Virtual, Remote Participation in Museum Visits by Older Adults: A Feasibility Study

Galena Kostoska, Marcos Baez, Florian Daniel and Fabio Casati
University of Trento
Via Sommarive 9, 38123 Povo (TN), Italy
{kostoska,baez,daniel,casati}@disi.unitn.it

ABSTRACT
The goal of this paper is to understand if older adults can participate in remote museum visits with virtual environments, and which design factors would be crucial for remote participation system success. We report on a study with 30 older adult participants, identifying strong and weak points of different designs for remote participation and identifying future design directions. Our results illustrate that different designs can change communication dynamics, exploration and navigation patterns, and we describe the design features that led to this. An interaction-free design was found to be the easiest to use, while virtual environments are perceived as aesthetically appealing. Implications for developers are discussed.

Author Keywords
Older adults; museums; remote participation; feasibility;

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

Physical isolation, lack of transportation as well as health declines can limit older adults' ability to travel [10, 3]. They typically want to participate in family events, such birthday parties, weddings, or in everyday family events, but they may be physically stopped in doing so [6, 5]. One way to deal with this challenge is to provide for remote participation with the help of online, virtual environments.

Previous research has investigated the use of technology to support communication between remote friends or family members in different contexts: reading books [8], connecting families [5, 6], watching TV and attending family events or parties [2]. The use of shared media in this context usually aims to go beyond simply conversing and to actually make the remote particpants part of everyday episodes of life [6].

Judge et al. [5] found that families in particular enjoy sharing extended moments of time which are not easily captured only with photos. Although photos and videos can be shared immediately after an event, this event has passed and leaves no opportunity for the remote participant to actively take part in it [6]. Further, they found that children/grandchildren are mainly sharers of information and parents/grandparents are the receivers of information. In order to actually share information, people typically use a combination of technologies such as telephones, email, messengers, and video conferencing [9]. People almost always choose the technology that is both easy for them to use and likely to allow them to reach their social contacts.

Some studies [10, 3] show that older adults can overcome social and spatial barriers with the help of ICT. Winstead et al. [10] reports on qualitative studies where older adults from assisted living communities used technology like Google Maps with Street View and virtual tours of cultural institutions, allowing them to stay connected with the places of sentimental value or to "visit" places of interest that are no longer accessible to them. These online visits resulted in lower levels of loneliness and social isolation.

Our work specifically focuses on remote participation in museum visits, informed by previous research on social museum experiences for remote visitors [1, 4]. Studies with remote participants have shown that social interaction with companion(s) while co-visiting can directly influence the remote visitor's museum experience. Awareness of other visitors' engagement with the exhibits as well as direct interaction with each other are however still overlooked. Our work advances previous works by specifically investigating how we can improve these two aspects.

With this motivation, our research question is: *are older adults able to participate in remote museum visits though virtual environments?* As a first step in this direction, we explored dyadic (two member) remote visits to museums, in which one member is in the museum and the older adult is at home. We explore different aspects of a museum visit and analyse whether and how we can (1) design for navigating and "visiting" museums from home, (2) design to strengthen social group awareness, and (3) foster social interactions between people and improve their communication. We aim to understand the design space of interfaces for museum visits for older adults (specifically focusing on tablets) and to assess

the respective suitability for remote participation in terms of ability to understand, follow and engage in virtual visits.

STUDY SETTING

In order to answer our research question, we developed three versions of a remote participation system with different levels of complexity and examined the following three hypothesis (for each of the prototypes):

H1 Participants are able to understand the presented museum content
H2 Participants are able to follow the virtual museum tour
H3 Participants are able to engage in contextual conversation around presented exhibits

Interface Designs

We took into account the difficulties in adopting and using new technologies by older adults identified with prior trials of the software [7], and we designed an interface that is based on familiarity: we translated a familiar interaction metaphor, the book, into a software interface. In order to make sure participants always felt comfortable while using the software, we also implemented an always-on audio channel, which is very natural to them and allows them to engage in discussions on the exhibits. The implementation was based on an iPad, given its general high acceptance by older adults as a device.

For the purpose of the experiment we took into account the following design aspects: (1) visual metaphor that represents visit: *book* (focuses on artefacts and content, the user jumps from artefact to artefact) vs. *virtual tour* (focuses on space, the user navigates virtual representation of the museum); (2) interaction paradigm: *interaction-free* navigation (the onsite member is a "guide" in the tour) vs. *interactive* navigation (the older adult navigates freely as well as can decide to follow onsite member in the visit); and (3) social interaction: we supported it with an *audio* channel.

We presented our participants three interfaces:

- *Interaction-free, guided tour* (F): the participant is led by the onsite member in the visit, using a book visual metaphor;
- *Interactive, guided tour* (I): the participant either follows the onsite visitor or explores the content on her own, using a book visual metaphor; and
- *Interactive, virtual reality tour* (V): the participant freely navigates in a 3D museum using the 3D Gallery app[1], a free app for iPad that provides a small set of simple movements for exploring 3D galleries.

To study a realistic museum setting, a museum that our participants would actually visit, we created a small museum of old crafts. The exhibition covered extinct crafts from the previous century, a topic suggested by a phycologist working in a care home as interesting for the participants. The materials for the museum were carefully selected with the help of the phycologist.

[1]http://goo.gl/dVNjej

Participants

We recruited 30 older adult participants for this study: 16 in a care home (CH) and 14 participants in a daily centre (DC). The participants were 4 men and 26 women whose age range was 70-93. The participants reported no prior use of technology, with only few participants reporting use of cell phones for communication with their relatives. Almost all of them had a high school degree as the highest level of education, except for one participant that held a Bachelor's degree. The DC group consisted of mostly healthy participants: 2 people reported hearing problems and 1 participant sight problems. The CH group consisted of frail adults: 12 out of 16 had mobility problems, and 1 had hearing problems. For the CH participants we also got results from their Folstein test, a 30-point questionnaire that is used to screen for cognitive impairment: three of our participants scored below 24, which classifies them as people with moderate cognitive impairment.

Procedure

We performed a within-subjects design, where the same subjects were presented with all of the three interfaces. The order of presentation of the interfaces was randomized. For each participant, we conducted a field visit (from 30 to 45 mins each). The study was conducted in the natural household of the participant (the care home or daily centre respectively). Each field session was conducted by two researchers, one onsite and one remote. The onsite researcher introduced the purpose of the visit and explained the designs and the interaction gestures (for the interactive interfaces). For the interaction-free and interactive design, the position of the remote collaborator could be understood from the position of a photo bookmark in the book (the photo bookmark indicates the position of the guide, if the guide is ahead, the bookmark is on the left page of the book, if the guide is behind, the bookmark is on the right page); the virtual tour design allowed its users to freely "walk" inside the museum.

Of the 30 participants, 2 preferred not to use the virtual tour design due to sight problems, and 4 did not wish to complete the questionnaire part of the study. The personal opinions of the participants were discussed with a semi-structured interviews at the end of the session. We asked them to discuss the problems that they encountered and to share their opinions about the visit.

Data Collection

We used a pre-defined observation list for each design and a questionnaire after the use of all interfaces. For each hypothesis we collected the following information, in order to assess them.

H1: We wanted to understand if participants were indeed understanding the presented material, or whether they were just blindly participating in the experiment without actually understanding the purpose of it. Some minutes after the beginnings of the experiment, the remote collaborator therefore asked participants to *name* the presented craft and the onsite collaborator carefully marked the participants' answers. This task did not require them to remember the name of the piece

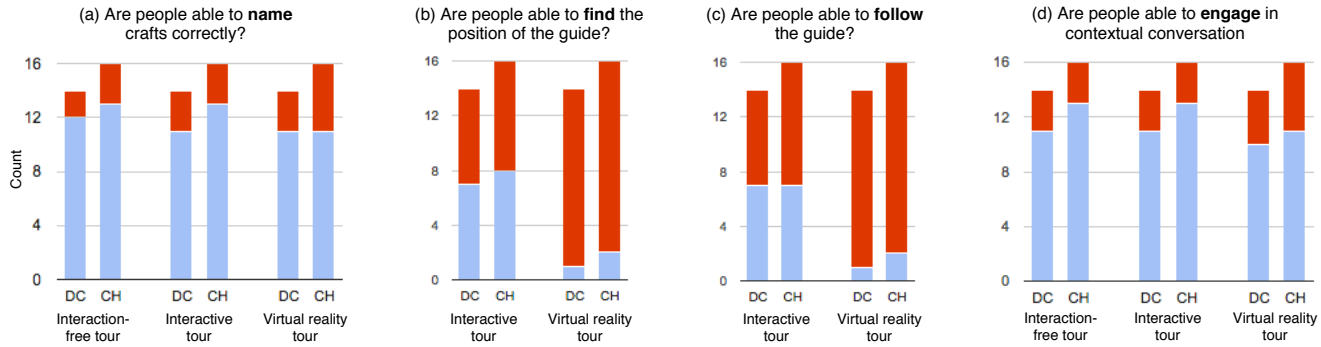

Figure 1. Data collected for the three interaction designs for remote museum participation by older adults (red bars correspond to "yes", blue ones to "no"). For questions (b) and (c), no data was collected regarding the interaction-free design, as participation did not require any system interaction.

of artwork, but to name the artwork that is observed at the moment.

H2: In order to understand whether participants were able to properly follow the tour, after 15 minutes of free exploration the remote collaborator asked the participants to *reach* his position in the museum; the onsite collaborator observed the performed action. Next, the remote collaborator moved to another position, asking the participant to *follow* him ("walk" with him). The performed action was again carefully marked by the onsite collaborator.

H3: We observed if participants engaged in contextual conversations by observing whether they used the available *audio channel* or not for discussions around exhibits.

FINDINGS

Findings are organised according to our three hypotheses outlined before.

H1: Participants are able to understand the presented museum content

We accept this hypothesis for the three designs: the results showed that 25 participants in the interaction-free design, 24 in the interactive guided tour, and 22 in the virtual tour, were able to name the craft that they are seeing, answering upon the questions of the remote collaborator about the presented craft (Figure 1(a)). There was no statistically significant difference between the different designs in terms of understanding the tour as determined by a one-way ANOVA ($F(2,87) = 0.46$, $p = 0.63$)

H2: Participants are able to follow the virtual museum tour

For the interaction-free design we accept the hypothesis, since participants were able to name the craft correctly (H1) and did not have to interact with the system to follow the guide. For the interactive guided tour, we reject the hypothesis, although we note that participants had a partial success in achieving it: 15 participants were able to find the position of the collaborator (Figure 1(b)), however only 14 were able to follow, out of 30 (Figure 1(c)). This design presented some difficulties: participants understood that they should move forward, but did not understand how many pages to go ahead in order to arrive to the position of the collaborator. The observed difficulties appeared mainly in the group of participants coming from the care home, which was characterized by a higher cognitive decline.

The virtual reality visit presented even more difficulties, and we reject the hypothesis: only 3 participants were able to find the position of the collaborator and to actually follow him in the visit (Figure 1(b) and (c)). Additional t-tests confirm a statistically significant advantage for the interactive tour for the task of finding the position of the collaborator ($t(58) = 3.69$, $p < 0.01$) as well as for the task of following the collaborator in the visit ($t(58) = 3.39$, $p < 0.01$).

H3: Participants are able to engage in contextual conversation around presented exhibits

The hypothesis is accepted across the three designs, with the virtual reality visit having a slightly smaller number of people engaging in contextual conversation due to 3D navigation problems. Once assisted by the collaborator, the participants engaged further in discussing the objects (Figure 1(d)). The one-way ANOVA analysis shows that there was no statistically significant difference in engagement between the different interfaces ($F(2,87) = 0.55$, $p = 0.57$).

PARTICIPANT'S EXPERIENCE AND DISCUSSION

Most of our participants found the presented content interesting, they were really happy to speak about the old crafts, especially for the ones they were familiar with. Typically, an exploration of an exhibit started by highlighting what is presented by both the participant and the remote researcher, contributing information about the exhibit such as a description of the craft presented or information related to the exhibit (for instance where the photo was taken). The initiator of the conversation was mainly the participant, reacting to the recognition of the presented content, for instance: "Ah, my brother in law used to be a shoemaker". Some of the participants were craftsman in the past and they also shared personal emotional stories with the remote collaborator. Content associated with their past resulted in vivid, and sometimes funny conversations. We observed that an affective and emotional rather than

a scholar approach to the content was creating stronger impressions in our participants. Fiorenza, 84-years old female participant, commented: "I used to be a tailor, this experiment was a really nice reminder, a great initiative."

The post-use questionnaire results pointed to several important considerations for design of interfaces for remote visiting systems and leisure technologies in general.

First, most users liked the audio channel. People particularly liked the guided tours, we understood that visiting museums in a company was a strong social motivator. In the post-use questionnaire we asked our participants specifically whether they preferred reading on their own or to follow another person in the visit. Almost half of the participants preferred to follow another person in the visit, 10 preferred a mix of both, but none of them preferred to visit alone. Given that the older adults are often alone in the daily setting, we identify a good potential for engagement and active participation in remote companionship with beloved ones to increase their participation and satisfaction.

Second, older adults aesthetically preferred 3D environments (they ranked the virtual reality tour highest for its aesthetic appeal), although almost no participant could actually use it. It is in line with existing literature that says that older adults are usually not good 3D consumers, they may feel disoriented and may not be able to navigate. This comes at no surprise, taking into consideration that it's difficult that virtual reality environments can guarantee easy to use interaction for every user, irrespective of technological skills.

Third, interaction-free designs worked better than interactive designs, especially for novel users. In the post-use questionnaire the interaction-free design got the highest votes for being easiest to use (the highest number of first ranks). We understood that when dealing with older adults, especially for our participants that had never used a computer before, issues of usability were going beyond making the system easy to use. Our participants were learning how to use our application while simultaneously understanding what an iPad is and how to use it.

While we believe our research provides valuable directions for the design of remote visiting systems, we also acknowledge its limitations. Cultural differences play an important role in research like this. Our participants were located in Italy; practices regarding communication with family and museum visiting vary greatly across cultures. Further research with people from other cultural backgrounds may expose additional aspects related to how people co-participate from remote. Additional limitation of our study is that the guide was a researcher, not a family member; further studies where participants interact with family members will be necessary to validate the generalizability of our results to the family context.

CONCLUSIONS

Our study clearly shows that participating in museum visits from remote is cumbersome to older adults and comes with several challenges, yet it's feasible. Participants' positive reaction to the idea, and especially on the social aspect, suggests that the social context should be a first aspect to focus on when designing more engaging experiences for older adults from remote. The interaction-free paradigm was found the most suitable interaction paradigm, the virtual reality tour design the most aesthetically appealing. While all participants were able to understand the tours in our experimental setting, we will next study the performance in an actual museum visit (adding complexity also to the guide in the museum). In our future work we will also explore additional mechanisms to design for curiosity and exploration.

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