e. they appeared to deliberately keep their gaze fixed forward so that they would not create eye contact with the robot, and they usually walked briskly and appeared to know where they were going. Although the sign informing about the study was at first close to the robot and later on close to the entrance, very few customers paid any attention to it, possibly because the service point had several other signs on the walls and in the waiting area competing with their attention.

The customer service staff working at the service point during the study had very little interaction with the robot. Six of them got briefly familiar with Pepper at the beginning of the study, but the rest of the staff were occupied most of the time during the opening hours and could not spare a minute to approach the robot. Four of them came to try out Pepper's guidance function on Tuesday morning when there was no queue to the public transport desks. The person working at the info desk close to where the robot was located made joking remarks about it, e.g. saying that he would like to take it home to do cleaning chores.

4.2 Experiences evoked by the robot

Table 2 presents the identified experiences in categories based on six basic needs Autonomy, Competence, Relatedness, Popularity, Stimulation and Security [16], and notes the valence direction of each experience (negative or positive, denoted by plus and minus signs). We were able to identify experiences that could be categorized under each need expect for Popularity (feeling liked, respected and influential). Moreover, the experiences we identified under categories of Competence, Relatedness and Stimulation were all positive, whereas Autonomy and Security related experiences were negative.

Table 2: Identified experiences under basic need categories.

Basic need	Experiences	Valence
Autonomy	Disappointment	-
Competence	Accomplishment	+
	Challenge	+
	Wisdom	+
	Learning	+
Relatedness	Warmth	+
	Fellowship	+
	Collaboration	+
Stimulation	Surprise	+
	Energy	+
	Delight	+
	Wonder	+
	Curiosity	+
Security	Fear	-
	Distrust	-

4.2.1 Autonomy. The only experience we could place under autonomy was the feeling of not being able to do what one wants (in this case, called **Disappointment**). Some participants whose native language was not either of the two languages supported by Pepper expressed disappointment in its abilities: *"It should speak Chinese."* (U41, M/Adult). In addition, the limited abilities of the robot were evident to some: *"I prefer to be in touch with a human. [The robot] can only talk about things that are installed into it."* (U22, F/Elderly).

4.2.2 Competence. When participants were doing the quiz with Pepper, we frequently observed expressions of success such as cheering and positive exclamations, which points to the experience of **Accomplishment**. Some participants appeared to think hard on the questions and commented that they enjoyed the experience of **Challenge**: *"I love all sorts of quizzes!"* (U31, F/Elderly). Furthermore, the experiences of **Wisdom** (meeting someone wise) and closely related **Learning** (increasing one's knowledge through interaction) were evident, as illustrated by participants' comments: *"[The robot's] brain is wiser than a human's."* (U14, M/Elderly); *"I like the possibility for interactive studying."* (U8, M/Adult); *"Questions are nice and you learn from them."* (U26, F/Adult). Two of the customer service persons also commented that the robot felt smart.

4.2.3 Relatedness. The relatedness experiences encompassed feelings of connection with Pepper and with other people in the same space, sometimes even those who were strangers. The experience of **Warmth** emerged from some participants' open body language and their descriptions of Pepper as warm, lovable or lovely: *"It feels like I'd like to give him a hug."* (U33, F/Elderly). In a similar manner, some of the customer service staff who briefly interacted with Pepper commented that the robot was *"lovely"*. In several interactions, we also observed a sense of **Collaboration** (working together towards the same goal) and **Fellowship** (forming a friendly emotional connection with another person). For instance, two elderly women (U31 and U32) who did not know each other beforehand engaged into a cheerful discussion about places shown in the quiz and their age. Moreover, families and friends often collaborated and discussed quiz questions together (e.g. *"I know this one, do you know it?"* (U24, F/Youth)), took turns in answering questions, and cheered together when the answer was correct.

4.2.4 Stimulation. The robot's unexpected presence at the service point was a positive **Surprise** to many, bringing them pleasure and enjoyment: *"I'd like to have more of such funny surprises around"* (U12, F/Elderly); *"New way to bring information and entertainment in surprising places"* (U15, M/Adult); *"It was a nice surprise."* (U27, F/Adult). Some felt invigorated (**Energy**) by the unexpected meeting with the robot, especially if they had never met one before. Many participants appeared to experience **Delight** when interacting with Pepper or watching others interact with it, as there were smiles and laughter; customer service staff also often smiled when they passed by the robot. The robot could also provide feelings of **Wonder**, especially to children, out of whom some described it with words such as *"exciting"* or *"amazing"* or were awed by its abilities: *"Wow, it can speak!"* (U9, M/Child). Moreover, the robot evoked **Curiosity** by its presence, appearance and animacy. Several participants touched Pepper's fingers or arms or commented about

them: *"It has splendid arms. Fingers and hands are impressive."* (U34, M/Elderly). Children and youth tended to readily touch the robot on their own volition, whereas adults and elderly expressed their curiosity more often verbally instead of reaching out to touch the fingers. Some inquired about Pepper's abilities to gesture with its arms and fingers, or to move around. Sometimes curiosity was expressed as positive puzzlement: *"It's puzzling that it has human characteristics but it's still a machine."* (U19, F/Adult).

4.2.5 Security. Security-related experiences emerged from the data only on a few occasions. Pepper's movements were jerky at times, which startled some participants and made them act wary towards the robot (experience of **Fear**). In addition, the robot's gaze and the way it moved was not always perceived as warm or friendly: *"A bit scary, how it seeks eye contact, it startled me."* (U24, F/Youth). We could also identify the experience of **Distrust:** one participant said that while Pepper seemed pleasant, he could not really trust the robot because *"it's a machine"* (U7, M/Adult).

4.3 Suitable tasks and contexts

Out of the two functions offered by Pepper, very few customers actually used the guidance function. We observed that not many customers needed guidance inside the service point, and most of those who expressed the need either walked to the info desk or asked for help from other people passing by. However, when we asked participants how Pepper could be useful at the service point, many stated that it could help customers in finding the service they are looking for.

The most common tasks for Pepper suggested by the participants were various guidance, entertainment and information delivery related tasks. In addition to the existing functions of the robot, participants proposed that it could provide information about public transport routes, give progress reports on construction work around the city, and tell about local attractions. The need to serve customers in their native language came up: *"It should speak several different languages."* (U7, M/Adult).

Outside the service point, it was proposed that the robot could be useful in teaching related tasks, arousing interest in children and youth: *"Suitable for interactive teaching in schools."* (U11, M/Adult); *"It would excite children who dislike school."* (U14, F/Elderly). Other public service contexts suggested by the participants included primary care, hospitals, employment offices, libraries and other bureaus. In such places, the robot could serve as an entertainer helping to pass the time while waiting: *"[It would be useful] in places where people have to wait."* (U24, F/Adult). As a mother commented to her two sons who had been highly engaged in the quiz and pondered on the questions together: *"You didn't get bored while waiting, if [Pepper] hadn't been here you'd have started complaining."* (U12, F/Adult). However, the robot could also serve a more serious purpose by providing information about the public service in question and how the customer's concern would be handled there, or helping the customer find their way to the right place. For example, *"It could tell what is done in a health checkup."* (U26, F/Adult).

Other potential contexts that came up in the interviews included museums, theaters, attractions and shopping malls: *"It could be in a shopping mall, where there are a lot of people."* (U25, F/Adult). Some other tasks potentially suitable for the robot were suggested jokingly, e.g. the info desk person said that he would like to take it home to do cleaning chores, and one of the customers stated that she could take it home as a companion and stop other social activities.

5 DISCUSSION

5.1 Experience goals

We were able to identify in total fifteen specific experiences related to the customers' interaction with the social robot. Some of the experiences were similar to those found in PLEX cards [21], namely Challenge and Fellowship. The identified experiences were mapped onto the framework of six basic human needs as proposed in [16] to connect them to the broad underlying motivations.

As we expected, Stimulation-related experiences such as Surprise, Delight and Wonder appeared to be the most common in our study. The emergence of such experiences may be partially enhanced by the official context where customers do not expect to find entertainment or hedonic experiences, since they come to the service point to take care of pragmatic matters. While the novelty effect of the robot is likely to decrease over time, the service point is a place that most customers visit only a few times in a year. Thus, it is possible that the positive surprise of meeting a robot there and finding out what new it has learned since the previous visit could sustain over repeated interactions. Similarly to the field study of a SPENCER robot at an airport [5], Pepper evoked excitement among many customers, and it was also considered potentially useful for others if not always specifically the customers themselves.

Somewhat surprisingly, Relatedness experiences such as Warmth and Collaboration were prevalent, and we witnessed customers starting to interact with each other triggered by the interaction with the robot. This suggests that a social robot could also serve as a facilitator of social connections between people unfamiliar with each other. Furthermore, the interaction with the robot evoked a warm emotional response among several participants, which has been proposed as one important factor in the acceptance of self-service technologies [19]. In a physical location such as the service point in our study, the robot could even influence ambience and atmosphere to support fellowship, enabling encounters between people who might not otherwise meet [22].

Competence-related experiences such as Challenge and Learning were evoked by the quiz Pepper presented to the customers, and as such, the robot's physical form probably had less to do with these experiences than its tablet. However, the stimulation and wonder of meeting the robot was likely to motivate customers to start interaction with it, thus enabling the Competence experiences. Many attributed intelligence and

wisdom to Pepper, which indicates that the perceived competence factor was present, increasing the acceptance of the robot [19].

While the above-mentioned experiences were all positively aligned, the identified Autonomy and Security related experiences steered to a negative direction. Negative experiences are important to account for, since they have a significant impact on the adoption and use of technology [30]. The experiences of Disappointment, Distrust and Fear were rare among the participants of this study, but we want to highlight them because it is possible that many of the customers who did not engage in interaction with Pepper could have felt such emotions.

5.2 Tasks and contexts

The most common tasks for Pepper suggested by the participants were various guidance and entertainment related tasks, which is unsurprising because the robot was able to do exactly such tasks in the study. However, the vast majority of the participants only used the quiz function of the robot, and had no need for guidance inside the service point. Moreover, the active ignoring of the robot practiced by many customers of the service point bore resemblances to the behavior exhibited in situations when one deliberately wants to avoid contact with someone such as a salesperson on the street. Such customers appeared to have a clear task in mind and were set out to complete it without distractions. These observations indicate that the signs and the layout of the service point were clear for the most, and that the robot was not expected to assist in finding the right service desk in the relatively small service point area. The only customers who really tried to find an answer to their need via the robot's guidance function were tourists, suggesting that the robot could have potential in the role of a tourist guide .

Other potential public service contexts that were frequently mentioned as suitable for the robot included e.g. healthcare services and employment office, which are places where people are often in a vulnerable position. This finding indicates that some people have a real need to make a contact with a human-like presence that can provide answers to their questions when they are feeling insecure or worried. Furthermore, parents who are visiting public services with their small children could have their caretaker burden momentarily lifted if a social humanoid robot would be there to entertain children while waiting.

Prior research suggests that people's expectations towards a humanoid robot's capabilities are often unrealistically high and shaped by portrayals of robots in science fiction [31]. While we observed such high expectations among some participants, especially children, in general most appeared to be content with the "tablet with a human touch" during the brief interaction. It is likely that the expectations towards the robot's abilities, usefulness and human-like behavior would be higher in longer or repeated use [25].

5.3 Limitations

Our study is an initial exploration into experiences evoked by a social robot and thus the validity and generalizability of the results are limited. The set of identified experiences is not exhaustive and they are based on a relatively small amount of qualitative data. The interviews were kept short to avoid burdening participants and thus we cannot claim to have gathered in-depth understanding of participants' experiences and the reasons behind them. We did not interview those who ignored or did not want to interact with the robot, and thus we do not have data about their experience of encountering the robot at the service point, which may have been negative or neutral.

While the field study lasted for two days, it was still a relatively short period of time, and the interaction between a particular customer and the robot was brief. Thus, the experiences evoked by the robot in this study may not be sustainable in repeated or long-term interaction. The temporal context was also special because schoolchildren's summer vacations had just begun and the summer timetables for the public transport came into effect on the first day of the study. This caused the service point to be more crowded than usual on the first day of the study. However, the number of customers visiting the service point on the second day was quite normal according to the customer service personnel, making the findings more generalizable and providing insight into the variety of contextual factors influencing user experience.

Finally, interaction with Pepper was constrained since we did not employ speech recognition and thus actual dialogue with the robot could not take place. As a means for speech input in a public space, a hand-held microphone provided for the users could negate ambient noise and allow natural dialogue interaction [26].

6 Conclusions and future work

The findings of this exploratory study indicate that a social robot Pepper in a relatively official public service context can bring about experiences that nourish customers' innate needs especially for stimulation, relatedness and competence. We have identified fifteen specific experiences related to the basic needs of Autonomy, Competence, Relatedness, Stimulation and Security, which can serve as inspiration for designing for (or against) specific experiences in human-robot interaction. A social robot may bring added value to public service contexts especially by its ability to provide experiences related to stimulation and relatedness in locations where customers are used to expecting only pragmatic experiences.

One of the aims of our research is to develop a set of robotic experience cards that could be used for inspiration for experience goals in a similar manner as PLEX cards [21] in experience-driven design. Once defined and explained, experience goals serve as a guiding light in the further design process, as they can be used to easily communicate the intended experience to other stakeholders and to keep the ultimate goal in mind inside the development team [13]. We will continue our studies to validate and operationalize meaningful experiences for social service robots, and to examine which characteristics of robots are connected to specific experiences. The next field studies at the city service point will focus on specific customer groups and collect more in-depth data about their experiences related to the interaction with the robot.

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