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CASE STUDY ON A TELEPRESENCE ROBOT AT THE TRAPHOLT DESIGN MUSEUM

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Abstract

In this case study, we explore the use of telepresence robots for museum visits. In our study, six international design students explored the Trapholt Design Museum using a telepresence robot; we video recorded the interactions and interviewed the telepresence robot operators (via e-mail) and other museum visitors onsite. The qualitative analysis of the video recordings and interviews reveals that telepresence robots can facilitate museum visits for people who cannot get to the museum in person, but also indicates what steps would improve the telepresence robot operators' experience; especially an introduction to the robot and some opportunity to practice navigating the robot and a map of the museum areas suitable for the robot navigation proved useful, as well as a stable internet connection on both sides.

Introduction

Beyond supporting children in participating in their classrooms, telepresence robots can also be used to provide people who do not have personal access to a museum with the opportunity for a self-guided visit (our scenario 5, see Fig. 1). Telepresence robots are of course not the only technology that allows people to visit a museum virtually; for instance, diverse interactive technologies such as apps, interactive maps, virtual reality equipment, videos etc. provide opportunities for virtual tours (Hebert, 2016). Such technologies are becoming more and more common in the development of museums (Germak et al., 2015). One current example is Google's virtual tours, a virtual platform that allows people to access collections and cultural knowledge from important museums around the world (Google Arts & Culture). Germak et al. (2015) suggest that virtual tours do strive to make the cultural heritage visible for distant cultural activities, such as study and research. These technologies encourage people to visit the museum and allow them to preview the area; telepresence robots are one such technology, but an interesting one because they provide their users with full autonomy over what they are seeing from what angle, in what order and for how long, and they furthermore require little premeditation or preparation on the side of the museum. In principle, a school class visiting a museum could just bring their telepresence robot for their home-bound classmates with them, or the museum itself could have such a robot to allow for remote visitors.

Our case study focuses on the Trapholt Design Museum in Denmark, which exhibits modern design and which is thus future-oriented and open to technological advancements. Our aim
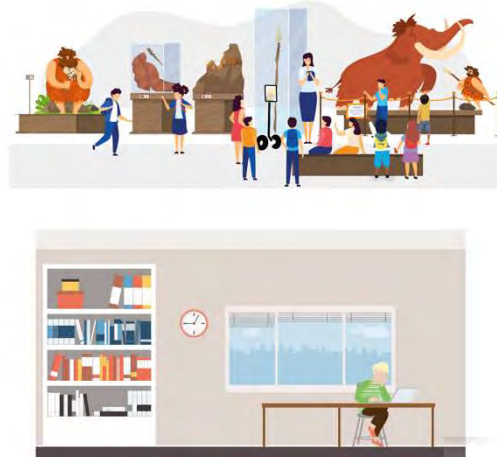

Figure 1: Scenario 5: Visit at a museum

was to investigate the experiences of the stakeholders involved in the interactions to also understand and find more suitable ways to apply this technology in art galleries and museums with the goal of increasing the accessibility of such sites. Specifically, we asked what would need to be done to implement telepresence robots for remote visitors in the museum. Our research questions that guided our research were:

- What kinds of interactions occur between visitors and the telepresence robot?
- What is the experience of museum visitors co-located with the robot?
- To what extent does the user who controls the robot feel immersed in the interaction and the experience of being at the museum?
- How is the experience of museum workers and managers regarding the introduction of telepresence robots in their workplace?
- How could the experience be enhanced?

Method and Procedure

To study the stakeholders' experiences with a telepresence robot in a museum, we placed the Double3 robot in the Trapholt Design Museum for one day. The museum's administration was very open and welcoming to the idea and supported us throughout the study.

The Museum

The Trapholt Museum is a museum for modern art, craft and design located at the Kolding fjord in Denmark. The building itself is part of the exhibition, as it was created by the internationally renowned Danish architect and designer Arne Jacobsen. The museum houses regular exhibitions as well as its own collections. It is spacious, but there is also a lot to explore (see Figure 3).

Figure 2: The telepresence robot

The Telepresence Robot

In this study, we used the Double 3 telepresence robot developed by Double Robotics (see Figure 2). It is a robust hardware system comprising a height-adjustable stand with integrated wheels and a display screen that facilitates remote interaction in real-time. The robot can be controlled through a web-based interface that allows users to enter the robot's video screen and navigate its movements using a computer keyboard.

Participants

The six telepresence robot operators and remote museum visitors in this study were recruited via ReDi School, a nonprofit organisation devoted to offering digital education and training to refugees and immigrants in Denmark. The goal was to capture a diversity of perceptions and to obtain insights into intercultural experiences during a culturally-shaped activity such as visiting a Danish museums because this made it possible to see what cultural knowledge such an encounter implied. Furthermore, during the museum visit, museum visitors were addressed and recruited for interviews by inviting them to share their experiences and impressions about the robot and the encounter with the telepresence robot operator in the museum. Furthermore, the museum's staff volunteered to participate in the interviews. All participants provided consent after having been informed about study's aims and data handling procedures.

Figure 3: The telepresence robot in the museum

Procedure

For data elicitation, we invited the six remote robot operators to connect to the robot one after the other by sending them first the consent form and then the link via email. Each participant had 30min to get to know the robot and to explore the museum. After the interaction, we sent them a brief questionnaire about their experience with the robot with closed and open-ended questions to convey their feelings about the telepresence robot and their entire museum experience.

While the robot was driving around, we observed and videotaped the robot and the bystanders and their responses to and interactions with the telepresence robot operators using a handheld camera. After an interaction was detected, we addressed the museum visitors and asked whether they were willing to answer some questions. Specifically, we asked them what their first thoughts were when they saw the telepresence robot, and what their thoughts and feelings were when observing the robot in the museum. They were compensated with a piece of candy for their participation.

Furthermore, during the experiments, we observed the robot operators' behavior and noted if they experienced any problems, what questions they had and how long it took them before they felt safe enough to drive around. Based on a request by the museum staff, we walked with the telepresence robot at all times.

After the experiments, we furthermore interviewed the museum staff.

For the data analysis, we used a thematic analysis of the transcripts we created of the videos and our notes, as well as from the remote robot operators' and onsite participants' questionnaire responses. The qualitative data collected through the video recordings and the interview with Trapholt staff and

museum visitors was transcribed and further analysed using thematic analysis. Thematic analysis

makes important aspects of qualitative data visible and uncovers themes clearly. Qualitative attitudinal data covered participants' thoughts, needs and beliefs. Qualitative behavioural data

covered the behaviour of participants (Rosala, 2022). The transcripts were coded and analysed to identify common themes and patterns related to the research questions. The analysis was conducted iteratively, with themes being refined as the analysis progressed.

The quantitative data collected through the survey questionnaire with ReDi participants was analysed using descriptive statistics presented in the charts and scale graphs. The data was analysed to identify patterns and trends in the participants' experience using the

telepresence robot, their perceptions of the museum's exhibits and cultural content, and their overall satisfaction with the
museum experience.

Results

We divide our results regarding the remote visitors' experience, the onsite visitors' experience, and the staff's assessment of the robot deployment.

The Robot Operators' Perspective

Five of the six robot operators state that they would use a telepresence robot again, even though all six answer that they have experienced technical problems. They liked the possibility of visiting a museum from the comfort of home or the possibility of reading the text associated with the works, not solely seeing them; one participant wrote: "It's been nice in a way that I can visit any museum just sitting at my home," another one states: "yes, it is less realistic and more limited. But I felt part of the future."

4 out of 6 respondents felt that the telepresence robot allowed them to interact with on-site visitors and staff during their remote visit to the museum. This suggests that the robot facilitated interaction and engagement with others present, more specifically on-site visitors and staff, at the museum to some extent. Participants mentioned interactions such as seeing visitors, receiving guidance from the
staff, greetings, conversations, or receiving support with navigating through the exhibits. These
interactions indicate that the telepresence robot enabled some level of social engagement during the
remote museum visit.

The biggest difference, according to the robot operators, was the stress from navigating the robot to the desired direction, which made it impossible to fully enjoy the paintings and exhibitions in the museum. Our observations show that the level of immersion and engagement the operators experienced while remotely operating the robot and participating in the museum visit depended on when the flow was maintained such that there were no technical issues related to internet connectivity and robot navigation. However, as one robot operator stated, the navigation becomes easier over time. Other issues they named were the slow movement of the robot or the limitations regarding the angles from which it was possible to observe the artwork. They found it hard to navigate the robot using the arrow keys, which resulted in the robot getting stuck; one of the respondents stated that they could not imagine how an elderly person would be able to control a robot.

Figure 4: Solving technical issues

Another limitation was the reduced vision, compared to human embodiment.

One recurrent topic emerging from the thematic analysis is the technical requirement of having a good internet connection at both ends, at the side of the robot operator (i.e. the remote museum visitor) and at the museum itself. Trapholt museum did not possess a stable internet connection in all parts of the museum during the on-site research and therefore we had to connect the telepresence robot to our data hotspot and always walk around the robot with the device which it was connected to. The telepresence robot also seems to be sensitive to the quality and speed of the internet connection.

Internet connectivity thus turned out to be a recurrent issue for the robot operators, which required much attention from the onsite personnel (see Figure x). We observed that the unstable internet connection caused navigation difficulties for remote visitors, and half of them also answered that the robot navigatability influenced their experience. On a scale between very easy and hard, participants found controlling the robot to be either neutral or
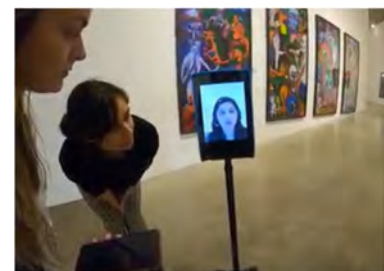
easy or challenging, but neither very easy nor hard. In comparison with onsite museum visits, four robot operators reply that they could not fully explore the exhibits – which may however also have been due to the limited time provided and the spatial restrictions imposed by the staff, as well as obstacles like stairs in the building.

The Museum's Perspective

From the perspective of the museum, safety was one of the biggest challenges since it was assumed that the robot needs a person being around at all times to make sure that art pieces are not affected. Both the communication manager and the guide thought that buying a robot would require the guide's presence all the time. In general, the employees perceived the robot positively. One employee entered the room and was observing the robot and smiled. The director of the museum started to take photos and videos of the telepresence robot, which were posted on the Instagram account of Trapholt museum the same day (The remote visitors experienced this as confusing but enjoyable and interesting at the same time).

Figure 5: Introducing the telepresence robot to the staff

The communication manager expressed her worries that the telepresence robot might be disturbing other guests, for which there was however no evidence; on the contrary, the guide stated that the guests were really curious about the robot. The on-site visitors were informed about the presence of the telepresence robot and how they should behave around it already when entering the museum.

The communication manager was amazed how clearly the remote visitor was visible on the screen. Similarly, the guide thinks the remote visit by the telepresence robot is very interesting and very new. Because of the screen, the communication with the remote visitor becomes livelier and more like a face-to-face interaction since one can hear and communicate with the remote visitor.
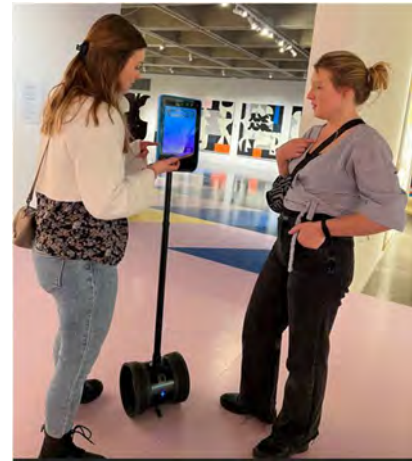

Figure 6: Interested on-site visitors

They also found the robot a good fit for the museum and its experience orientation. Nevertheless, the communication manager is not sure whether the full entrance fee should be charged for remote visitors because they would not get the full experience as on-site visitors, which includes participation in interactive exhibitions or spending time in the museum cafe. Both the communication manager and the guide perceive the AI exhibition at the Trapholt museum as an advantage since the audience might already have some interest in this topic. Even though the on-site visitors were not informed about the research prior to the visit, they might consider the robot as a part of the AI exhibition. However, the communication manager explains that the main purpose is visiting the Trapholt museum is to make new experiences - seeing the exhibition, meeting new people, in this case, also the robot and having talks. Altogether, the telepresence robot aligns well with the museum's concern with digitalization and new media.

Currently, Trapholt museum does not possess either the financial or human resources in order to get a telepresence robot. They believe robots are still developing and will be more secure and more reliable in future.

For full accessibility of the museum for a telepresence robot, obstacles such as stairs in the building would have to be overcome, fragile statues in the open areas of the museum should perhaps be protected, and additional help in wayfinding might also be useful: our remote visitors found the navigation quite stressful at times because they felt confused regarding navigation and directions. This problem could be overcome with sufficient instructions for the operation of the telepresence robot provided to remote visitors in advance and a map of the museum, which might have helped the remote visitors to get a sense of the layout of the building and see the directions which can be taken during their visit. Interestingly, one of the on-site visitors suggested that the remote visitors need to know a lot about the art pieces before the start of the remote visit because it is not possible to find out as much information as during the on-site visit. This concern was however not voiced by the remote participants themselves.

Other visitors

The findings from the ethnographic observations and video recordings suggest that museum visitors co-located with the robot engage with its presence often positively. Also, the human-robot interaction became more human-like when they could see a real face or when they were explained that there was a person controlling the robot remotely.

Figure 7: Interactions with on-site visitors

On-site visitors state that they perceived the robot as more human-like and natural than they had expected since they could see a real face on the screen. One of the on-site visitors stated that she was not a fan of the remote visit or the robot, but changed her opinion once she realised that telepresence robots can be useful for people with mobility issues. Another visitor was curious if the person behind the robot screen can communicate with the people around.

One on-site visitor was initially surprised to see the robot when passing by and then let the robot pass through first, but did not pay much attention to the robot afterwards. Other on-site visitors were passing by and staring at the robot. One of them was smiling and seemed curious. There was also an on-site visitor passing by the robot very naturally and did not seem interested in the telepresence robot.
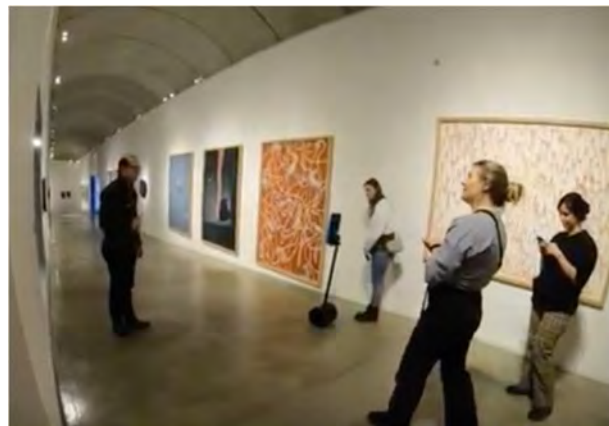
Discussion

Our case study suggests that there is a potential for the use of this technology to be support accessibility if certain minimal,

Figure 8: The robot operator interacting with other visitors

mostly technical, conditions are given, such as a good internet connection and an intuitive user interface. Some introduction to the robot and some time to practice can also benefit the remote users' experience. Furthermore, some information on the environment, like an overview of the accessible areas, a map or some indications within the museum could be

helpful. With these features in place, telepresence robots can certainly promote immersion and embodiment and therefore, increase accessibility.

Also the attitude of on-site visitors towards the use of this technology was found to be mostly positive or neutral – and in any case acceptable if it increases accessibility. There are some indications that people associate telepresence robots with 'the future', which suggests a certain novelty effect, which will of course wear out if telepresence robots are becoming more widespread. However, currently, providing telepresence robots in museums is perceived as novel and interesting and can be used for attracting visitors to the museum.

Safety – of the onsite visitors and the exhibits – was a real concern for the museum, and more experience with such robots will have to reveal what those dangers really are. In any case, it will be helpful if robots are not large and heavy, so that potential collisions are not problematic. Experience with robots in school contexts is generally positive, and no case of accidents that lead to any harm have been documented in the literature. Thus, trust needs to be gained over time that telepresence robots are of no danger.

To conclude, the experiment of placing a telepresence robot into a modern museum was promising, suggesting that this technology may be very beneficial by allowing remote participants who cannot access the museum for the one or other reason an immersive museum experience in the future.

References

Germak, C., Lupetti, M. L., Giuliano, L., & Ng, M. E. K. (2015). Robots and cultural heritage: New museum experiences. Journal of Science and Technology of the Arts, 7(2), 47-57.

Hebert, J. M. (2016). Accessibility and Technology: Remote Access to Art through Telepresence Robotics. The University of San Francisco USF Scholarship: a digital repository @ Gleeson Library, Geschke Center.

Rosala, M. (2022): How to Analyze Qualitative Data from UX Research: Thematic Analysis. https://www.nngroup.com/articles/thematic-analysis/

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