

UNIVERSITY OF TRENTO

DOCTORAL THESIS

Museum Visits for Older Adults with Mobility Constraints: Sharing and Participation through Technology

Author:
Galena KOSTOSKA

Supervisor:
Prof. Fabio CASATI
Dr. Florian DANIEL



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in the

Social Informatics

Department of Information Engineering and Computer Science

Declaration of Authorship

I, Galena KOSTOSKA, declare that this thesis titled, 'Museum Visits for Older Adults with Mobility Constraints: Sharing and Participation through Technology' and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

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Date:

“It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.”

Charles Darwin

Abstract

The aim of the thesis is to study how older adults with mobility constraints can enjoy museum experiences of their family members (by providing methods and tools for family members to “save” and share memories of museum visits with older adults at home) and to investigate how older adults can remotely participate in museum visits through technology.

We employed face-to-face interviews and questionnaires inside two different museums settings to understand if and what visitors share with non-visitors, and which technology they use for this purpose. The results showed that a low number of visitors share their museum visits with some materials like pictures they took or books bought in the shop. Although visitors have the intention and would like to share information, they rarely do so.

In order to support sharing with non-visitors, we provided several ways for “saving” museum content. The visitors were able to bookmark objects during a museum visit, and received by email a link with the bookmarked content in the form of a digital booklet. We tested whether people would use these features, and if they would access and share the “saved” content after the visit. The results suggested that our approach can significantly increase sharing: at least half of the participants shared the digital booklet with someone.

We adapted the booklet for older adults and we performed usability study on it, in order to understand if older adults with and without cognitive decline can use it. We measured and compared the performance on four tasks: opening the booklet, browsing the content, zooming in the content and closing the content after being zoomed in. Results show that the booklet enables older adults to consume content to some extent and it allows additional in-depth exploration.

We studied factors influencing feasibility of remote participation for older adults, where we measured the impact of different designs and interaction techniques on participants ability to understand, follow and engage in remote museum visits. Interactive navigation was found the most suitable interaction paradigm for active older adults, whereas frail adults can participate only through interaction-free tours. While almost all of the participants were able to understand the tours in our experimental setting, the ability to follow a visit was strongly influenced by the interaction type.

We investigated levels of experienced presence, social closeness, engagement and enjoyment when older adults join museum visit of onsite visitors in a drama-based approach.

The remote participant and onsite participants were connected with audio link, the information about the objects were contained and presented in form of a story connecting all the objects in the exhibition. The constructs of closeness, engagement and enjoyment correlated significantly: we found that both audio channel and interactive story were important elements for creating an affective virtual experience, the audio channel increased the sense of togetherness, while the interactive story made the visit more enjoyable and fun.

A virtual tour was designed and developed to engage older adults in an immersive visit through part of the Louvre, by a distant real-life guide. An initial diary study and a creative workshop were conducted to learn how to better support the needs and values of older adults, and which approaches would work better for the scenario of remote participation. Visitors' experienced levels of social and spatial presence, immersion and engagement were quite high independently of the level of interactivity of the guide, or the presence of others. We discuss further recommendations for video-mediated remote participation for older adults.

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Abbreviations

MART	Museum of Modern Art in Rovereto, Italy
MTSN	Museum of Science and Natural History in Trento, Italy
MUSE	Museum of Science and Natural History in Trento, Italy
MMSE	Mini - Mental State Examination Questionnaire
SPMSQ	Short Portable Mental Status Questionnaire

Dedicated to my lovely family

Chapter 1

Introduction

1.1 Motivation and Rationale

Sharing is an important part of many enjoyable experiences. The fast adoption and spreading of mobile devices makes sharing and collaboration possible between significant others, both close and distant. Nowadays, digital technologies are much more pervasive and, as a consequence, they allow people to share in places and in situation where they didn't share before, like for instance during leisure events. Sharing and collaboration is supported using media such as: photos, videos and hypertext [1]. In order to share information, people normally use a combination of tools such as telephones, email, messengers, video conferencing, and social sites [2].

Cultural heritage sites and museums are more and more adopting new technologies. Technologies are considered valuable resources for engaging audiences and stimulating their involvement. Technologies allow their visitors to appreciate cultural content with high quality audio and visual material. Diverse solutions are already deployed in many cultural sites: information kiosks, mobile applications, multimedia presentation rooms. Existing research examines the use of mobile technologies to support sharing inside museums and how mobile technologies can change the way visitors interact with each other and with the cultural sites [3–6].

Older adults experience difficulties in moving around and traveling. Due to poor health, physical isolation, or lack of transportation older adults become challenged in performing their everyday activities and become more frail [7–9]. They want to participate to events and perform activities they used to do, but their lives are confined to the home or the institution where they live. They find themselves isolated and can no longer actively participate in the world outside of the living place. This may lead to (real or perceived)

sense of spatial and social isolation [10, 11], can significantly reduce quality of life, and can lead to increased sense of loneliness [12]. Successful ageing integrates practices that focus on improving or maintaining physical, functional, psychological, and social health. The use of communication and virtual technologies may lower social and spatial barriers for older adults, allowing them to stay connected, and to visit places that are no longer accessible to them for various reasons.

Although cultural institutions are eagerly adopting the new available technologies, they miss opportunities for inclusion of people who for various reasons cannot attend the visit, and fail to understand their needs and expectations. In particular, the already present technologies are designed for individuals who are already visiting the museum and they can't be used by audiences that due to various cognitive or physical limitations, find it impossible or impractical to visit. Currently, the people that can not come visiting are not supported with the current solutions and they can not participate in the visits of their families and friends.

1.2 Research Goal

With this thesis, we wanted to address older adults by providing different solutions for experiencing museums from home and to accommodate for the older adults virtual visitors by providing different types of “virtual” tours. Thus, this research aims to provide cultural institutions tools with which they can reach older adult audiences ([13, 14]) and to allow older adults with physical limitations to experience museums from home ([14–16]). In addition, it suggests novel ways for presenting museum information which can stimulate curiosity about the artefacts in cultural spaces without having to sacrifice some audience groups (two papers in process of submission).

The goal of this research is to enable older adults experience museum visits from home. We focus on experiencing museums where onsite visitors act as facilitators for the processes of sharing and participation and make the museum visits engaging and fun for the older adult at home. We take two approaches: one where friends or family visits the museum and bring memories from the visit back home that can be easily shared with the older adult, and another one where the older adult joins a group of onsite visitors in the museum visit from home, and potentially engages in an interactive group visit. For this purpose we try to answer the following research questions, targeting these two approaches:

1. What museum visitors share after museum visits with non-visitors (including older adults) back home?

2. Will a non intrusive technological intervention for “saving” memories of the visits inside the museum increase sharing?
3. Can older adults access and consume memories of their friends and families presented in form of tablet application?
4. Can older adults join and participate in museum visits from remote with tablet application?
5. Are interactive remote museum visits engaging and enjoyable for older adults?

1.3 Thesis Overview

This thesis summarises findings from diverse studies we performed over the period of 3 years. It is divided into two parts: *Sharing* and *Participation*, the *Sharing* part covers the studies where we investigated sharing museum experiences with or without technology for general audiences and older adults, and the *Participation* part covers the studies where we investigated remote participation in museum visits for older adults. Each chapter in each part represents its own study.

The *Sharing* part is organised as follows:

- In *Chapter 3* we summarise findings from ethnographical investigations exploring generic sharing habits of visitors with non-visitors ([17]), and sharing habits of visitors with older adults at home. In order to study what visitors share with non-visitors we employed structured face-to-face interviews, semi-structured face-to-face interviews and post-interview email questionnaires.
- In *Chapter 4* we summarise the findings from a study performed in two different museums where we tested an application we developed for saving and sharing memories from museum visits, in form of a digital booklet ([13]). We measured click-through rates of the “saved” content, in order to understand how many of the visitors actually interact with the content, and additionally investigated if, with whom and under which conditions visitors share the booklet with non-visitors.
- In *Chapter 5* we present how we adapted the digital booklet for older adults and we introduced it inside two different institutions: a care home and a daily centre for older adults. We performed a usability user study on the adapted booklet (measuring task performance) in order to understand if older adults can access and consume saved content from museum visits of their friends and families ([14]).

The *Participation* part is organised as follows:

- In *Chapter 6* we evaluate feasibility for older adults to participate in museum visits from remote. We developed a system that mimics a person staying inside the museum and guiding the remote older adult through the content exposed in the museum. The content is delivered to the older adults again in the form of booklet, this time enhanced with an audio-channel (published in [15]). We collected data in form of structured observation notes, studying specifically the ability to understand, follow and engage in museum visits.
- In *Chapter 7* we tested a new approach to integrate older adults in a real museum visit of a group of onsite visitors coming from the same town as the older adult. The group is taken on a tour in the museum and the onsite visitors are given tablets that can detect their position and deliver content for the surrounding objects on the spot. Selected objects on the path in the museum are connected via a story, story segments are delivered when the onsite visitors are positioned next to an object having a story segment associated with it, and are delivered to everyone including the remote older adult (the idea is published in [16] and the results paper is submitted and in process of review). We measured if older adults engage in and enjoy in this kind of remote visits, as well as their perceived experienced level of sense of presence and social closeness.
- In *Chapter 8* we designed an interactive virtual tour of Louvre. Older adults were positioned in front of a camera and provided with a virtual environment that shows them as if they were physically inside the museum. We measured experienced levels of presence, immersion and engagement and naturalness in this kind of visits (paper in preparation).

Lastly, we discuss research contributions as well as limitations and future work in Chapter 9.

We always worked with the premise that in order to develop new technologies, especially for specific target user group of older adults, it is necessary to understand both, the final users and the environments in which they live. In the whole process we always included physiologists, educators and all the personnel inside the care home and the daily centre in order to determine content and context in which the approaches for sharing with booklet or remote participation in an actual visit can work.

1.4 Key findings

From the performed user studies we learnt that museum visitors share experiences and information about their visits, and providing an easy non-obtrusive way to save memories from museum visits can make sharing much easier, more comfortable and can bring to increased sharing rates. We learnt that older adults, even with cognitive impairments, can consume content and participate remotely in museum visits. Interaction with the system plays an important role and must be as simple as possible, as more sophisticated interaction techniques can represent a barrier for use for older adults. We learnt that participating from remote in a story-based approach can be engaging, fun and can bring to high levels of experienced social closeness. Participation through video in an immersive environment with real-life guide is engaging, but comes with initial problems in orientation.

Taken together, the presented studies in this thesis provide new insights into the design for remote participation, explore new ways in which museum experiences can be delivered at distance, and help addressing the common and specific usability and user experience problems we encountered when designing for sharing experiences. We also reflect on a series of lessons learned and on the application design process: what worked and what did not and under which circumstances.

Chapter 2

Literature Review

2.1 Introduction

The relationships between older adults and their families are more difficult to maintain when the older adults are separated from their family. The fast development of new technologies opens possibilities to bridge this separation. The wide spread of powerful computing devices (tablets and mobile devices) coupled with the recent advances in adaptivity and personalisation provide new means for older adults to stay connected.

The pervasive use of media-capturing devices and the increasing adoption of online social networks have allowed people to create, and distribute digital content that documents the real world - from cultural sites to landmarks, points of interest and live concerts. Such content holds great potential for creating richer representations of the events and helps telling engaging stories about them. This is not only due to the abundance of media capturing sources but also on their ability to provide a large variety of contextual information, ranging from location metadata and textual description to additional online information from different web sources for example. Leveraging on information about content and its surrounding context thus presents new opportunities for better capturing and collaborating around events that happen in real world and/or for telling them in innovative ways to large and remote audiences.

The state of art is divided into two sections, Sharing and Participation. Sharing is the section where we report on existing practices and approaches for “saving” and sharing museum experiences for general audiences and for current systems for sharing with older adults. In Participation section we cover tools and studies conducted investigating remote participation in museum visits, and various aspects correlated with it such as interactive storytelling, mediation of sense of presence and social connectedness.

Taken into account all the studies we present here, we believe that targeting collaborative sharing of museum content and participation in remote visits is important. It can improve the maintenance of the social ties and it can help older adults to stay in touch with others. Sharing content and participating in experiences can contribute to increase in social awareness and engagement for older adults. In this way, older adults not only overcome social and spatial barriers, but strengthen the relationships with their close ones based on shared mutual experiences and interests.

2.2 Sharing

2.2.1 Bringing museum memories home

Over the years many museums have been experimenting with different ways of prolonging the museum experience and facilitating its sharing after the visit. Bookmarking has been the primary tool used to capture the experience, and it has been ported to different platforms [18]. These platforms range from online websites, where people can bookmark the virtual representation of exhibits, to computer or interactive kiosks and personal mobile devices used inside the museum, where people can bookmark the objects directly when watching them.

Some prominent examples are the *Multimedia Tour* [19], an application developed for the permanent collection at Tate Modern, and the *GettyGuide* [20], multimedia kiosks in the J. Paul Getty Museum; tools that provide visitors the option to email home links with detailed information on the bookmarked artefacts. *Rememberer* [21], a tool deployed at the Exploratorium for capturing museum visits, enables visitors to capture information about exhibits while they are visiting the museum and later, after the visit, allows them to access the exhibit information on personalized web pages. It uses RFID card (Radio Frequency IDentification) to implement the bookmarking and a PDA in order to allow the users to immediately visualize the links they bookmarked (to enhance the actual experience as well). The *eXspot system*, an evolution of the Remember tool, removes the PDA device and replaces it with a registration kiosk physically present in the museum [22].

Myartspace [23], a service on mobile phones aiding the process of inquiry learning, is motivating student visitors to 'collect' and share the objects; the students are 'saving' objects by typing in a code shown on a printed card beside the exhibit. After the visit, students are able to retrieve the bookmarked information on *MyArtSpace* website and to share the content between themselves; the final goal of the system is to improve learning from a museum visit.

SmartCard [24] is a card that visitors could buy in the entrance of the museum and allowed them to collect objects or self created data (in this case pictures and videos) in a 'digital backpack'.

Interesting studies have been conducted on these platforms. Some studies address the participation and effectiveness (e.g., [18] [25]) raising some questions about the actual value of the deployed solutions. These studies point to some factors affecting participation as i) lack of interest and time from visitors, ii) visibility of the deployed systems and iii) transparency and simplicity [18]. Other studies point to the type of exhibit being an important factor for deciding on the bookmarking platform [26]. Therefore, any successful system should consider the exhibits settings, the visitors and their intentions and the technical solutions.

What the above suggests is that a clear understanding of the nature of sharing to identify if, what, why, and in which context people share is key to the development of technologies to capture and share the museum experience. We address these issues with two user studies described in detail in Section 3.

2.2.2 Museum experiences for groups

Several projects explore social interaction and collaboration between group members inside museums. The *Sotto Voce* project [27], offers a shared listening option in order to promote interaction and communication between companions. It also offers an option to follow a member, when a companion is guiding the other companion(s), to check in, and to tell the other companion(s) the current location. PIL (PEACH-Israel) project [5, 28] supports small groups in the museum by context-aware communication services; it enables visitors to communicate with other members of the group or by sending predefined messages about exhibits, or by leaving post-its on some exhibits that they would like the others to see. *ReGroup* [29], a mobile distributed information system enables the group members to "see" the current and past locations of group members.

Ciccero [30] promotes interaction between visitors through cooperative and educational games. Collaboration is supported explicitly, where participants together solve collaborative game similar to treasure hunt, or implicitly, the participants solve enigmas at individual level, and by this they collect clues for the shared enigma. *WeTangram* [31] aims to support social interactions within variable-sized groups by solving tangram, an old Chinese geometry puzzle in which the players jointly put together seven geometric pieces to fit an outline. The *ARCHI* [32] museum project incorporates elements of role playing games into a mobile application to explain visitors different topics such as social

differentiation in society. The quest is designed to have a favourable end only through social interaction and cooperation within the groups.

Museon [33] is a tool that implicitly influences collaboration among children by guiding them in groups inside the museum and letting them collaboratively choose topics of interest. When the children visitors arrive in the museum they form groups of max 4 members and select a topic of interest (they use the ticket cards on the tabletop in order to 'login' and perform the steps). When they go around the museum and encounter one of the stations, they 'log in' and receive questions related to the topics they selected. At the end of the visit, they place their cards on the tabletop, and create a personal catalogue. The catalogue can be consulted on the web, or on a stand alone application called *Show and Tell* (this tool allows ordering of the storyelements on the fly).

Museum cafe [34] is a tabletop interface that influences a development of the conversation by monitoring the conversation among the visitors and dynamically showing visual stimuli on the surface of the table. The system shows stimuli to support the current conversation of the group or influence some participant to be more active, and provides positive "reward" to favour the persistence of an already occurring conversation. The system also tailors the content, by selecting content according to the topic currently discussed.

In all these scenarios, collaboration was supported only for onsite visitors, however, little attention was paid for non-visitors and how to support them in a collaborative visit of an onsite group. We address these issues in Section 6, 7, and 9 with three different user studies.

2.2.3 Museum guides for visitors of different abilities

Several museum guides targeting specifically visitors with different abilities have been developed and deployed in the last decade in various museums, with the aim to allow challenged individuals to explore them in an independent and adaptable for them way.

Different electronic guides with sign language videos and audio descriptions has been introduced in museums for deaf and hard-of-hearing visitors [35]. Proctor [35] analysed and gave examples of solutions providing this category of visitors the information in one of the following digital guide forms: i) a sign language guide: visitors receive information about objects via video with a sign-subtitled interpretation; ii) a subtitled guided: extra layer of communication in form of subtitles is added to the already existing audio tour, and iii) audio + text tours guide: provides visitors with scripts of the audio tours and

other textual information about the exhibits in full-screen format, and scrollable format along with the audio guide.

Tate Modern Museum first piloted their tour for the deaf in British Sign Language (BSL) in 2003 in parallel with their Multimedia Tour [36]. The deaf visitors were able to access 'on demand' information in their own language. Evaluations have been made of the BSL tour at the Tate Modern and the results showed that the users of BSL were satisfied with the guide and that it had significantly improved their visit. Their quantitative analysis showed that 79% of the participants reported that the guide had improved their visit whereas only 1% of the visitors who used BSL said that the mobile guide made their visit worse [35].

Understanding of the needs of the visitors with reading disabilities or reduced vision comes from [37]. They used off-shelf portable device (Daisy-player, a special device developed for dyslexics) for a study in which they delivered auditory and context-dependent information based on the data coming from a location-aware system. Audio was selected as a medium mainly because people with reading disabilities and dyslexia are better at understanding sound than text and they generally have better listening skills than fully-sighted people. The study described the requirements that should be followed in order to design and develop the mobile guide: headphones should be used in order to filter out extraneous noise, they should be compatible with hearing aids in order not to limit social interaction if the visitors had come with a friend or a guardian, information presented on the guide should be straightforward with short sentences and no ambiguous words, and the guide should be robust in design and easy to distinguish for different functions.

The support for blind visitors comes also in the study of Scan and Tilt [38, 39], an application that runs on PDA device equipped with an RFID reader (to read objects in the museums) and a 2D accelerometer (to recognise small movements of the handheld device). In order to enable different users to use the guide application according to their needs and preferences, the mobile guide developed and supported different levels of accessibility of content, offering basic navigation, navigation with audio, navigation using tilt, and navigation with audio and tilt.

A portable handheld computer was designed for visitors with physical, visual, hearing and/or cognitive disabilities [40]. PDA was used in order to scan the objects in the exhibition to get more explanations on each exhibit through the guide application called the Museum Exhibit Guide (MEG). A traditional guide was extended to support menu navigation using single-switch or single-key press on a keyboard. The initial responses from the visitors in the study showed that it was a good mobile guide for visitors with different disabilities and was able to enhance a meaningful and enjoyable experience for visitors.

Multimedia Guide for All (MFA) [41] is a set of guidelines that should be taken into consideration when designing, such as: accessibility mechanism, integration and compatibility of audiovisual contents, the interface area for accessibility resources must be equivalent to the area occupied by content for people without disabilities. This means that other features for visitors with special needs (for example, sign language video, audio-visual contents) are always placed on the screen as add-on feature(s) and they may be hidden if not in use.

We address all the spacial affordances we made in the design and development of our tools especially in Chapter 5, 6 and 7.

2.2.4 Communication technologies for older adults

The limitations of current communication technology, such as telephone and video calls, led researchers to explore novel ways for sharing at distance [42]. Previous research explores different content-sharing scenarios [43] and different remote communication applications for different contexts: reading books [44], shared gameplay [45], connecting families [1, 46] watching TV and attending family events or parties [47].

Numerous studies explore how lightweight communication technologies can be successfully incorporated into family life. ICTs for older adults imposes unique challenge because (i) there are asymmetries in the communication needs between different age groups, and (ii) there are different emotional and cognitive abilities between different age groups [48]. Wayve [49] was created to examine how lightweight communications (SMS, MMS, scribbled messages) were adopted and valued across the family. TxtBoard [50] studied how scribbled notes and text messages provided means for social touch and coordinating activities. ASTRA [51] provided a context for conversation for families by displaying picture messages sent to it by household members. All these technologies were adopted by the family members and they were often considered to offer much better connection than mobile phones can provide for instance.

The difficulties older adults experience while using new technologies have been attributed to many factors: natural decline in cognitive abilities [52], lack of interest [53], and problems with user interfaces of the devices [54]. Interactions with digital interfaces make sense only for people familiar with digital products, whereas older adults, who are less likely to be accustomed to electronic products, are having difficulties using such complex product interfaces [55]. It is clear that if we are to develop technologies for capturing, sharing and consuming experiences that can be widely accepted and used by individuals of different abilities, more attention should be put to embedding familiar everyday analogies into product interfaces, or the use of ordinary metaphors.

Interface design requirements for ICTs for older adults have been studied by previous research [56]. Reduction of complexity, clear structure of tasks, consistency of information and rapid and distinct feedback are set of guidelines proposed by Phiriyaopokanon [57]. High color contrasts, and bigger fonts produce less errors in older adults [56]. Another work from Zajicek [58], summarised his findings into a simple set of interface guidelines: Keep output messages as short as possible, Reduce choice wherever possible, Use mnemonic letters to indicate key press menu selections, Insert confirmatory statements wherever possible. All these requirements were taken into account when designing the remote visiting application.

The presented literature tells us that if we want to target older adults, we should design technologies that are easy to use for older adults. The tools we developed are based on familiar everyday analogies, with an easy to use interface. We present the designs that we developed in Chapter 4, 5, 6, 7.

2.3 Participation

2.3.1 Overcoming spatial and social barriers for older adults

Previous research has identified that information and communications technologies (ICTs) can bring various benefits for older adults: self-understanding benefits (e.g, health monitoring) interaction benefits (e.g., increased connectivity and social support), or task-orientated benefits (e.g., help for traveling, shopping, finance) [59]. Other studies found that greater involvement in on-line communities brings lower perceived life stress [60]. The use of ICTs for older adults can improve connection to the rest of the world and improve psychosocial well-being among older adults [61].

The potential for ICTs to bridge social and spatial barriers have been studied by several studies [7, 8, 62]. Qualitative studies with older adults using technologies like Google Maps with Street View and virtual tours of institutions found that ICTs can provide means 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. Internet communication technology can help older adults feel as they are in companionship with others even when physically unable to leave their residence [63]. Participants indicated that the systems facilitated their social interactions and provided chance to visit new places.

Technological advancements have brought mobile remote presence systems (MRP) another opportunity for bridging social and spatial barriers for older adults [64–66]. MRPs

are designed to be teleoperated and are used to improve communication between individuals. They were found to have the potential to assist older adults in instrumental activities of daily living as well as to foster social interaction between people [64]. A qualitative study where older adults used MRP system identified benefits for the participants such as being able to see and to be seen, reducing travel costs and hassles and reducing social isolation [66]. Many of the participants expressed the desire to go outside, visit new places and attend live performances and visit museums.

In the presented studies many of the participants accepted the proposed solutions and expressed desire to use such technologies for overcoming spatial and social barriers. We present tools for active participation in a museum visit in Chapter 6, 7 and 8.

2.3.2 Visiting places from remote

There are several studies on supporting museum participation from distance [67–69].

The *City* project allows co-visiting with a remote visitor [70] for the Lighthouse museum in Glasgow. It allows the visitors to navigate jointly with remote visitors, and to communicate through audio. The visitor inside the museum uses a PDA equipped with headset and microphone, the remote visitor visits the museum using a 3D representation of the museum, or a webpage enhanced with a map showing the position of the onsite visitor. The evaluation of this system shows that audio interaction, spatial awareness and mutual visibility are essential factors for co-visiting between remote users. Further investigations show that when well integrated with technology, sharing with distant relatives can create more enjoyable experiences and can create stronger relationships between the group members [68, 69].

The *George Square* [42] system comes on a portable tablet, and allows the visitor to explore the city and to share the experience using voice, location, photographs, and webpages with the remote visitor. The software for the remote visitor can be run on a standard PC supporting in this way co-visiting while at home. One of the design goals was also to support activities before and after their visit (organizing the visit, and reviewing memories of the visit). In the remote application, the visitor are depicted as avatars on a map (the location determined by GPS or manually entered). The system additionally shows recommendations from the others 'ghosted on the map'. Photos taken by the visitors are connected with the spot where they are taken. The testing with 20 participants (with visitors in the square in Glasgow) showed that participants found the most interesting to take photos and comment on them.

For the needs of the *Mediated museum* project, a mediated museum extension was designed for a pilot study in which a Stockholm museum was extended to an archeological excavation site [71]. During an exhibition that concerned an Art and Industry Fair that Stockholm hosted in 1897 (inside the Museum of National Antiquities in Stockholm) a glass door has been integrated into an exhibition, connecting the museum with an excavation point where the original remaining of the original Art and Industry fair resided. The installation allowed visitors in the museum to be guided remotely in real time through the extension to the excavation place. Almost 2000 visitors saw the excavation point remotely. Due to the activities at the excavation site, the sounds of the digging site people inspired the remote visitors to ask more about what is happening on the other side. Although the door was the size of a normal food - participants expressed a wish to see more.

The presented works are exploring possibilities for empowering remote visitors and for enlarging audience “access”. We present approached designed and developed to take specifically the special needs of remote older adults in these scenarios.

2.3.3 Interactive storytelling for museums

Interactive storytelling can provide new levels of engagement with collections and exhibits. Storytelling is deeply embedded in the human nature, it provides an organisation structure for the new experiences and knowledge; people mentally organise information better when the information is presented in the form of a story [72]. Telling a story is not limited to just oral communication, but also involves the creation of an atmosphere through senses in which all the events told are emphasised one after other. In order to facilitate the process of engagement, narratives are often introduced in the virtual museum contexts [73–75]. Narratives are stories that change individual’s emotional states, modifying the way people assess the quality of the experience [76].

According to Gorini et al. [76] narratives are responsible for mental immersion through which users can be engaged and involved in the experience, increasing their sense of mediated presence as well. More engaging approaches have been proposed for stimulating visitor interests by using presentations such as drama or film [6, 77, 78]. Results have shown that drama, when designed for small groups, and combined with the raw emotion of being in front of actual original artifacts, can emotionally engage visitors [79].

NICE [80] is an application for museums that enable visitors to talk with 3D animated avatar of the fairytale author Hans Christian Andersen (HCA) and his fairytale characters. When the user points (using a touch screen) at an object in the interface, HCA tells a story about the object. HCA has knowledge about: his works (including in-depth

knowledge of his fairytales), his life, (mainly the childhood), his physical and personal presences; his study room (including many of the objects in there). He gathers information about the user and understands a variety of generic input, and adapts the his behaviour accordingly. Day of figurines [81] is a slow narrative driven game for mobile phones and the game following twenty hours in the life of a small virtual town. The storyline turned out to be attractive feature especially because of its unpredictability, openness and interactivity.

Interactive Storytelling [82] project developed a network of personal computers, or stations positioned around the museum. The visitor starts the journey at a registration point, and when they enter unique identifier at some of the stations on the chosen path the system plays the appropriate episode for that user (or group). Visitors are in the role of tabloid reporters and follow up an exiting breaking news story about tomb opening. ART-E-FACT [83] is a mixed reality interactive storytelling project that introduced interactive installations positioned next to real art pieces in an exhibition. The information about objects is transferred to the user through conversation with virtual characters. The discussions between these characters is embedded in a story deeply connected with the background of the character. The user interacts with the character thought keyboard input as well as various special interactive devices.

Immersion, interestingness and believability are necessary ingredients to make a story more engaging. We present approaches incorporating storytelling in the scenarios for remote visiting for older adults in Chapters 7 and 8.

2.3.4 Presence and social connectedness

One way to alleviate the mobility disadvantages for older adults is the use of virtual environments. Virtual environments offer the possibility to study navigation, interaction and orientation in variety of environments and contexts. However, virtual environments face the challenge to provide a realistic experience, or the participant's feeling of "being there" in an environment, or defined as sense of presence [84]. There are different types of presence [85] and most of the time the distinction is made between physical/spatial and social presence. Physical, or spatial, presence refers to the sense of physically being in another location, forgetting about the technology involved and accepting the virtual environment as a real environment [86], while social presence is generally referred to as "the feeling of being together (and communicating) with someone" [87]. Research has shown that the more salient the mediated environment is, the the more likely it becomes that users will accept it [88].

Previous research acknowledge that virtual presence in museum visits is less intense than physical presence but may be a good substitute [89]. We evaluate the experienced levels of presence and social closeness for the tools we developed in Chapter 7 and 8.

2.4 Conclusion

Although series of visitor studies looked at how social interaction may affect the overall museum experience and how social behaviour is expressed inside museums, they offer little knowledge on how social interaction can be augmented and helped though out the visit with the help of technology especially between physically separated visitors with different abilities. The connection between remote and local visitor from the point of view of visitors interaction, how to blur the boundaries among onsite and remote visits, and fostering shared experience for visitors and non-visitors has received little attention in the literature so far.

One important cause of the difficulty in implementing tools for remote participation to events seems to be that visits are not simply an interaction channel between the onsite and remote visitors, but rather complex set of logically inter-related aspects (easiness of use of UI, cognitive ability of the older adult to understand, follow and engage in a remote visit, invasiveness of technological solutions inside the museum). In this thesis we try to investigate these different aspects and we try to develop solutions for seamless sharing and participation.

Many of the presented approaches are based on the idea that shared spatial location is a strong and intuitive resource for collaboration, giving users awareness for co-visitors inside the museums. The approaches focus on providing key resources (information about the objects) as means for supporting interaction and social experiences. The challenge is how to design engaging and entertaining content delivery for older adult individuals with mobility problems and their specific needs; designs of specific interfaces that compensate for their problems is required.

The review of the literature also shows that using entertaining stories can improve the overall engagement of the visitors. Immersion, interestingness and believability are important for engagement. However, the majority of the presented solutions do not take into account the remote visitor in this scenario; additionally, they usually target the onsite visitor alone. Therefore, in this thesis we will provide means to support entertaining experience that make the older adult from home feel as part of the group during the visit.

Part I

Part: Sharing

Chapter 3

What visitors share with non-visitors

3.1 Introduction

Museums are no longer places where visitors only go and observe objects: they are becoming a place where visitors enjoy different kind of experiences. Museum managers are increasingly trying to extend the experiences from visitors to other people, including people who wouldn't normally come visit and people who for various physical or logistic reasons are not able to come. There are two reasons for this: first, to create interest and attract more visitors, and second, to help people with disabilities enjoy the same experience as those without disabilities. Sharing - the act with which we are primarily concerned - includes announcing intentions to go to an exhibition at a given date and time, sharing emotional state or museum content during the visit to one's social network, and sharing emotional state or content with friends and family (e.g. storytelling supported by images, maps, souvenirs) after the visit.

In order to better understand sharing as well as implications for design of museum technology for sharing we performed an ethnographic study aiming to understand activities, needs, motives and values of visitors related to sharing inside museum. The idea is to better understand the museum experiences and practices of visitors and how they can be potentially mediated by technology and by this to gather input for a new design.

The goal of this study is to understand if and what people share about their museum visits with their friends and family members, and to identify which technologies can increase sharing (the shared material to be attractive for non-visitors). More specifically, we study how sharing occurs before, during, and after a visit. Thus, our study also

explores how digital sharing fits into visitors life. This approach allows us to ask questions about the broader context in which sharing usually happens, and which practices at which time of the visit (before, during and after the visit) contribute to sharing.

For this purpose we performed more than 500 face-to-face interviews and received more than 200 responses in our follow-up email questionnaires [14, 17]. Participants told us about sharing museum visits in the past, the practices, and we asked them questions about memories.

The study was based on the following research questions:

1. If and what people share after a museum visit,
2. Which technologies visitors use for sharing their experiences?
3. What visitors share with older adults physically bounded to home?

3.2 What visitors share

With this study we specifically want to understand if, what and how people share from their museum visits. We investigate whether visitors share something, what they share (*emotions*, the emotional state they were in while visiting the museum, e.g., “it was a lot of fun”, “we had a great time”, or *information about exhibits*), with who they share, how they bring memories at home, whether they use the online resources of the museum and for what purpose.

3.2.1 Method

In order to gather as much information as possible for the sharing habits of the visitors after the museum visit, we based our first phase of this investigation (Phase I) on individual, face-to-face interviews. These interviews were conducted by two researchers, based on a questionnaire consisting of 14 questions¹. Visitors were approached inside a museum, asking if they want to participate.

The questionnaire has an extensive list of questions asking if and what people share after a visit in a museum, if they visited the website of the museum, if they took notes, what kind of notes, how long did the visit last. The researchers were posited at the exit of the exhibition, asking participants if interested to help the research by answering several questions about their experience. Researchers were equipped with tablets and

¹Interview scheme, Phase I, MTSN and MART: <https://goo.gl/Qrh0w3>

took all the notes electronically, using Google Forms. Responses were later processed and analysed in terms of common groups and similar themes. Participants in Phase I were additionally asked, if interested, to leave their email addresses to be contacted for the second phase of the study.

In the second phase of this investigation (Phase II), exactly one week after the initial face-to-face interviews, we sent email questionnaires² to the participants of the first phase.

All the questionnaires used for this study are provided in Appendix A.

3.2.2 Participants

We recruited participants in two museums for this purpose: Museum of Science and Natural History in Trento (MTSN) in the period of 1st to 4th of November 2012, and Museum of Contemporary Art (MART) in Rovereto in the period of 23rd to 24th of March 2013. We approached visitors at the end of the visit, asking them whether they would like to help our research by answering questions connected to their sharing habits. We conducted 307 interviews³ with visitors in MTSN: 166 of them were with families, the rest were adults that visited the museum both individually or in small groups; and 208 interviews⁴ in MART: 144 were with young couples. We received 79 responses⁵ in Phase II from MTSN visitors and 62 responses⁶ from MART visitors.

3.2.3 Results

Previous research has found that each experience can be understood as an *individual experience*, which is derived from objects in the context and their subjective meaning and significance to the person, and in the same time as an *emotional experience*, sensorial, emotional feeling that the person is sensing in the context [90].

We were interested and we asked the visitors what they share after a museum visit, their individual experience or the emotional, and if they only talk about content or whether they show content while telling.

In Phase I, 79% of visitors reported that they share emotions after the visit, 59% also show content when sharing. From the visitors we understood that that sharing emotions

²Questionnaire, Phase II, MTSN: <http://goo.gl/45WQ2Z>. MART: <http://goo.gl/nVopAj>

³Raw data, Phase I, MTSN: <http://goo.gl/G3YiHd>

⁴Raw data, Phase I, MART: <http://goo.gl/GwEAUP>

⁵Raw data, Phase II, MTSN: <http://goo.gl/jQKF65>

⁶Raw data, Phase II, MART: <http://goo.gl/nG3ASf>

is generally easier. Visitors told us that it much easier to share what one felt compared to remembering content and telling about it (Figure 3.7).

We further investigated how do visitors keep track of the interesting objects they would later share and discuss. We asked them if they take notes as memories from their visits. From the results we understood that people don't take notes (Figure 3.1).

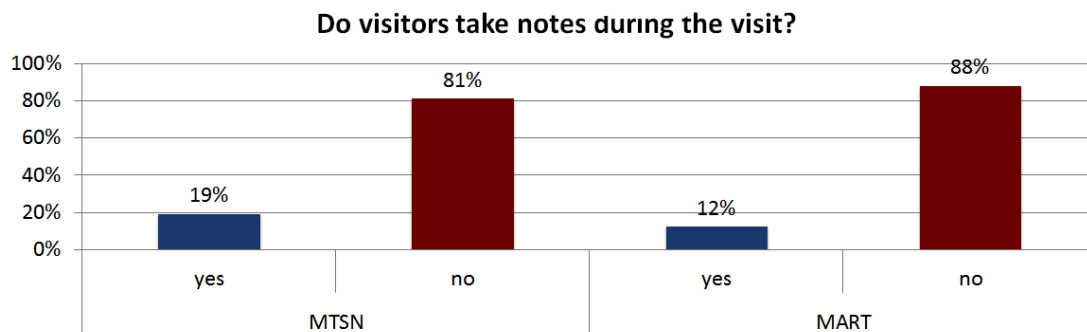


FIGURE 3.1: Visitors do not take notes.

We understood that the majority of the visitors that takes notes, takes either photo notes (notes of the descriptions of the artifacts), or photo for a memory (for instance a photo with their kid with some artifact), or both of them. A small number of visitors said they take videos.

We asked if they consulted the website before and after the visit. People mainly check the museum website before the visit (Figure 3.2) and majority of them rarely visit the museum website after the visit (Figure 3.3). We investigated if the website is used as a resource, and additional if the website is consulted as a source of information for future sharing. What we found is that the museum web resources are in essence not used. The main reason for looking up the page is to get logistical information in MTSN, while is for getting more information about the content/exhibitions in MART (Figure 3.4).

We investigated whether the visitors utilize the social networks to share their experience. The results showed that almost no visitor shares "virtually" (Figure 3.5).

Next, we asked how much time visitors spend in the museum in order to understand better patterns of museum visits, as well as to understand the time spans of interest for the content (Figure 3.6). In both of the museums, the majority of visitors stayed between 1 and 3 hours, with one third of visitors visiting MTSN for only 1h.

In Phase II, we asked whether people shared emotions or they show content again as in Phase I, however this time we were more specific and we asked what they shared after this particular visit. We also asked if the answers about sharing content in Phase

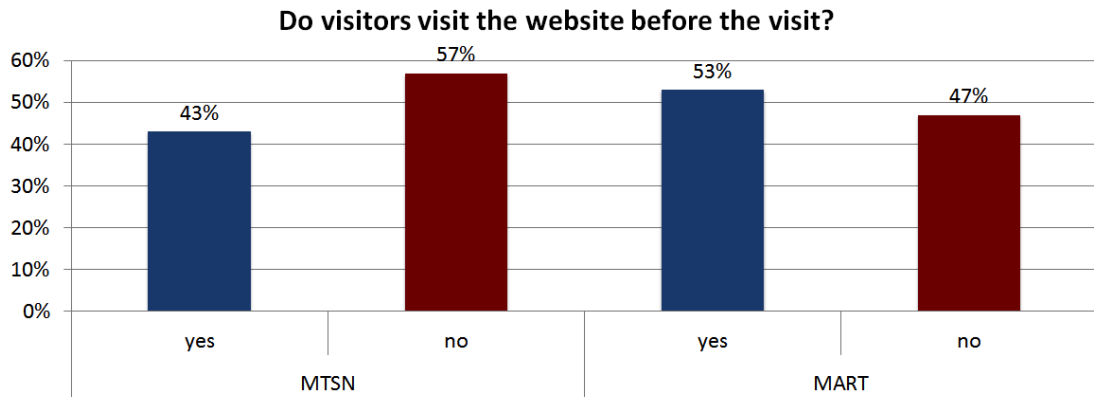


FIGURE 3.2: Half of the visitors check the website before visiting.

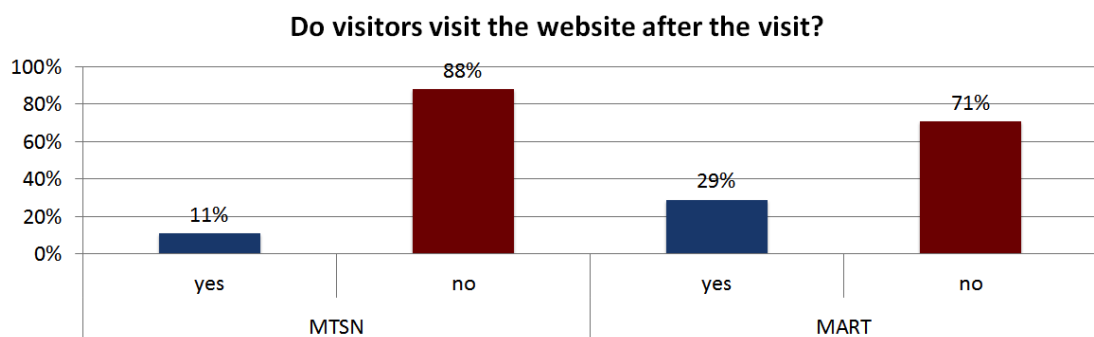


FIGURE 3.3: Visitors mainly don't consult the website after the visit.

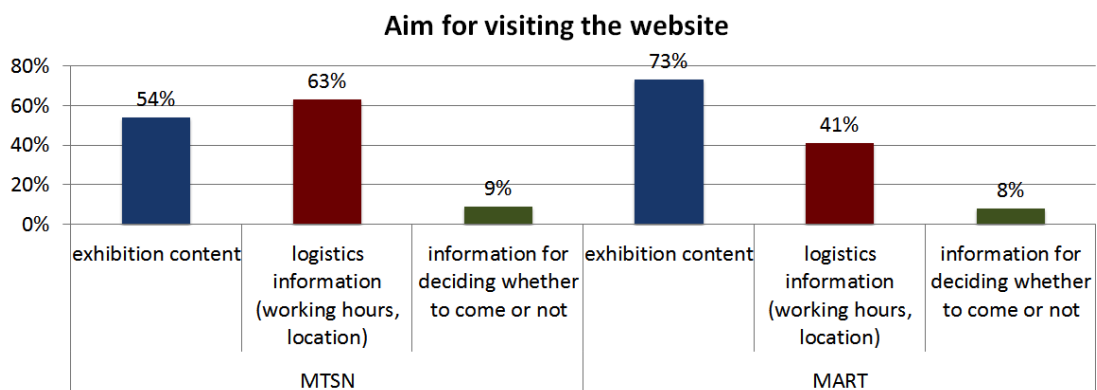


FIGURE 3.4: The majority of visitors in MTSN looking for logistical information on the website, where as the majority of visitors in MART look for more information about the exhibits.

I were related to only speaking about the exhibits or also using various means (leaflets, catalogs, souvenirs) to actually show content.

In general visitors share more emotions. We found the same sharing rates for emotions between the two phases, however, for content, only 15% in MTSN and 27% in MART

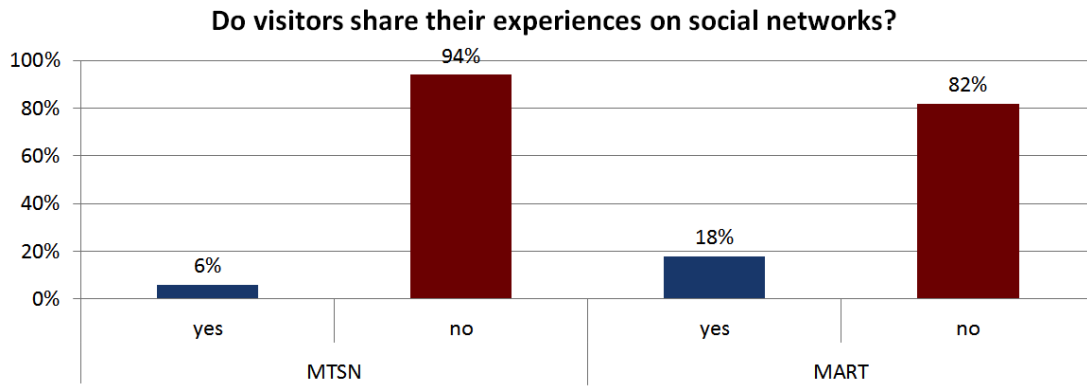


FIGURE 3.5: Visitors rarely share museum information or memories from museum visits on the popular social networks.

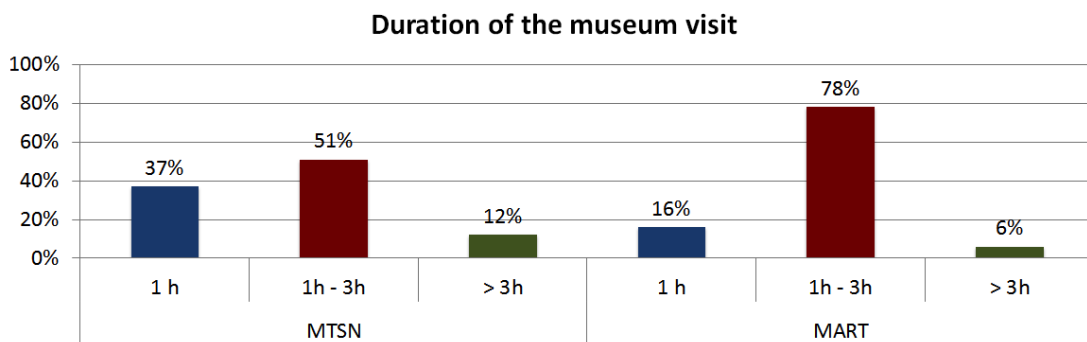


FIGURE 3.6: The majority of visitors stay in the museum between 1 and 3 hours.

of the participants stated that they did share content with or without any support. At MART sharing seemed to be more shifted towards sharing with materials, whereas in MTSN it was easier just to share emotions. This may be due to the different nature of museum; previous literature has shown that different museums attract different types of visitors [91].

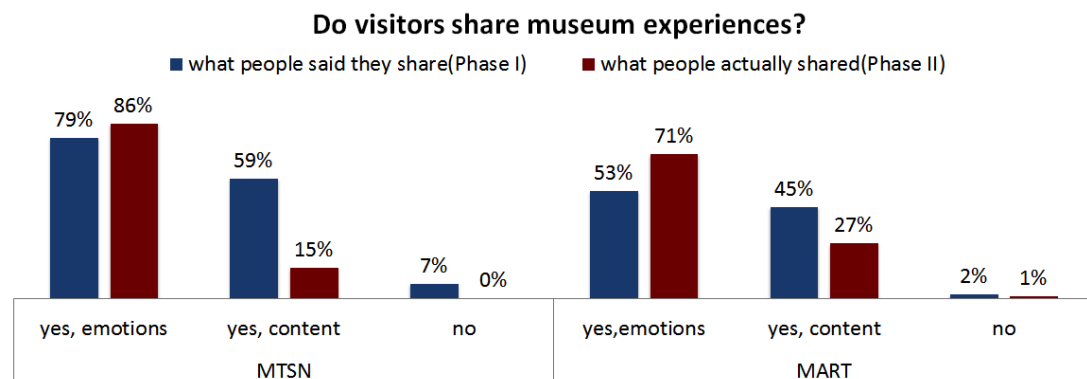


FIGURE 3.7: What visitors say they usually share (Phase I.) vs. what visitors actually share (Phase II)

The results from Phase II told us that the majority of the visitors (71% in MART and

90% in MTSN) use comments and verbal narration for sharing the experience, whereas 11% in MTSN and 27% in MART use books and catalogs for describing the visit (Figure 3.8).

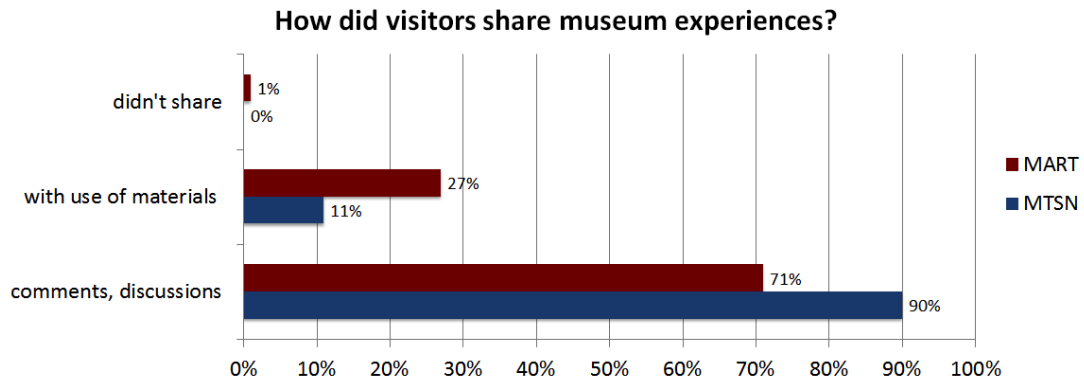


FIGURE 3.8: Visitors share with verbal narrations, comments and discussions, and with support of additional materials, such as booklets, catalogs and photos.

We also asked with who visitors actually shared their experience. The results told us that visitors shared their experience predominantly with their families and friends, and their partners (Figure 3.9).

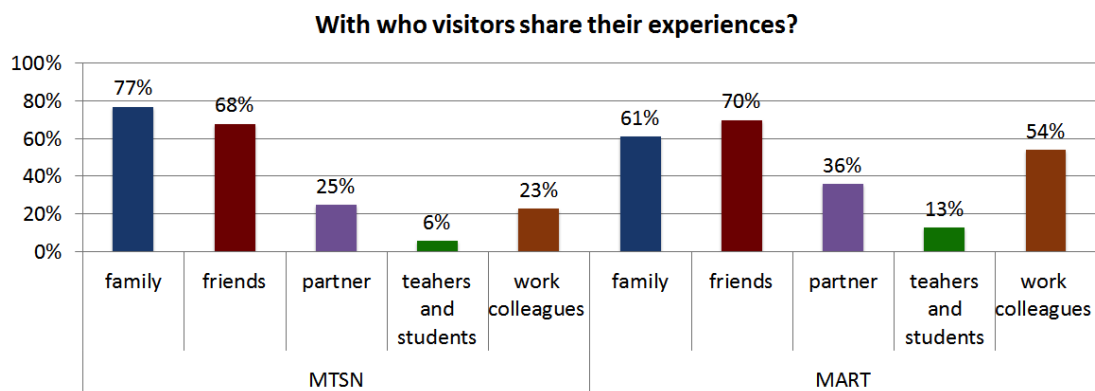


FIGURE 3.9: Visitors share museum information or memories from museum visits mainly with families and friends..

3.2.4 Discussion

These results tell us that sharing emotions is generally easier than sharing content, and visitors tend and share emotions more easily. However, only a low number of visitors (11% in MTSN and 27% in MART) share supported with additional materials (Figure 3.7). These results tell us that although visitors have the intention and would like to share information (based on the interviews), they rarely do so (based on the questionnaire one week after the visit). Visitors mainly share with families and friends,

and they consult the museum webpage before the visit (for logistical information or information about current exhibitions), but barely after.

3.3 Characterizing sharing with older adults

The aim of this study is to understand more specifically what visitors share with older relatives who can't come to the museum and how it fits visitors life. We want to understand what family visitors share with older adults at home. We ask if and how

1. visitors share museum experiences with their older relatives,
2. the motives for not coming to the museum and by that non-participation in museum visits,
3. and the frequencies of sharing museum experiences with them.

Some of the questions also examined older adults' current involvement in social activities.

3.3.1 Method

The study was conducted in MUSE (Natural Science Museum in Trento) in the period of 21th August to 28th August 2013. Two researchers were involved in collection of the data, data was collected with tablet, using Google Forms. The researchers were positioned at two different positions in the museum, positions that are junction points between two floors, where usually people go out from one exhibition and enter in a new one. Participants were asked if they would like to help an ongoing research on how to improve sharing museum visits with older adults by answering the questionnaire we developed for the purpose. The study had two phases: first phase, where we collected data from semi-structured⁷, where we had extensive 20 mins open interviews with interested participants, and the second phase, in which we collected data by using structured interviews⁸, each of them with duration of around 5 mins. With the semi-structured interview we asked our participants more precisely if older relatives visit museums, and if not, why not, and what kind of activities they are involved in usually during day, while with the structured interviews we asked to select one older adults relative and to tell us how often they see the selected older adult, how often they see him/her and if they share experiences from the museum visits with the selected relative.

All the questionnaires used for this study are provided in Appendix A.

⁷Semi-structured interviews schema: <http://goo.gl/7Km7xN>

⁸Structured interviews schema: <http://goo.gl/K42Mb1>

3.3.2 Participants

We recruited 42 participants for the semi-structured interviews⁹, and 307 visitors for the structured interviews¹⁰, collecting qualitative and quantitative data from all the participants. We approached the visitors at different points in the museum, explaining the purpose of the study and asking if they would like to participate. We asked them, when replying to our questions to think of one older adults relative, a person above 65 years that is in close familiar relationship with them such as mother/father, grandma/grandpa, sister/brother, aunt/uncle.

3.3.3 Results

In the semi-structured interviews, we asked which means the families use to share their experiences with older adults. The majority of the interviewed families, 52% of the participants, stated that they share their experiences with the older relatives by storytelling, 38% use storytelling supported with photos and 10% with videos (Figure 3.10).

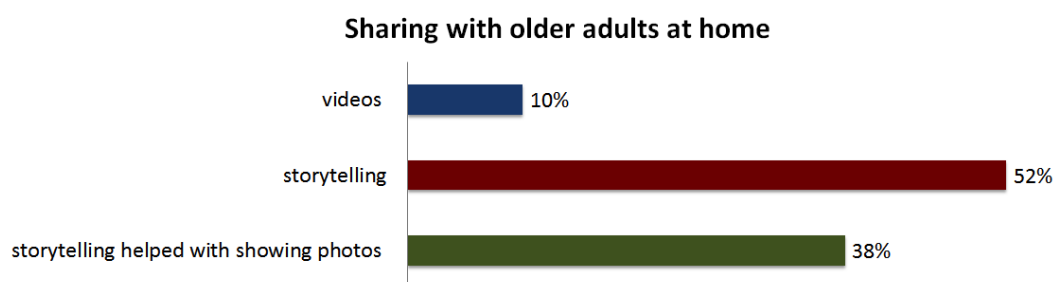


FIGURE 3.10: Visitors mainly use storytelling as a way to share with older adult relatives.

We asked if kids in the family relive the museum visit with grandparents and the motives for doing or not doing so. In the biggest number of the families (88%) kids do share their experience with grandparents, 5% don't share at all, and 7% kids tell from time to time, or only that they've been to the museum, without entering in the details. (Figure 3.11)

We asked them to explain what kids usually tell grandparents about the visit: what shocked/moved them, interesting stories around the exhibits, what they have done, the most interesting objects and impressions, what they have learnt. In the case when kids didn't share their experience with the grandparents is the case where the grandchildren are too small, or if there's no interest from the older relatives for museum themes.

⁹Raw data, semi-structured interviews: <http://goo.gl/5fHVY1>

¹⁰Raw data, structured interviews: <http://goo.gl/cEk6hH>

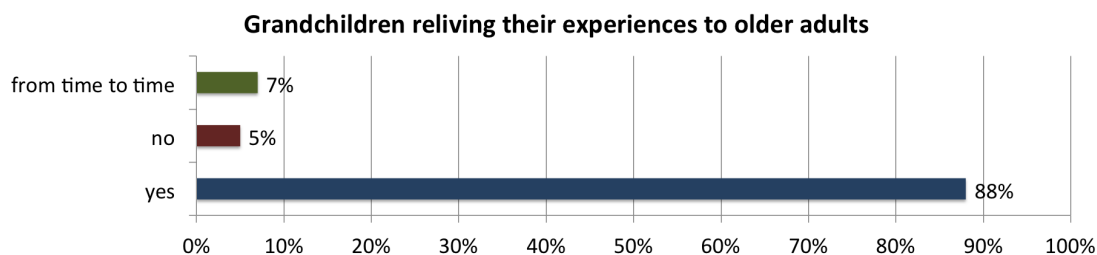


FIGURE 3.11: Grandchildren usually share their museum experiences with grandparents.

We asked which means the family would use to share the museum experience, 30% would use voice, 26% would send additional information and 38% would send photos for this purpose (Figure 3.12)

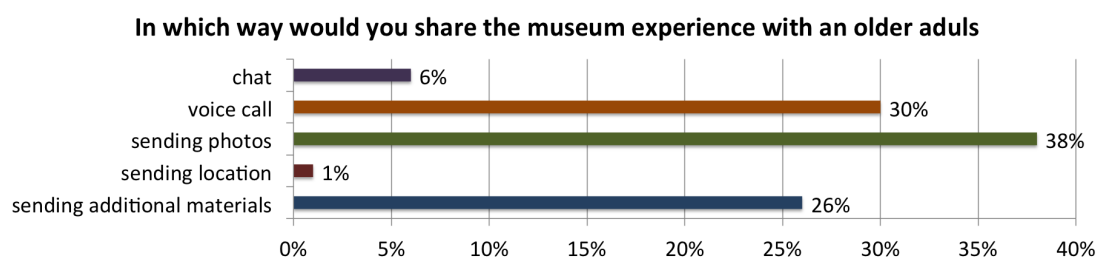


FIGURE 3.12: Photos, voice call and other available materials from the museum hold promise to augment sharing with older adults.

We also asked about the social activities preferred by older adults at home. The following categories were dominant: crosswords, puzzles, playing cards (Figure 3.13).

In the structured interviews, we asked the participants to choose one older adult relative and when replying to the questions to answer the questions having that person in mind.

We asked for the age of the chosen older adult relative. Mainly the older adults were in the age group between 65-75 (Figure 3.14), and participants mainly answered the questions about their mothers / fathers or grandparents (Figure 3.15). The older adults for which we got data live mainly alone (Figure 3.16), and the participants meet them each day (30%) or weekly (42%). (Figure 3.17). The main reasons for older adults not coming to the museum, reported by the interviewees are walking problems (37% of the participants), lack of interest in cultural themes (45%), and cognitive problems (9%) (Figure 3.18). We asked for the frequency of sharing, and we understood that whenever the family goes to a museum, they always (38%) or very often (34%) share their experiences with their older adult relatives only after their visit (Figure 3.19).

We observed that in this museum people take many photos. One of the participants commented: “I can’t stop taking photos”. Some of them were making videos too. Many

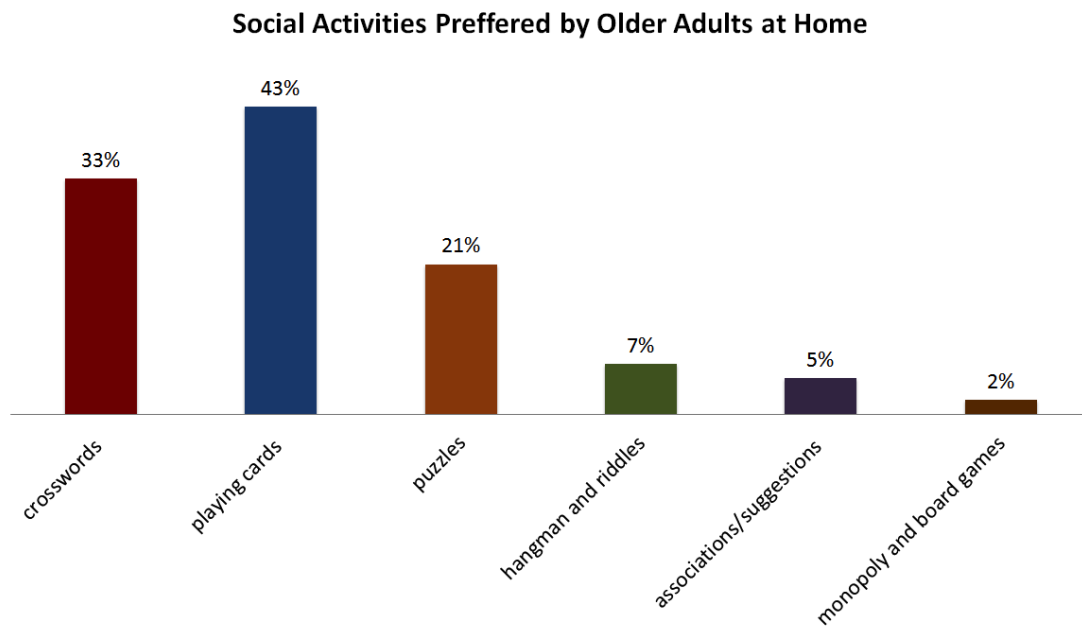


FIGURE 3.13: Older adults at home engage in playing cards, crosswords, and solving puzzles.

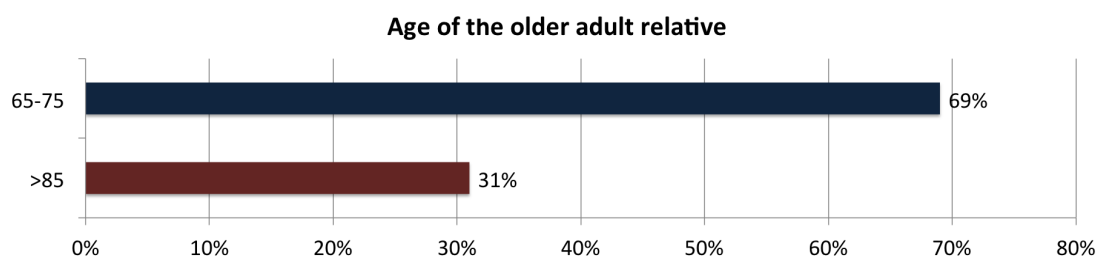


FIGURE 3.14: The older adult relatives of our participants were mainly in the age range of 65-75.

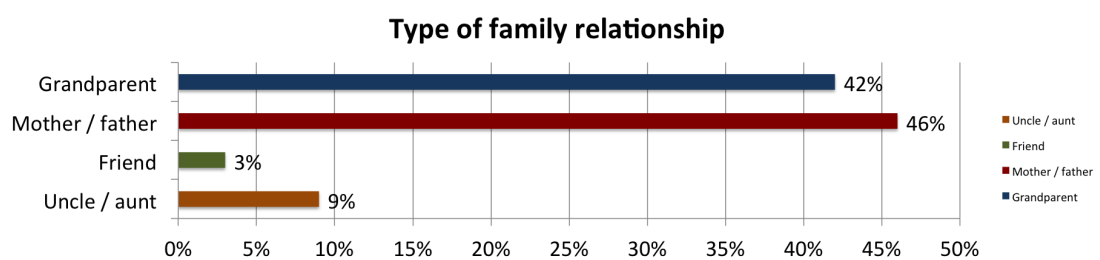


FIGURE 3.15: The participants mainly answered our questionnaire about their parents and grandparents.

of the people told us that that is the material that they would share later with non-visitors.

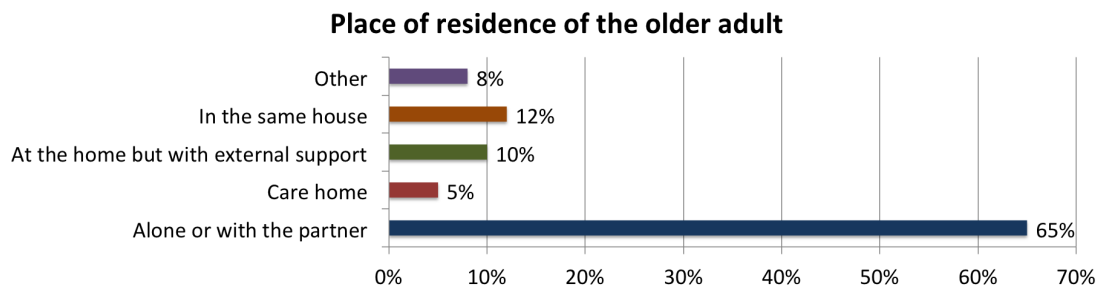


FIGURE 3.16: Older adult relatives of the participants live mainly at home, alone or with their partners.

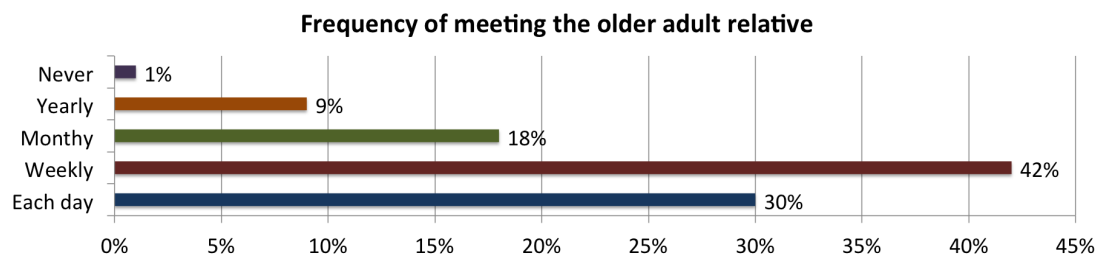


FIGURE 3.17: Frequency of meeting the older adults relative: most of the participants meet them each day (30%) or weekly (42%).

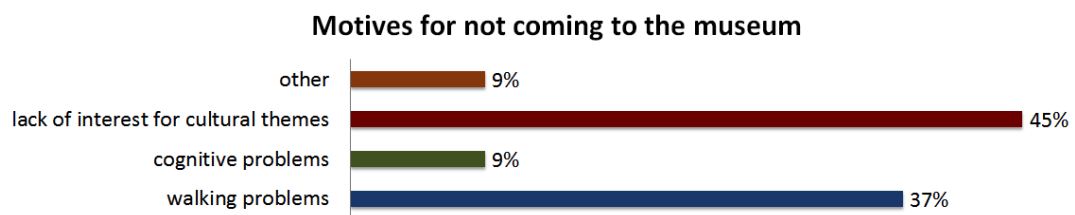


FIGURE 3.18: Older adults don't come to museums mainly because of lack of interest, of physical limitations.

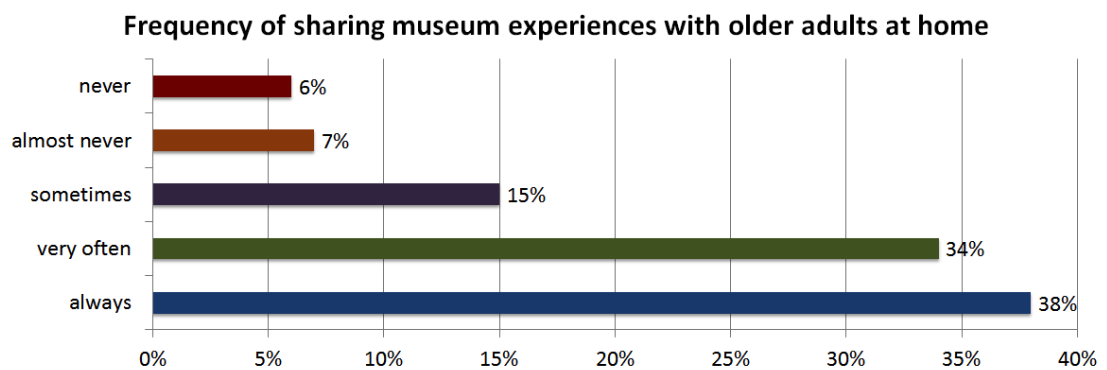


FIGURE 3.19: Visitors always or very often share with their museum experiences with older adult relatives.

3.3.4 Discussion

The study suggests that visitors meet often the older adult relatives, like to and often share museum experiences with them. They mainly share emotions, and they try to use the other means, such as photos and videos. Results also suggest that sharing at home involves engagement in direct communication from both sides and that it involves storytelling and interaction around content. Photos and videos of the exhibition can act as facilitators for discussion and interpretation.

Chapter 4

Sharing Memories with the Help of Technology

4.1 Introduction

The findings from the previous study pointed out that people like to share museum experiences and activities. Information around objects in museums holds potential to tell stories in a new engaging ways to geographically distributed audiences. Following this, there is a need for technologies that support easy access, collection, and presentation of multimedia content. In this section, we introduce an online multimedia system designed to facilitate creation and sharing of museum content.

Given the appropriate means to effectively “save” and collect memories from museum visits, an onsite visitor can create powerful media-rich stories around the objects and better capture the experience. This chapter converges on the concept of capturing and storytelling about museum visits.

We start by investigating what seems to be the biggest limitation for sharing, that is of being able to bookmark or save content in an easy way, and to access and consume it. Bookmarking can be a powerful tool for supporting the learning from museums experiences [92] and creating a stronger relationship between the museum and the visitor. The ability to save an important part of the content encountered during the museum visit and access it at home or in another context allows the visitor the possibility of focusing more on discovery and the aesthetic experience while in the museum and to leave the more traditional didactic aspects for later [18]. Repetition improves saving memories over time [93], so in this sense bookmarking can help increase intrinsic desire

to get back and see more, as well as the possibility to share the positive responses to the exhibition to other people and create interest.

Taken all this into account, we study several ways to support “saving” museum content in a non-intrusive way during a museum visit. The idea is to offer various options ranging from low intrusion and low cost one, which can be used by everyone, people that are technology illiterate, to high-tech options for highly technology literate audiences. We study two different options: pre-printed form with all the artefacts where visitors mark the preferred artefacts and a big screen or kiosk, positioned by the end of the exhibition, where visitors can select the preferred artefacts. By using these bookmarking features, the visitors receive by email a link to a webpage where they can consume the bookmarked content in a form of a booklet. The booklet we developed specifically for Museum of Science and Natural History in Trento (MTSN) is shown in Figure 4.1, and for Museum of Contemporary Art (MART) in Figure 5.1.

Diversità italiana nel mondo



FIGURE 4.1: The booklet we provided in MTSN: participant could read additional descriptions as well as the story behind the presented exhibit. It offered the possibility to be shared on the common social networks on the last page.

The system also supports the social context by providing the possibility to share it on social networks (Facebook, Google+ or to share it via email) and incorporates additional materials from the web to improve the user experience by supporting for an additional curiosity for more information. The booklet contains information about the exhibits as well as more detailed information about their authors. In total, more than 800 booklets were created in both museums. We published the details about the user study in MTSN in [13] and for MART in [14].

We base our research on the following research questions:

1. Are visitors interested in saving memories from their museum visits?



FIGURE 4.2: The interactive booklet in MART offered the possibility to read additional descriptions of the artefacts, more information on the background of the author, as well as the opportunity to share it on common social networks.

2. If provided with tools for saving memories, will the visitors share their memories with others?
3. Will providing a tool for easy sharing increase the sharing as observed without technology?

4.2 Method

We tested the previously described bookmarking features in situ. When visitors were buying the tickets they were told that there's the possibility to create a virtual reminder of the visit. The kiosk was positioned on the exit of the exhibition with two to three researchers were always present around it, and visitors were invited to create the booklet. In the same location, if not interested to use the kiosk or if there was a long queue to use the kiosk, the researchers offered the visitors to select the interesting objects on the pre-printed form and to write down their email, so that we can send them the virtual reminder of the visit. The kiosk was available in MTSN (Figure 4.3) during the Christmas period for three days, from the 4th to 6th of January 2013, and in MART for three days in the period from 30th of March to 1st of April, 2013 (Phase I). We additionally informed the visitors that we'll use the email to ask for personal opinions about the booklet later in the study. One week after that, we sent an email questionnaire¹ (Phase II), to the

¹Questionnaire after bookmarking in museum, MTSN and MART, <http://goo.gl/foFLQH>

visitors that tested the bookmarking features, asking if and with whom they shared the booklet.

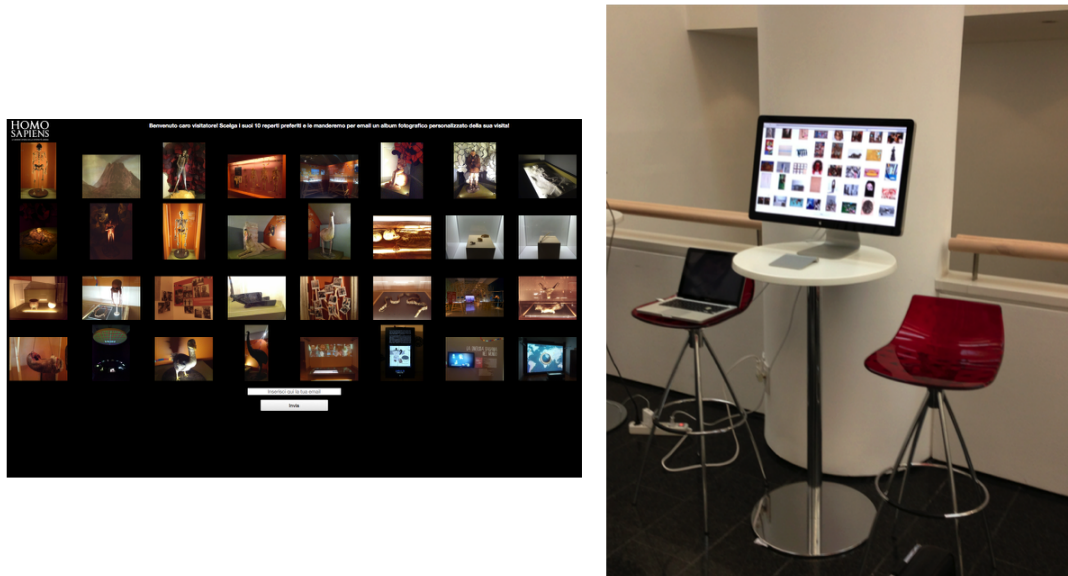


FIGURE 4.3: The visitors in MTSN could select their favourite exhibits from a big touch screen positioned at the exit of the exhibition (a), and the kiosk inside MART where visitors could choose their favourite artefacts by selecting them from the screen positioned at the end of the exhibition (b)

4.3 Participants

For Phase I, we recruited participants inside the museums; at the end of the visit we approached the visitors explaining the possibility to send a digital booklet on their email address. We collected bookmarks of more than 300 visits at MTSN, and more than 500 at MART. The participants in Phase II were visitors from Phase I that responded to our email questionnaire. We collected 93 responses² in MTSN and 120 responses³ in MART.

4.4 Results

The interest in the bookmarking feature was high and visitors were happy about this opportunity. The majority of the visitors (72% in MTSN and 46% in MART) collected as many objects as possible (10), some collected between 6 and 9 objects (22% in MTSN

²Raw data, after bookmarking in MTSN, <http://goo.gl/ud0LqP>

³Raw data, after bookmarking in MART, <http://goo.gl/HCxW9v>

and 36% in MART), and only few selected between 1 and 5 objects (6% in MTSN and 17% in MART) (Figure 4.4).

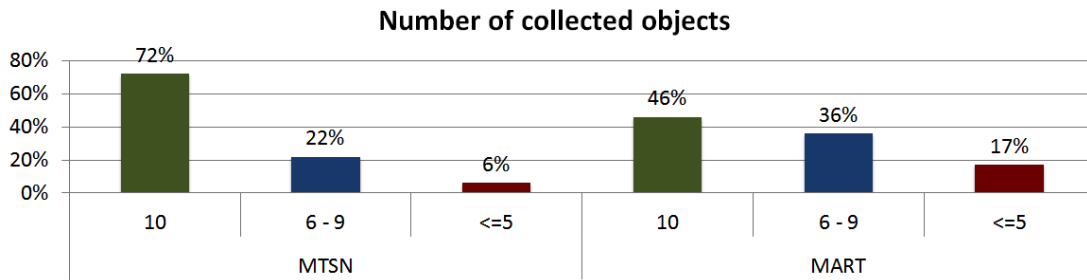


FIGURE 4.4: The majority of the visitors collected the maximum number of objects (10) in both of the museums.

What we were more interested in was understanding whether people really open their booklets and if they show them to their families and friends. Around 53% of the participants in MTSN and 52% in MART read the museum email and accessed their virtual booklet (Figure 4.5). From the results we found that for both of the museums, 30% in MTSN and 34% in MART of the participants showed the booklet to others directly on their computers, and 22% in MTSN and 19% in MART send it via email; the sharing rates on social networks were: 16% for MTSN and 10% for MART (Figure 4.6). Visitors in MTSN shared the booklet predominantly with their family members, 58%, and then friends, 44%, whereas in MART, visitors shared their memories with friends, 58%, and then with family members, 44% (Figure 4.7). We asked the visitors how can be improve the booklet. In MTSN participants asked for more information about the objects (48%), then for more photos (37%), more multimedia content (27%) and possibility to leave a comment (14%). In MART participants asked the most for more photos (51%), then more information (34%), more multimedia content (30%) and possibility to leave a comment (12%) (Figure 4.8).

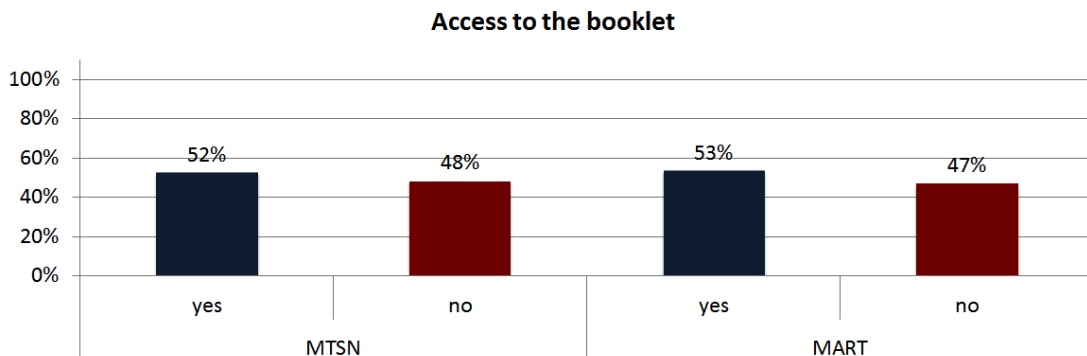


FIGURE 4.5: We traced if visitors open the booklet. More than 50% of the visitors that created a booklet, opened it.

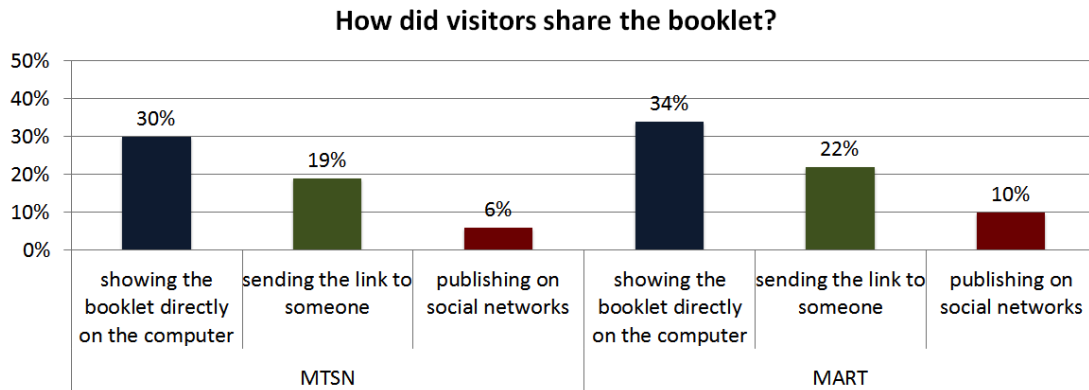


FIGURE 4.6: We traced if visitors open the booklet. More than 50% of the visitors that created a booklet, opened it.

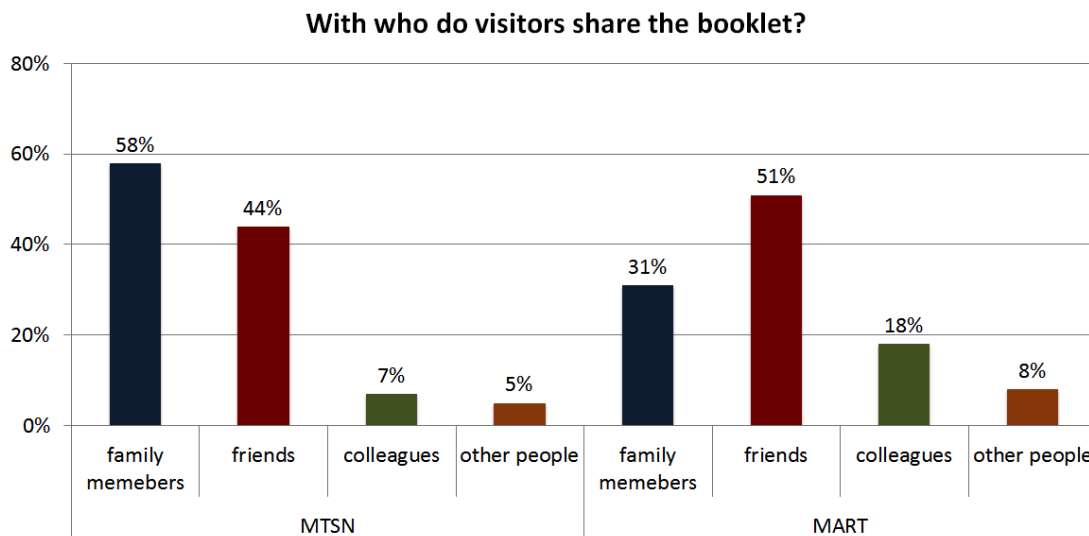


FIGURE 4.7: In the follow up questionnaire we asked the participants with who did they share the booklet. The participants in MTSN shared the booklet with their families, whereas the majority of the participants in MART with their friends.

We investigated the effect of these bookmarking features on sharing. In order to estimate the effect of our approach on the sharing habits of the visitors, we performed a comparison between the results obtained from the previous study, where we investigated what visitors shared after a particular visit (Chapter 3), Phase II (before our approach was introduced), and the results from this study, Phase II (after the introduction of the booklet) by calculations of the odds ratios. Odds ratio is a statistics used to calculate the odds of an event happening given a particular intervention [94]; in this case we wanted to test the effect of our intervention (the big screen in the museum) on sharing, by using the formula: odds for exposed/odds for unexposed. Table 4.1 reports on the general sharing rates (how often people reported that they talked about or shared something after the visit) before and after our intervention. Table 4.2 reports the sharing rates on social networks measured by our system.

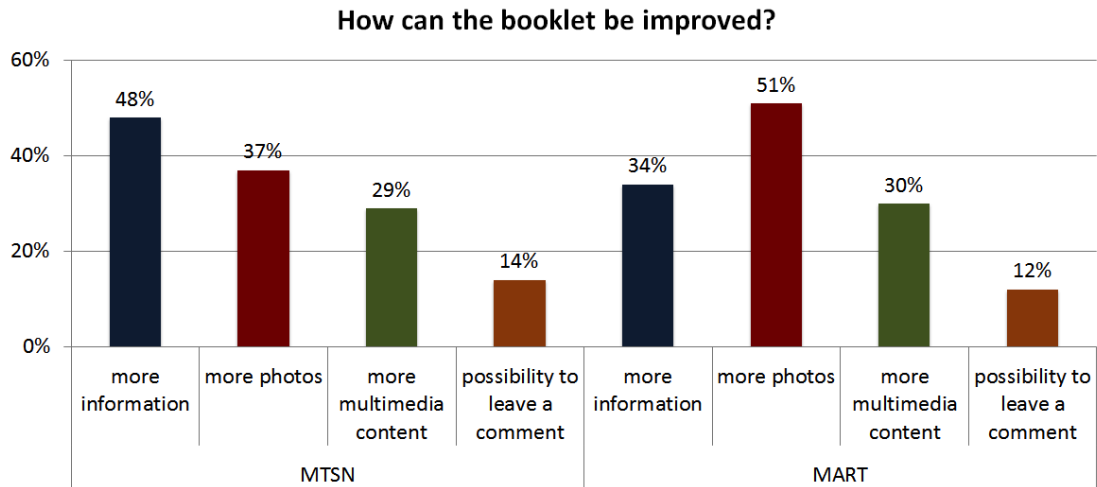


FIGURE 4.8: We also asked the participants how they think the booklet can be improved. In MTSN participants asked for more information about the objects, whereas in MART participants asked for more photos.

TABLE 4.1: Number of people that reported sharing (speaking, talking about) their experiences before and after the introduction of the technological intervention inside the museum

Museum	Condition	Did share	Didn't share	Num. of participants
MART	after intervention	62%	37%	120
MART	before intervention	34%	66%	62
MTSN	after intervention	47%	53%	79
MTSN	before intervention	15%	85%	93

TABLE 4.2: Number of people sharing on social networks before and after the intervention.

Museum	Condition	Did share	Didn't share	Num. of participants
MART	after intervention	10%	90%	120
MART	before intervention	6%	94%	62
MTSN	after intervention	6%	94%	79
MTSN	before intervention	5%	95%	93

The visitors with the big screen in the museum have 4.97 times in MTSN and 3.25 times in MART bigger odds of sharing compared to visitors before our technological intervention. Similarly, the sharing on social networks increased with odds of 1.19 for MTSN and 1.76 for MART after the technological intervention.

4.5 Discussion

We found that visitors are interested in having a virtual reminder of their visit and that given an easy approach to “saving” and later accessing content from home can significantly increase sharing. Visitors with booklets have bigger odds for sharing compared to visitors without booklets. The experiment has also been evaluated very positively by both museums, up to the point that (i) we have been asked to repeat the experiment, and (ii) one of the museums relaxed some of the restrictions they had on the media we could use in the booklet.

Chapter 5

Booklets for Older Adults

5.1 Introduction

Family members and friends are the major source of physical and emotional support for older adults and influence their experienced subjective well-being [95]. Previous research [95] has suggested that leisure participation is positively related to an individual's physical well-being and overall life satisfaction. Participation in hobbies and crafts and visiting friends was positively related to greater psychological well-being and to lower levels of depressive symptoms among all older adults regardless of sex, age, and marital status [96]. Targeting collaborative sharing of museum content is important because it can improve the maintenance of the social ties and it can help older adults to stay in touch with others [97].

In the previous chapter we introduced the booklet, a technological intervention we came up with to allow saving of memories and bringing them home. Motivated by the high acceptance rates of the booklet, in this study we examine if sharing museum experiences can be supported with the booklet for older adults. We study if older adults can consume the bookmarked content from their families, asynchronously, on their own, with the help of our booklet.

We choose to use tablet as a device. Tablets have proven to be useful for older adults because they allow the users to focus only on the screen without requiring attention to input hardware [98]. Additionally, they are lightweight and small-scale, and provide easy Internet access everywhere, tablets could help the usually reluctant to technology older adults to accept them [99]. As a result of these characteristics, the tablet devices have been used as a bridge between older adults and their communities successfully. In the last years and several projects based on exchange of lightweight information took

advantage of the Internet connectivity and camera for sending and receiving messages and photos between and to relatives and friends, such as Wayve [49] or Building Bridges [100].

Several iterations over the initial design of the booklet took place in order to incorporate previous research findings for interfaces for older adults. Previous research has shown that ageing is associated with declines in different interaction abilities that have implications in the design of human-machine interfaces [101, 102]. These abilities are usually described in terms of motor functions (e.g., finger and hand precision), cognitive functions (e.g., attention, working memory, understanding abstract signs), and perception (e.g., visual and auditory acuity). Considering these special abilities, universal design principles and guidelines [101, 102] were followed in the development of the booklet.

The following major design decisions were taken to accommodate potential different interaction abilities:

- Perceptual issues were addressed by following guidelines in terms of legibility of information (e.g., readable typeface and proper font-size).
- Issues in orientation, memory and learnability were addressed by using metaphors to increase recognition and incorporation of previous knowledge.
- Potential issues in terms of interaction were addressed by providing two navigational modes (swipe and tap). In addition, proper visual feedback on actions (e.g., page flip in navigation) was provided to cope with reduced finger sensitivity.

We investigate if older adults are able to consume museum content via four key navigation tasks. The evaluation took place in our collaborating institutions: care home “Toblino” in Malcesine, and the daily centre “Centro Verde”, Trento. In both of the institutions we were helped by the personnel in the whole evaluation process. The topic of the exhibition underlying this study was modern art, developed in collaboration with MART, the museum of modern art in Rovereto, Italy. The booklet contained contemporary art content presented in MART, part of the *La Magnifica Ossessione* exhibition.

We explored if the booklet is intuitive to use for older adults by testing if they can correctly perform its basic interaction gestures. We evaluated four key tasks relevant to the booklet design:

1. Opening the booklet, i.e., starting the application by touching the icon on the home screen (are participants able to open the application?);

2. Browsing the booklet, i.e., consuming the content presented in the booklet (are participants able to navigate, that is, swipe, through the booklet?);
3. Zooming in/out a picture, i.e., exploring the presented content in further depth by zooming the pictures (are participants able to open the picture in a zoomed in mode?); and
4. Closing the picture, i.e., returning to normal browsing (are participants able to close the window that opened after the picture has been opened in zoom mode?).

The tasks we select are also representative of actions to be performed during a remote visit of the museum from home with the help of the booklet. The task of opening the booklet, tests whether older adults are able to open the application independently. The task of browsing the booklet tests the ability to navigate through content. The tasks of zooming in and closing a picture after being zoomed in, test the possibility to access more information about the presented content.

Two groups emerged from our pool of participants, non-impaired and cognitively impaired group, and we decided to investigate how these different groups of participants will perform the tasks and whether some of them find them easier to complete. The aim was to see if familiar gesture interaction principles also mean high rates of correct task performance on the interactive booklet even for the cognitively impaired group.

5.2 Method

We organized two sessions: A pre-evaluation session was held on 5th of June, 2013, in the care home, and on 6th of June, 2013, in the daily centre; and an evaluation session was held on 12th and 13th of June, 2013, in both of the involved institutions. In the pre-evaluation session, participants were briefly introduced to what a tablet is and to the basic functions of the iPad. We explained the participants the different basic features (taking photos, basic browsing) and how they can use them. One week after the pre-evaluation, the actual usability evaluation session took place. In each session, one researcher worked with one participant. The participant was introduced to the basic modalities of interaction with the booklet. The researcher presented the participant with one task after another, asking the participant to perform them and carefully marking the task performance on a predefined observation sheet composed of the four tasks presented above¹. Finally the participant was asked for an opinion about the experience.

For each task we collected the following information:

¹Observation sheet used for the study: <http://goo.gl/w80yZs>



FIGURE 5.1: The final look of the booklet is presented, after it was adapted for older adults.

1. Open the booklet: we asked the participant to press the icon of the booklet application on the home screen in order to open the booklet and observed if they were able to do it; this is not a task on the booklet per se, it is a task of the opening an app on tablet home screen,
2. Browse the booklet: we asked the participants to swipe up to page 3 of the booklet application and observed if they were able to do it,
3. Zoom in/out of picture: we asked the participants to zoom in a picture, and observed their performance,
4. Close the zoomed-in picture: we asked the participants to close the modal window that was open after the picture has been zoomed-in and we observed their performance.

5.3 Participants

Thirty older adult participants took part in this study, 20 participants coming from the care home and 10 from the daily centre. Ten of the care home participants suffered of a significant cognitive impairment; they were all diagnosed with a progressive stage of Alzheimer's disease. We worked with very old adults, our participants had an average age of 80. The daily center on the other hand admits only people that are highly independent and non-impaired older adult individuals. Almost none of the participants reported daily use of computer (except for two) or cell phone (except for four). Some of the participants had reduced mobility: they used wheel chairs and needed assistance. A Folstein test, also known as mini-mental state examination (MMSE) test, was used for screening cognitive impairment [103]. The MMSE index of the participants of the cognitively impaired group was below 14, which classifies them as people with moderate cognitive impairment. We have the cognitive measures only for the participants in the care home. We don't have the cognitive measures for the people in the daily centre, as the daily centre doesn't reveal this kind of information for the people coming there, but we know that they admit only people that are independent and non-impaired.

5.4 Results

Findings are organised according to the four tasks outlined before.

1. *Opening the booklet:* The percentage of participants performing the task correctly for the non-impaired group was relatively high (70%), while for the cognitively impaired group it was 30% (Figure 5.2). Among the reasons for low performance were difficulties with the right sensitivity in touching the screen or shaking hands (difficulties to correctly tap). We understood that the difficulties with correct performance came from the required precision for the interaction and the lack of feedback when tapping icons. Some of the participants also had problems spotting the exact icon on the screen among the others.
2. *Browsing the booklet:* We offered two modalities for navigating: using arrow buttons to move back and forth, and swiping across the screen, i.e., a hand gesture similar also for browsing a physical book. The performance rates were relatively higher compared to the first task, and even the cognitively impaired group had a performance rate of 50%, which was surprising considering the fact that for the other tasks usually less than 50% were able to complete the task (Figure 5.2). One

female participant with Parkinson disease found, in particular, the swiping gesture very natural. What this suggested us is that familiarity of the gesture and its similarity with real life gesture can improve the performance and general usability of the application. Some of the reasons for unsuccess were lack of sensibility and lack of will to participate, which was dependent on the mood of the participants on the day of the study.

3. *Zooming in/out a picture*: This task required less precision, in that any form of tapping on the image resulted in a correct task completion. The performance was however lower for the cognitively impaired group compared to the booklet browsing task (Figure 5.2). Our assumption is that the task was not evident and intuitive, especially for the people with cognitive impairment. Participants easily forgot how to perform the task, although correctly instructed on how to do it. One intuition may be that the task of zooming in/out did not resemble any gesture used in real-life booklet browsing.
4. *Closing the picture*: This feature was neither evident nor intuitive to our participants. It also required more precision when tapping. We observed the same problem with the participants with cognitive impairment like in the previous task, the participants were prone to forget how to perform the task. The general performance for this task was lowest across all the tasks (Figure 5.2).

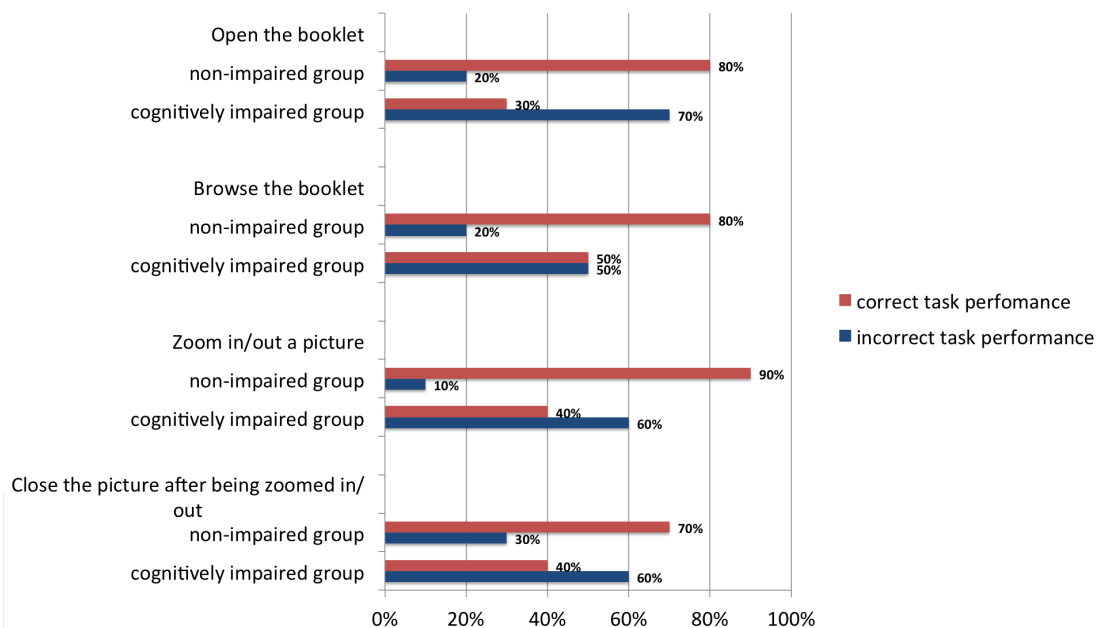


FIGURE 5.2: Usability evaluation of the booklet: the healthy participant were generally able to consume the content, 80% of them were able to browse the book; participants with cognitive impairments performed the task of browsing the booklet with a higher success rate compared to performance on other tasks.

5.5 Discussion

Our booklet enables older adults to consume content, especially the non-impaired ones. There was no significant outperformance on any of the tasks compared to the rest of the tasks for the non-impaired group, as confirmed by a one-way ANOVA ($F(3,36) = 0.39$, $p = 0.76$). Browsing seems like an intuitive task for the cognitively impaired participants although we didn't find statistical evidence also for this: a one-way ANOVA statistical analysis confirms that there was no statistically significant outperformance on any task compared to the rest of the tasks also for cognitively impaired adults ($F(3,36) = 0.26$, $p = 0.85$).

We understood that our participants were able to use our application to some extent. We observed that people had problems with consuming the content on their own, because of several reasons, such as difficulties with the right sensitivity in touching the screen or shaking hands. To the best of our understanding, the reported low performance in this group could additionally be result of the fact that we worked with really old participants, previous research has shown that for the group of older old (80+), a complex set of factors, such as social, attitudinal, physical, digital literacy, and usability, influence the acceptance of technologies [104]. Zooming in or out a picture, or closing the picture after the picture had been opened in zoomed-in mode was difficult and non-intuitive to our cognitively impaired participants. We understood that we could improve the interaction significantly if we simplified those interactions that require precision and made the application more responsive to different sensitivity and shaking hands, by making the tap spaces bigger and making the application responsive to different tap patterns that we observed in our participants.

Part II

Part: Participation

Chapter 6

Feasibility of Remote Participation for Older Adults

6.1 Introduction

Museums are becoming more technological. Audio guides, kiosks, and touchscreen have been in use in the museums for some time: museums have supported the design and implementation of various interactive tools, which enhances the museum experience for diverse audiences. The dynamic nature of the museum, renders it a fertile groups for studying visitors behaviour and envisioning new systems for visitors inside the museum, however, in the same time, it makes it really difficult for people to visit it from remote. Museums cannot reach many who would like to access the collections and see its contents. In the following chapters we explore possibilities for virtual participation for home and by this enlarging audience “access” to museums.

In this section we specifically focus on older adults actively participating in a museum visit from remote.

For the purpose of experiment we study the state-of-the-art systems and software applications already present. The works and studies on remote participation in museum visits [67–69] have identified the key elements of remote visit: social interaction with companions while co-visiting, mutual visibility, spatial awareness. Combining them with the results from research on social isolation [7–9] that show that communication and virtual technologies can lower social and spatial barriers for older adults, we design our approach. We take the findings of these works as valuable input and we base our work on them: having audio channel was shown as instrumental in the Lighthouse project for remote visiting, tracking visitors’ position for seamless delivery of information was

essential in PIL [5] and ReGroup [29], conceptual insights about how the tackle social aspect (shared listening for instance) during the museum visits was informed by the work of SottoVoce [27] and ARCHI [32]. These works mainly focus on generic users only, our works advances previous work by investigating how to take into account the particular needs of older adults in this scenario.

We develop an intervention, that is, a software application for the virtual, remote participation in museum visits. The concept of the approach is illustrated in Figure 6.1;

The intervention studied in the rest of this article specifically focuses on the remote visitor: A group of people that visits a museum (the *onsite visitors*) are equipped with a tablet (an Apple iPad) running an *onsite application* that enables (i) tracking the location of each individual onsite visitor inside the museum (with the help of purposefully installed beacons for the positioning) and (ii) establishing an *audio channel* with the remote participant. The *remote visitor* operates a similar tablet application (again an Apple iPad, particularly suitable to older adults without considerable computer skills) inside the own house or care home and is able to follow the onsite visitor in their movements inside the museum and to engage in conversations with them via the audio channel. All data exchanges and interactions leverage on the Internet as communication channel.

The practical implementation is illustrated in Figure 6.2: the central server hosts two types of servers: positioning server, responsible for tracking the location of each individual onsite visitor inside the museum, with the help of iBeacons carefully located next to objects, and VOIP (audio) server: responsible for establishing the audio channel between the onsite and remote participants. We developed two interventions, that is two software applications, one for the onsite visitors (native iOS application) and one for the remote participants (web application in browser). The server additionally hosts the backend (or the APIs) serving both of the applications. All data exchanges and interactions leverage on the Internet as communication channel and are mediated by a centralized application server.

For the sake of this paper, we focus on the remote visitors and the app we run on their tablets at home or in their care homes. The museum visit and the presence of onsite visitors is emulated by an instructed operator (a *guide*) of the research team.

In order to test whether this approach indeed makes our targeted group to participate in remote museum visits from their home, we designed a user study that we present in the following. The purpose of the research goes beyond understanding of how to show museum content to older adults at home but rather aims to investigate how to integrate the person from home into a real visit in a museum by family members. To



FIGURE 6.1: In our scenario, the older adult participants in the museum visit from home, via tablet application.

our knowledge, no previous studies have researched technology for social family museum experience between older adults from home and family members in the museum environment.

We study under which conditions (software design) remote participation to museum visits is most accessible to older adults. The goal is to investigate the factors of feasibility and the potential limitations. In particular, we evaluate if older adults are able to participate in remote museum visits through virtual environments through examining the following three hypotheses:

1. Participants are able to understand the tour;
2. Participants are able to follow the tour; and
3. Participants are able to engage in contextual conversation.

6.2 Method

We took the following design dimensions into account for the experiment: (1) visual metaphor for the visit: *book* (represents only the artefacts in the museum, the user browse through the content) vs. *virtual tour* (represents the museum space with the artefacts, the user navigates in a virtual representation of the museum); (2) interaction: *interaction-free* navigation (the onsite visitor is a “guide” in the tour) vs. *interactive* navigation (the older adult navigates on its own or can decide to follow onsite visitor in the visit).

We studied remote participation with the help of two different applications. One application is in the form of a digital booklet (Figure 6.3). The booklet contains information

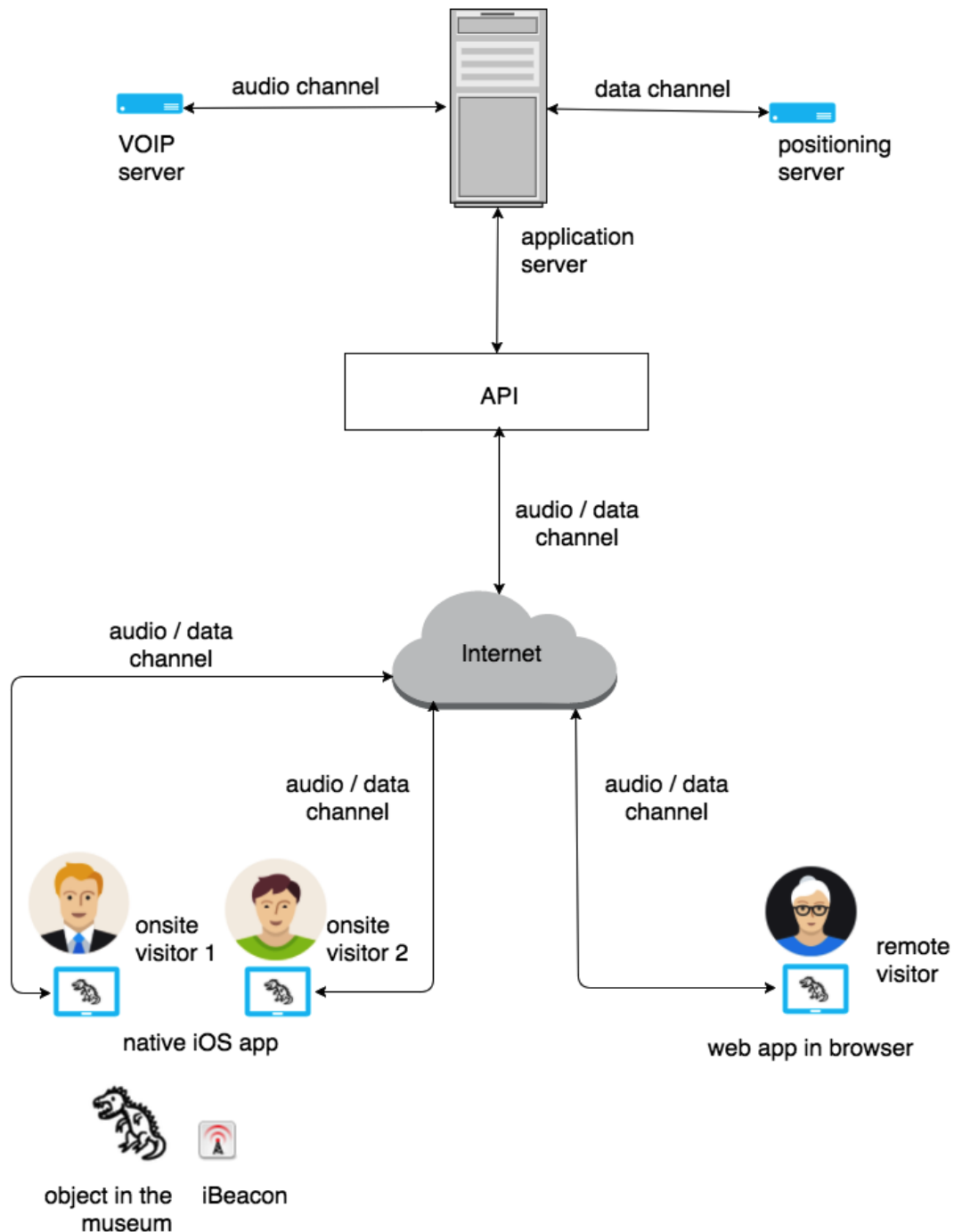


FIGURE 6.2: The position of the onsite visitor is determined via beacons positioned around artefacts in the museum. The onsite application delivers content to the onsite visitor based on the mapping between beacons and artefacts. The same content is delivered to the remote visitor at home. There is an audio channel between the remote and onsite visitor.

about the artefacts as well as more detailed information about their authors, origin and date of creation as in the previous study. This time the booklet additionally supports an audio channel and photo bookmarks, representing the people physically visiting the

museum. If the person is ahead on the path, the bookmark points to a page ahead in the book (it is positioned on the left hand side), if the person is behind on the path, the bookmark points to a page behind in the book (right hand side of the book). The screenshot shown in Figure 6.3 (a) is the final result after several adaptations of the booklet for our target group. The other application is a 3D gallery¹, a free app for iPad that provides a small set of simple movements for exploring 3D galleries.



FIGURE 6.3: Screenshot of the applications used for the feasibility testing, the booklet app is enhanced with a photo bookmark that indicates the position of the guide, if the guide is ahead, the bookmark is on the left hand side, if the guide is behind, the bookmark is on the right hand side (a), the 3D gallery app allows free navigation in the museum gallery (b).

We presented participants with the following three interface designs:

- Interaction-free, guided tour (F): the participant is led by the onsite member in the visit, using the booklet interface;
- Interactive, guided tour (I): the participant either follows the onsite visitor or explores the content on her own: if exploring on her own she can always re-join the onsite visitor and continue following him, using the booklet interface; and
- Interactive, virtual reality tour (V): the participant freely navigates in a 3D museum using the 3D Gallery app.

The rationale for selecting these designs stems from what we understood from the previous study and what our participants said in the last usr study in the post-experience debrief. The booklet was easy to use so in the previous study so I decided to keep it, however since it was not conveying the space dimension, we additionally explored also

¹3D Gallery app in the Apple Store: <http://goo.gl/dVNjej>

a 3D environment. Some of the participants also expressed preference for a passive use, without having to interact with the system, so we propose the interaction-free paradigm. Considering that virtual 3D tours usually require a good set of skills, which my participants didn't have, we specifically selected an easy to use 3D application among many of the application on the Web. We presented the interface asking them if they would feel comfortable navigating it or not. If they did not feel comfortable, we stopped this part of the experiment. The study sessions in the care home always involved the psychologist of the care home, so as to assure that none of the participants was forced to do anything he/she didn't want to or was exposed to unpleasant conditions.

We conducted a field visit for each participant, in the month of February, 2014. 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. Each visit consisted in an approximately 30 to 45 minutes session conducted by two researchers, one onsite and one remote. The onsite researcher introduced the purpose of the visit, explaining the participants that they were about to remotely visit a museum with a collaborator that is inside the museum inspecting the objects in front of him/her. The researcher also explained how to use the photo bookmark feature to derive the position of the guide in the museum. For each hypothesis we collected data (in the form of observations of use²) in order to assess them. We asked the participants to rank the interfaces on two criteria: ease of use and aesthetical appeal. We discussed the personal opinions of the participants with a post-use questionnaire at the end of the session.

We decided to test the hypothesis in a realistic museum setting, a museum that my participants would actually visit. We created a small museum of old crafts, with an exhibition covering crafts from the past, a topic suggested as interesting for the participants by the personnel in the care home.

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

1. 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 beginning 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.

²Observation sheet and post-use questionnaire used for the study: <http://goo.gl/v0eRf2>

2. 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.
3. We observed if participants engaged in contextual conversations by observing whether they used the available audio channel or not for discussions around exhibits.

6.3 Participants

We recruited 30 older adult participants for this study: 16 in the care home (12 of which with significant cognitive decline), and 14 participants in the daily center. The participants were 4 men and 26 women whose age range was 70-93. The demographics of the participants showed no prior use of technology, with only few participants reporting use of cell phones for communication with their relatives.

6.4 Results

The findings are presented in the order of the three hypothesis outlined before.

1. *Ability to understand the tour:* The results showed that 83% of the participants in the interaction-free tour, 80% in the interactive guided design, and 70% in the virtual tour were able to understand the tour (Figure 6.4). A one-way ANOVA statistical analysis confirms that there was no statistically significant difference between the three different designs ($F(2,87) = 0.46$, $p = 0.63$).
2. *Ability to follow the tour:* Reaching the position of the guide was partially successful only for the booklet interface (50% of the participants, see Figure 6.4); for the virtual reality environment there was no success (only 3% of the participants were able to arrive to the position). Next, the remote collaborator moved to a new position, asking the participant to *follow* him to the next exhibit. Again, for the booklet interface there was a partial success (46%) and no success for the virtual environment (again only 3% of success rate). Pairwise 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 ($t(58) = 3.39, p < 0.01$).

3. *Ability to engage in contextual conversation.* Engagement in conversation around objects happened in all the designs; 80% of the participants in the interaction-free and interactive tour and 70% of the participants in the virtual tour engaged in further conversation about the exhibits (Figure 6.4). There was no statistically significant difference between the three designs in terms of engaging in conversation as determined by a one-way ANOVA test ($F(2,87) = 0.55, p = 0.57$).

We debriefed our participants about their experience in the post-use questionnaire, and it told us several things. Most of our participants found the content interesting, they were really happy to speak about the old crafts especially for the ones that they were familiar with. Typically, the exploration of an exhibit included identifying what is presented to both participant and remote researcher; contributing information about the exhibit, such as a description of the craft presented; or adding information related to the exhibit, for instance, where a photo was taken. Some of the participants had been craftsman in the past and they shared personal stories with the remote collaborator. Content about their past experience resulted in vivid and sometimes funny conversations. 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”. We observed that an affective and emotional rather than a scholarly 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 majority of the participants aesthetically preferred the 3D environment (it got the highest number of first ranks as the most aesthetically appealing). However, almost no participant could actually use it effectively. The interaction-free booklet got the most votes for being easiest to use. Some of the participants expressed a clear preference for the interaction-free interface. Augusta, 90 years old, said: “I’m too old, and I cannot see well. It is so much easier for me to just follow, without having to interact myself.” She had never used similar technologies before and thought that the booklet was easy to use because it felt “just like a normal book”. Several participants that understood well how to navigate in the booklet and the incentive to follow the collaborator, were however slow in their reaction to move forward/backward, due to shaking hands and/or mobility problems. Moving in 3D was impossible for these participants.

The audio-channel was a favourable feature of the application. We asked if participants 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, 33% preferred a mix of both, but none of them preferred to visit alone. One of the participants commented: “Since the content was interesting, I would also browse on my own, but in general I prefer to go visiting a museum in a company.” For this participant in particular, it was easy to follow the collaborator, always understanding where he was located.

Some of the issues were going beyond the scope of the study. For instance, some of the participants expressed that they felt too old for using technology or that a past life event had made them lose will for anything. These comments suggest that further investigations should explore how to motivate older adults to use technology and to encourage older adults’ participation to social activities.

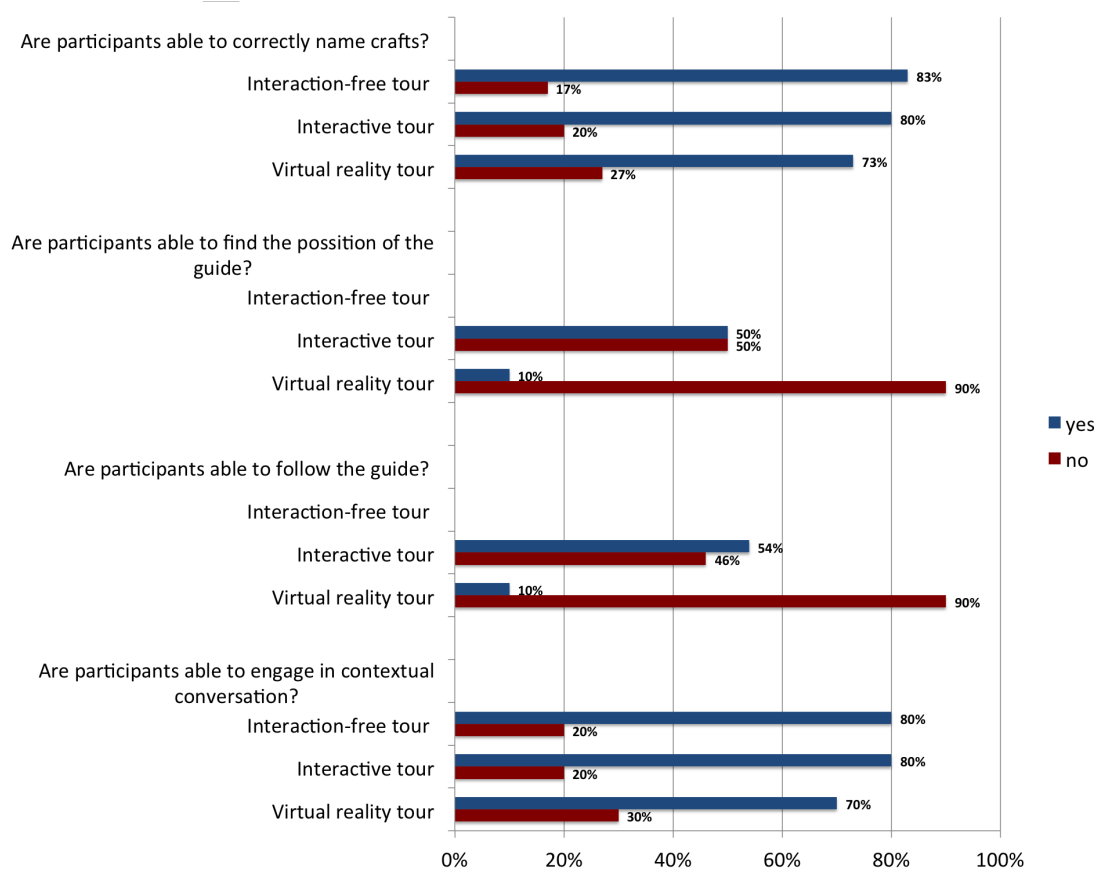


FIGURE 6.4: Results of the feasibility user study: data collected for the three designs for remote museum participation by older adults. Interaction-free design assumed constant following of the guide therefore no data were collected for the questions regarding finding and following the guide.

6.5 Discussion

Our feasibility study shows that participating in museum visits for older adults from remote is not trivial, however it’s feasible. We understood that participants were well

able to understand content and engage in the remote visits; the ability to follow the tour was dependent on the interface design. The interaction-free paradigm was found the most suitable interaction paradigm, the virtual reality tour design the most aesthetically appealing.

Chapter 7

Remote Participation in a Museum Visit: Drama-based Approach

7.1 Introduction

Museums constantly “tell stories” through representation of their collections [105]. Incorporating a form of narrative in a museum comes as a natural extension to the basic museum function as a storyteller. Additionally, storytelling can contribute to make exhibition and content more accessible and engaging for different audiences [106, 107]. Narrative and stories are important for mental immersion through which users can be engaged and involved in the experience, increasing their sense of mediated presence as well [76]. Using entertaining stories can improve the overall engagement of the visitors and immersion, interestingness and believability are important for engagement.

In this chapter we propose a new method for visiting museum from home based on drama. In our scenario, we investigate how a remote visitors (older adult in our case) can take *active* part in *small group visit*. The remote participant (older adult) is at home, and a group of onsite visitors is in the museum. The people in the museum are all equipped with tablets, these tablets capture their position and deliver information about the near by objects instantaneously. The remote participant in our scenario chooses to an onsite visitor to follow in the visit and information about what the onsite visitors sees are delivered to the remote visitor too. During the visit, the group (onsite visitor and the remote older adult) collaborate between each other and they discuss the presented objects. Pieces of a story, specifically written to connect the objects on the museum path, are delivered when the all the group members are near the triggering object. The

story thus covers the objects on the path and progresses along with the live visit. This system has the following technological components:

1. mobile application for the onsite visitors able to capture their location and deliver contextual content
2. application server that processes the received positions of the onsite visitors and delivers data to all the mobile applications
3. mobile application for the remote visitor that delivers content about the onsite visitors

Our main objective is to get a general feedback around remote visiting for older adults and possible improvements on whole user experience. Qualitative research methods (observations, semi-structured interviews, and content analysis) together with quantitative research methods (statistical analysis of data gathered from standardised questionnaires) are used as means to better understand perceptions and the willingness to use technology. The wider goal of the this research is to understand:

1. older adults' view on what the proposed remote visiting system means for them and how it may be used,
2. older adults' perceived usefulness and suitability and,
3. criteria for older adults to accept and use the system

We report here on our results to underline the potential of technology like this to help decrease isolation of older adults and how technology like this can be used in a care home. The following research questions were investigated:

1. Does remote participant enjoy the visit in the drama-based approach? Our first research question is directed to understand if and how enjoyable the visit is with the help of our system. Given the fact that the remote participant is visiting together with the onsite group we expect participant to enjoy the visit.
2. Does remote participant engage in the visit in a drama-based approach? With this question we want to investigate if the participant actively engages in the visit per se, or participant participates in the experiment without actually having any interested in it. In an interactive visit like ours, we expect engagement to take place and to have an effect on enjoyment and the sense of social and spatial presence.

3. Does the remote participant experience spatial presence in a drama-based approach? This question is directed at the sense of feeling of "being there", and we expect participants to experience spatial presence.
4. Does remote participant experience social closeness with the rest of the group in a drama-based approach? Does remote participant feel as he/she are part of the group? With this question we want to investigate the ability of our application to create the feeling of "being there with someone", and if participants feels as he/she is part of the group.
5. Do the dynamics of the onsite group influence the experience of the remote participant? Is the remote participant experience correlated with the dynamics of the onsite group? I.e if the group remains closer during the visit, does the remote participant enjoys or engages more in the visit? If the visits lasts longer will the remote participant enjoys/engages more? We expect that there'll be a positive correlation.

7.2 Method

To inform our method better and to investigate content and context in which our idea would work we conducted two interviews with an educator and a psychologist in a care home and a daily centre respectively, familiar with the final aim of the project and its scope. We asked which themes to incorporate in the story in order to make the experience more engaging and fun, and which themes would arouse more interest and curiosity in the older adult. In both of the interviews, we understood that a greater co-involvement from the elderly can be achieved if there are social elements in the story (maybe even more than the drama), and that the drama and the social aspects of it can induce engagement, even if there's no interest for museum content per se. Also, from the interviews we understood that if we want to create a more affective experience it would be better if the stories for the artefacts somehow relate to something they already know, or to the territory (Trentino), and that for instance telling that the dinosaurs was found in a place near by could create more interest and curiosity. The caregivers additionally proposed our method as a tool for a small group of older adults (friends) staying together in the care home. All the information gathered informed and fed the decisions made about the project.

Taking all the input, we designed a system that allows the remote older adults persons to join a group visiting the museum.

The system tracks visitors' location inside the museum and presents visitors relevant information as they are arriving to an object. The system delivers the same digital content synchronously to the remote participant: the application server sends each second an update to all the clients, informing them about the position of each onsite client. The remote visitor in the same time uses the remote application inside the care home and is able to follow the onsite visitor in their movements inside the museum and to engage in conversations with them via the audio channel. The implementation was described in the previous Chapter, Figure 6.1. The specific drama-approach and scenario are depicted in Figure 7.1.

As previously mentioned, the system incorporates a *story*, written by a professional studio, connecting the objects on the path (Figure 7.2, for the full description of the story see Appendix B). Selected objects on the path are associated with specific story segments. The story segment are delivered to both, onsite and remote visitor(s) only if all the onsite visitors are close to the triggering object. For one minute after a drama has been played, the system enters an *observe stage*, where the system does not deliver any new information to the clients. The audio channel is open, and all participants can discuss further the presented content. Several *connectors*, i.e small phrases that support and inspire discussion, are played in observe stage to encourage conversation if there's a lack of ideas about what to talk. The story is about two aliens landing close to the museum, not familiar with the history of the planet Earth. They learn more about the evolution on Earth based on the exhibits in the exhibition. Each object they progress further, they discover a new information about the story of evolution progressively. The story ends with aliens discovering an important insight that may save their race from extinction.

We focus on the remote visitors and the remote visiting application (Figure 7.4). The interface is in a form of a theatre stage. The "journey" to the museum starts by a small animation where the curtains on the stage open. After the curtains are open, the users are presented with the onsite visitors who are depicted standing on the stage (at this phase the theatre stage has an empty background), and they can choose the person from the group to follow in the visit (the selection is performed by touching the figure of the person on the stage). Once the user selects the onsite visitor to follow, the application does not require any further interaction. The theatre background is automatically updated based on the object in front of which is selected person is standing, and participant can see the group members currently seeing the same object as she (located at the same object). If all the participant are standing and watching an object that has a story segment associated with it, the systems enters in drama state: the curtains close, the aliens appear on stage, the onsite members face towards the presented object, the

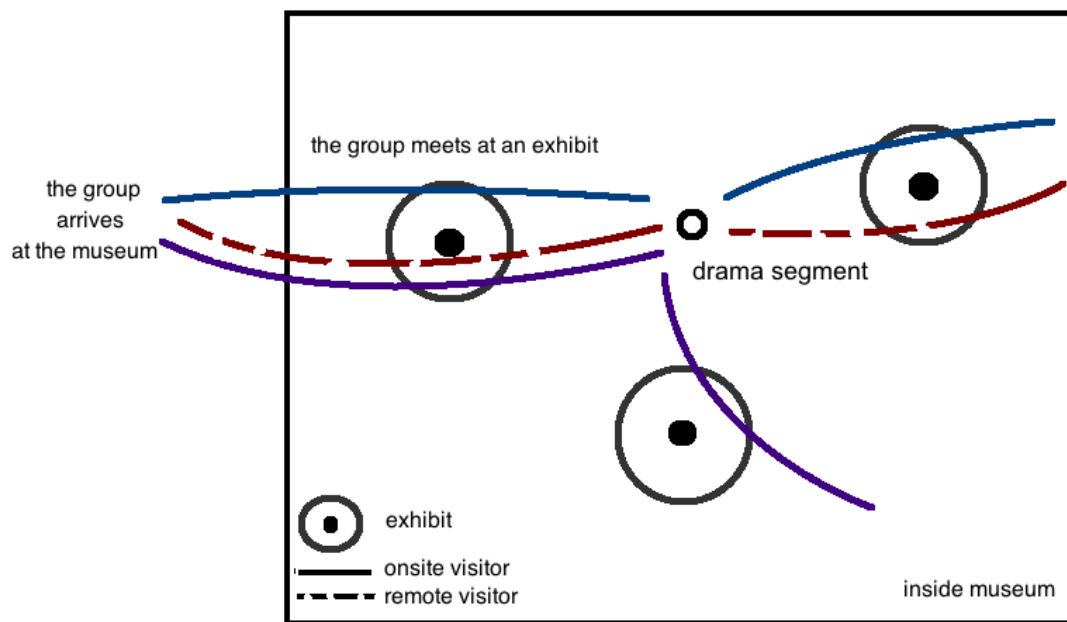


FIGURE 7.1: In our drama approach, the remote visitor chooses one of the onsite visitors to follow in the visit. The update in the position of the selected onsite visitor, means an update of the position of the remote visitor too. When the whole group is around an object that has a drama segment associated with it, drama segments starts to play.

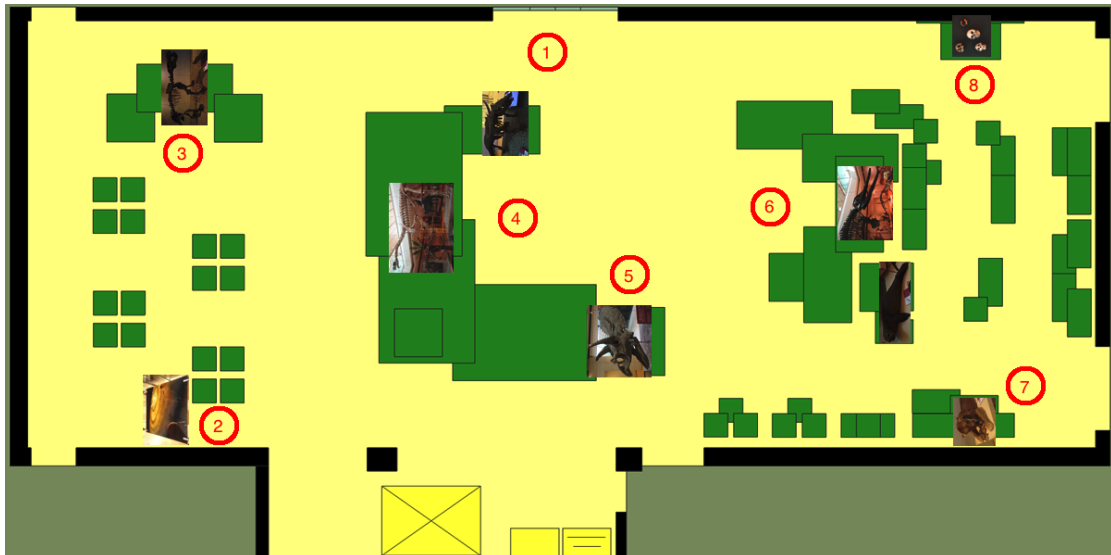


FIGURE 7.2: Each circle depicts a position where there's a drama segment. The circles are in chronological order.

curtains open again and an audio story segment starts. The audio channel is closed during a story segment, people are not able to talk (Figure ??).

We used the following measures for our study.

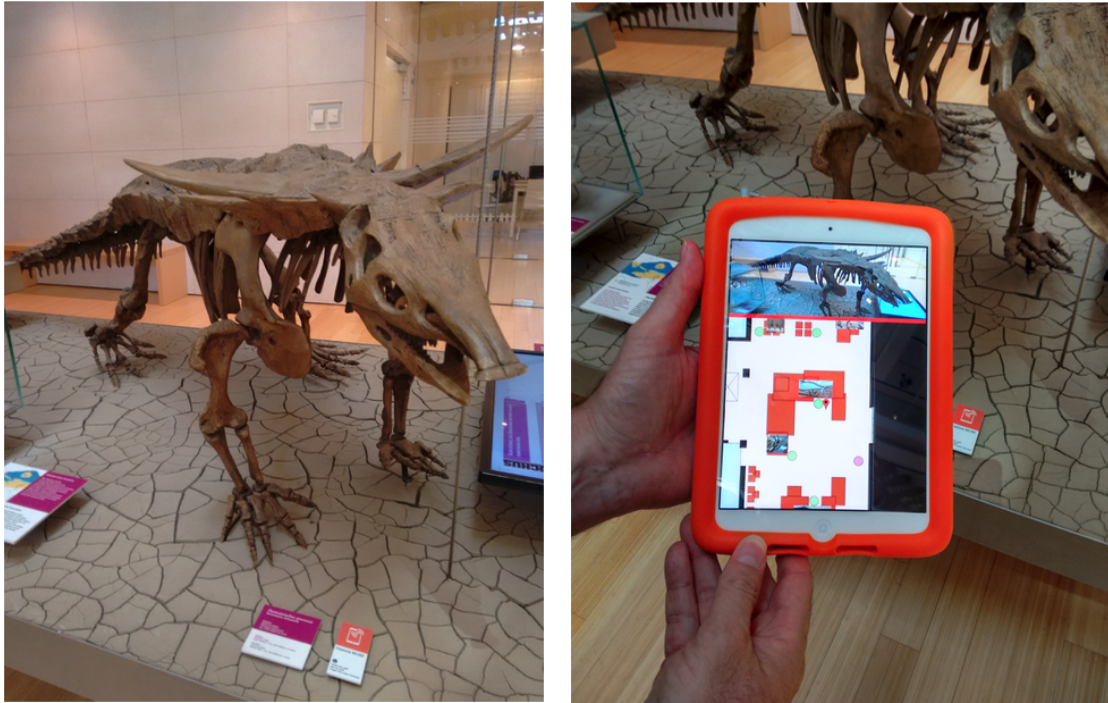


FIGURE 7.3: An object inside the museum with an iBeacon next to it (a) and the onsite application after the iBeacon has been detected (b)

Engagement ITC-Sense of Presence Inventory (ICT-SOPI) questionnaire [108], a standardized technology-agnostic presence scale that consists of 46-items, each validated for independent use. We used the Engagement sub-scale (e.g., “I felt involved (in the displayed environment)”, “I enjoyed myself“, “My experience was intense”).

Spatial presence The ICT-SOPI questionnaire was also used here, using the Sense of Physical Space sub-scale measuring the sense of being located in another place, in this case the museum (e.g., “I had a sense of being in the scenes displayed”, “I felt I could have reached out and touched things (in the displayed environment)”).

Social closeness The Inclusion of Other in Self scale (IOS) [109] is a single-item, graphical measure that shows two circles for self and others at various levels of distance until they substantially overlap. Our participants indicated which one represents best the perceived interaction with the onsite companions.

Enjoyment Four items on a five-point Likert scale from the GEQ scale [110] measured enjoyment in the experience (e.g., “I enjoyed the experience”).

Onsite group data We collected the following data regarding the onsite visitors.

1. The position of each onsite member each second
2. The state of the system in each second, i.e in drama, observe or just visiting

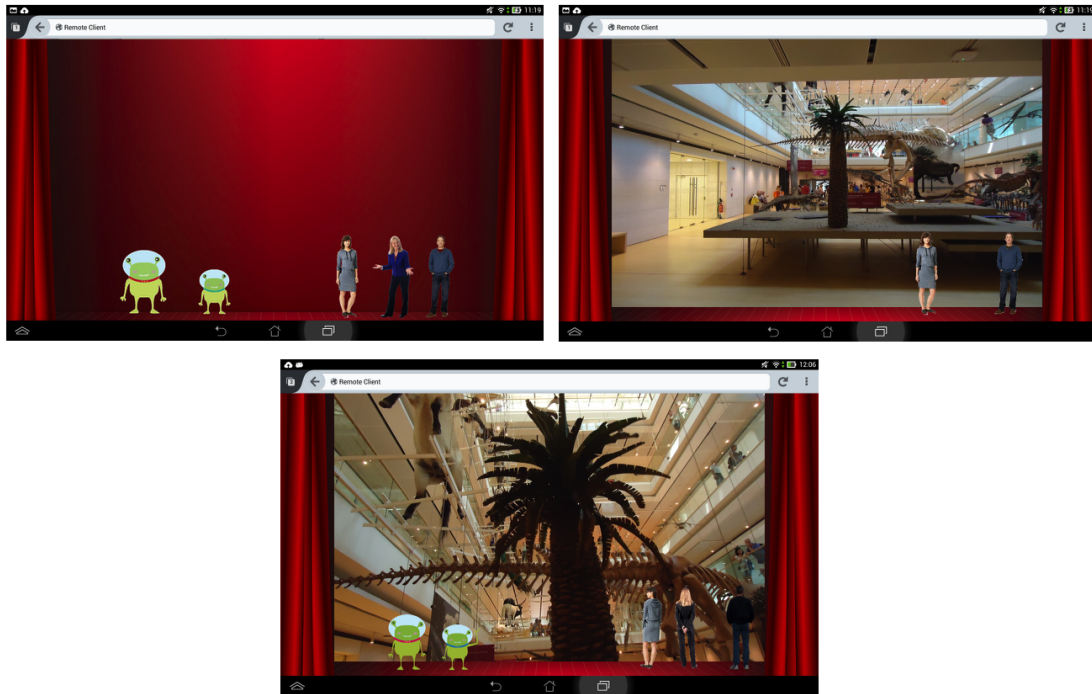


FIGURE 7.4: Remote visiting application: all the onsite companions are presented at the stage, and the remote participant has the option to choose who to follow in the visit (a), after the older adults selects the person to follow, the background is automatically updated with a picture of the object that the selected onsite visitor is seeing (b), and when all the onsite companions are at the same object, and there is a story segment associated with this object, the system enters in drama state, the group starts to listen to a story segment, the onsite participants are facing the object and there are aliens on the stage, telling the story of the object.

3. Audio recordings of the sessions

We had three extra remaining questions examining perceived suitability of the application for visiting museums from remote, usefulness for the envisioned task, and whether participants would use it for visiting other museums. Each item was a statement, and we invited participants to state the level up to which they agree or disagree with the statement on through 5-point Likert scale, with 1 = "totally disagree" and 5 = "totally agree".

Testing, approved by the University of Trento ethical committee, was conducted in diverse sessions at the care home Azienda Feltrina of each participating older adult. After participants signed the informed consent form, the experimenter introduced the study and informed the subject(s) that they are helping researchers to test a software intervention for remote participation in museum visit of an onsite group coming from the same town. Experimenter informed the subject(s) that they will complete a questionnaire assessing the experience at the end of the study. Then the experimenter introduced the application, explaining the way it works. The subject(s) were explained that the onsite

visitors are watching the same museum content that is delivered to them. After assuring that subjects understood the purpose of the application, the experimenter established the link with the onsite visitors in the museum. The onsite visitors guided the subject through the visit, interacting with the subject via audio channel communication.

A summary of the procedure steps:

1. Participant signs the consent form
2. General introduction by experimenter about the purpose of the study
3. Experimenter explains how the tool works
4. Link is established the onsite visitors
5. Questionnaire is admitted to the subject at the end of the experiment

The experimenter observed the behaviour of the user, and took notes on potential design or communication problems.

7.3 Participants

We had two types of participants:

- **onsite visitor(s)**: people experiencing an interactive story inside the museum delivered by our system. They are invited to join the drama adventure when entering the museum. They participate through iPad, receiving information from the system, and according to their position, and they immerse into the drama. They can also communicate between themselves and with the remote visitor via an audio channel.
- **remote visitor(s)**: older adult individuals at care home experiencing an interactive story delivered by our system and presented in a way specifically tailored for them. They are invited to join the shared adventures with the rest of the group members that are inside the museum when virtually entering the museum. They also participate through tablet, receiving information from the system, according to the group position. They also can communicate around the delivered content and information with the onsite visitors.

A summary of the involved parties in the study is shown in Table 7.1.

Older adult participants were selected from a care home distant from the museum, home for many older adults with physical difficulties to move. They were participating in the experiment assisted by a research assistant that was responsible for establishing the connection with the museum, introducing the subjects to the experiment and submitting the questionnaire at the end of the study. The research assistant also took observations in form of observation notes (regarding how participants behaved) during the session.

Older adults were screened based on their functional cognitive level. Short Portable Mental Status Questionnaire (SPMSQ) [111] is a short questionnaire assessing levels of intellectual functioning for older adults: a score between 0 and 2 corresponds to intact intellectual functioning, 3 to 4 indicates mild intellectual impairment, 5 to 7 corresponds to moderate intellectual impairment and 8 to 10 indicates severe intellectual impairment. We investigate if our tool can be used and is appropriate for older adults with diverse abilities, so we only excluded participants with severe intellectual impairment and for the purpose of the experiment we choose participants with SPMSQ score below 7. The caregivers verbally invited the older adults in the care home (that fulfil the criteria) to participate in the study, explaining the details of it. The selected care home is a rather big structure so we had only participants that showed interest on their own in participating.

Younger adults were recruited through word of mouth inside the care home. The young adults were offered free entrance to the museum. They were relatives of the care home personnel or part of the personnel but not care givers or people directly working with the participants. They did not know the older adult participants personally, although they were quite well familiar with the dynamics of the care home, and the everyday life of older adults in it. The younger adults, participated in the study from the museum, and were welcomed by another research assistant explaining them how to use the tool. We choose to have younger older adults from the same place because of the cultural differences: building the feeling of closeness would be much easier with people coming from the same place. Additionally, people somehow familiar with the everyday lifestyle in the care home, would know which arguments can potentially be sensitive to older adults, something that a family would not bring as an argument.

Each session lasted around 45 minutes and we had 15 older adults that showed interest in participating. Three participants did not take part: 2 due to audio problems at the scheduled session and 1 did not feel like participating that day, which left us with 12 participants in total. This is in line with the existing research [112] that recommends that for distributed research like ours, where the participants can't come by themselves,

to have approximately 10 participants. The background data about each participant is given in Table 7.2.

TABLE 7.1: Participants in the experiment

Participant	Description
Remote visitor(s)	Older adult(s), participating from care home
Onsite visitor(s)	Young adult(s), participating from the museum
Experimenter 1	Introducing the remote visitor(s) to the experiment
Experimenter 2	Introducing the onsite visitor(s) to the experiment

TABLE 7.2: Background data of the participants

ID	Age	Gender	SPMSQ	Co-visitors
P1	81	Female	2	Visited with P2 and 1 onsite visitor
P2	88	Female	1	Visited with P1 and 1 onsite visitor
P3	92	Female	0	Visited with P4 and 1 onsite visitor
P4	79	Female	2	Visited with P3 and 1 onsite visitor
P5	88	Female	0	Visited with 1 onsite visitor
P6	81	Female	5	Visited with 2 onsite visitors
P7	82	Male	5	Visited with 2 onsite visitors
P8	88	Female	0	Visited with P9 and 1 onsite visitor
P9	95	Female	3	Visited with P8 and 1 onsite visitor
P10	73	Female	1	Visited with 1 onsite visitor
P11	76	Female	0	Visited with P12 and 1 onsite visitors
P12	89	Female	1	Visited with P11 and 1 onsite visitors
P13	84	Female	0	Did not participate due to audio problems
P14	91	Female	2	Did not participate due to audio problems
P15	81	Female	1	Decided not to participate just before the session

7.4 Results

The three participants, who did not finish the study and did not completed the questionnaire, were omitted from data analysis, so our final data set contained 12 participants. Data analysis was performed with R.

Through ANOVA, we tested whether age had any significant effects on our dependent variables, but no correlation was found.

In order to test the internal consistency of the sub-scales of the questionnaire and to test if the items measure the same construct we calculated Cronbach's Alpha [113] of the constructs. The reliability of the 4 scales that were used in the questionnaires is acceptable (Table 7.3: Cronbach's Alpha >0.40), therefore, the items belonging to each scale seem to describe one construct and all scales can be calculated as mean scores. Taking into account that Social Closeness was measured only by one item, we could not

TABLE 7.3: Cronbach's Alphas of the constructs

Scale / Construct	Cronbach Alpha
Enjoyment	0.94
Engagement	0.57
Presence	0.90
Social Closeness	NA

calculate Cronbach's Alpha for it. We report on the means and standard deviation of each construct in (Figure 7.5).

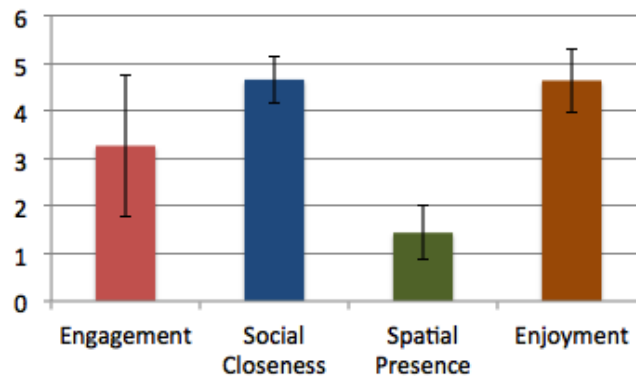


FIGURE 7.5: Means and standard deviations of the constructs measured in the study.

We additionally looked at the correlations between independent variables. We find that Enjoyment correlates significantly with Engagement ($r(12) = 0.834, p < 0.001$) and Social Closeness ($r(12) = 0.605, p < 0.05$). Also Social Closeness correlated with Engagement ($r(12) = 0.605, p < 0.05$) and Enjoyment ($r(12) = 0.594, p < 0.05$) but not with Spatial presence. Furthermore, Engagement correlates significantly with Spatial Presence ($r(12) = 0.660, p < 0.05$) and Enjoyment correlates significantly with Spatial Presence ($r(12) = 0.622, p < 0.05$). What we understood from this is that within the use of our tool, the constructs of Engagement, Enjoyment and Social Closeness are highly correlated, where as the constructs of Social Closeness and Spatial Presence don't seem to correlate. How close participants felt with the onsite visitors did not affect their feeling of "being there" with our system and vice versa.

We analysed the data we gathered on the three extra questions, examining usefulness, suitability of the application and whether they would use the application again for visiting other museums. We got high scores, which confirmed our observation that participants really liked the experience and found the application useful and suitable for the task (Figure 7.6).

We analysed the data the research assistant took in the observation notes. We discuss the data by summing it across the different categories of behaviour we observed. The

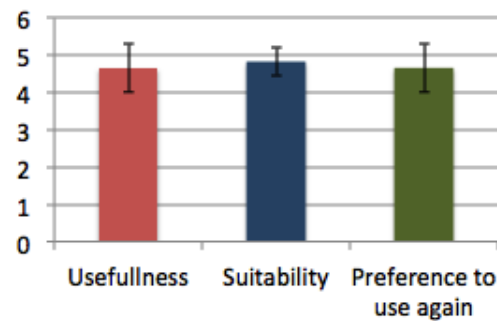


FIGURE 7.6: Summary of the additional questions in the questionnaire, examining usefulness, stability and preference for using the application again.

observation noted told us that all the participants talked with the onsite visitors, except for one that felt that the approach is not for her, and relied on her friend in the session. Mainly participants talked on topic, often introducing other topic too, but always having the topic of the exhibit as a starting point and an inspiration. Two participants barely talked on content, and always used the presented topics to start talking about their own life experiences. Mainly participants laughed, with few participants being serious all the time, although they positively evaluate the experience. Only three watched around during the experiment which came as another confirmation that our approach was interesting for the participants.

We had only two groups of two people inside the museum, so we couldn't test if different patterns on moving inside the museum influence the older adult's experience. In these cases the group members stayed close to each other and didn't feel like separating, although they were instructed that they can if they want. We observed that remote participants had fun in this scenario however future research is needed to demonstrate this.

We performed thematic content analysis [114] of the audio logs to understand which themes were found more interesting to discuss for older adults. In our analysis, the focus was on the content of the talks, excluding the drama pieces, and on what was said in the conversations. Themes were generated and grouped into categories, and we detected several topics emerging as most interesting ones about older adults. Animals, and mammals in particular were the most popular theme, with participants asking additional details about their fur, skin, differences in reproduction. Second theme were dinosaurs, that were mainly discussed for how old they are, their teeth, and for their actual size. Participants additionally showed curiosity and asked about life in other planets, chemical composition of the Earth and astronomy.

We additionally analysed who initiated conversations in the sessions and in how many of the conversations were initiated by the onsite visitors or by the remote visitors. Talk was predominantly initiated by the onsite visitors in only 2 of the groups: P1 and P2 (5 out of 6 talks), and P5 (6 out of 10 talks). In 5 of the groups the talk was predominantly initiated by the remote visitors: P3 and P4 (11 out of 13 talks), P5 (6 out of 8 talks), P7 (10 out of 13), P8 and P9 (8 out of 12), P10 (5 out of 9) and P11 and P12 (6 out of 11). Talk was equally initiated by both sides in the session of P6 (7 times talking was initiated by both of the sides). This told us that participants were curious about the presented contents and eager to ask questions about it to the onsite visitors

We debriefed the participants at the end of the experiment. In this post-experience interview they told us that they all liked the experience, except for one that found it not adequate for her, due to her age and health problems. The most favourite story segments were: the story about the lioness (7 people), dinosaurs (3 people), and beginnings of planet Earth (1 people). They all liked the approach, with one participant indicating that she prefers plain facts, and 4 participants specified that they liked visiting with a story, not necessarily only with aliens. Some commented about the elements on the interface, that they liked the opening and closing of the curtains and said that they prefer to see it on a bigger screen so they can see the details and the people on the stage better.

Results are discussed further (together with the observation data) according to our five research questions outlined before.

1. Does remote participant enjoy the visit in the drama-based approach?

From our results we found a high degree of enjoyment for the participants. Participants liked the visit and they found it fun. They were laughing at some of the jokes in the story, enjoying the quest of the aliens. Some of them found the story and the scientific facts nicely integrated. Our non traditional alien “guides” in the museum visit attracted attention to our participants, and each session started by additional curiosity shown by elderly about what and who they are. Although some of our participants didn’t know if aliens exist, still found the whole experience entertaining and expressed a desire to repeat it again. The interactions between visitors (remote and onsite) indicated a high level of overall enjoyment, allowing users to focus on both, seeing the objects and talk. Some older adults tried to make additional new jokes, besides the ones told by the aliens, and made the whole experience even more fun. Some examples: “If you see real dinosaurs like this, you won’t be able to sleep in the bed at night!”

Sometimes, some of the story segments were too long, and this was found boring for both, onsite and older adults participants. Some of the participants suggested to have

videos instead of static photos, or maybe several photos changing over time to follow the story flow.

2. Does remote participant engage in the visit in a drama-based approach?

Previous literature has shown that engagement in museum visit is really important: conversation is the moment of the visit when co-construction of meaning happens, and memories are created to be remembered later [115, 116]. In our experiment, participants introduced comments and their point of view about the presented objects, commenting primarily on the content on museum. The drama pieces, together with the pictures of the objects and the people onsite to ask, allowed the elderly to deepen their interest and develop further curiosity for the arguments that they see. We also observed that the subjects not only discussed the presented facts, but additionally reasoned upon them. For instance, some subjects asked what kind of consequences these scientific findings have on how we live nowadays, and how can they improve life and well being. Many participants told us that they found the topic the exhibition good for their memory, that it is content they have studied them in the past, and it now brings their memories back.

Our system brings some limitations too. The small phases in the observe state of the system, the connectors, sometimes even stopped the discussion. They were timed to start at a certain preset times after the story segment, so when connector would start and the people were in a middle of discussion, it would stop them in the middle of a sentence. This was especially a drawback for elderly that after the connector forgot what they wanted to say. Another limitation of the system, when the people in the museum speak, the elderly don't feel like interrupting them although they want / have something to ask. Seeing a small video stream of the elderly, to show their intentions, may help in this.

3. Does the remote participant experience spatial presence in a drama-based approach? Our intuition was not confirmed, and our study revealed that our system didn't score high on the construct of spatial presence. Our participants didn't feel as "they are there" in the displayed environment. We believe that the lack of continuous flow of the image (the limitation of the positioning system) is the main cause for the lack of appreciation of the spatial rendering factor. In the long intervals while people walk in "undefined" areas there is no novel visual info provided remotely, that we believe negatively attributed to the sense of being there.

Some of the participants showed additional curiosity and asked for more information about real size of the animals exposed in the museum, asked additional questions about the animals that were partially shown in the images, or for the actual arrangement of the objects in the museum. Some of the subjects admired the presented photos and

tried to reach out and “touch” to presented objects on the screens, or for instance tried to “caress” the presented lioness object

4. Does remote participant experience social closeness with the rest of the group in a drama-based approach? The levels of experiences social closeness were rather high, the results show that older adults felt as they are with someone. In our experiment, people participated not only as individuals, but as co-citizens, part of a social group, going for a visit of a museum together. Being together with other people in a shared activity, such as ours of visiting a museum, created a more subjective feeling of a group and created a feeling of togetherness, that was observed from both, onsite and remote visitors, in their questionnaire.

5. Do the dynamics of the onsite group influence the experience of the remote participant? The groups usually stayed together through the visit and usually there was a strong overall tendency for maintaining the coherence of the group. Due to the relative weakness of our experimental setup, we could not test for significant differences between conditions where the onsite groups are of various size (we had only two groups with 2 onsite visitors, and the rest with 1). What we observed is that there was much more interaction and engaging communication when the group in the museum contained two people, and in general the experience was more fun. We observed the same when two elderly participated together from the care home.

Post-experience interview

The participant told us that liked the experience and were really happy for the given opportunity. They told us that continuous interaction and communication was a necessity during the visit, and this is what made the interactive visit more interesting. Some of them commented: “They [the people from the care home] won’t take us for an excursion to the museum, Trento is far away, this is the only way to see all these things before we die”. Some of them found the process enjoyable and good opportunity to reminiscence about topics studied in the past.

Our participants felt as there is a mediation channel with the museum but did not feel as they were inside the museum. According to some presence theories [117], presence is a function of our experience of a given medium (Media Presence), and specifically the “illusion of non-mediation” is provided by disappearance of the medium from the conscious attention of the subject. For our experiment, we used tablet, its’ small screen was a barrier, and as a mediating tool it influenced the level of presence felt in this mediated experience. Some of them told us that bigger screen or more immersive technology can provide a better experience. Additionally, they commented that a bigger screen would

allow each object to be seen better, and additional details to be explored in further depth.

We also understood that we can improve the museum experience greatly by providing diverse techniques for narrative presentation. They commented that providing drama was fun, but sometimes seeing only static images was boring. This told us that we should use more dynamic visualisations and interactive multimedia (that fully occupy the attention of users) in order to make the story more engaging for our participants.

Additionally, they commented that the connectors were found too loud sometimes and prevented them from talking. From this we understood that the system has to be adaptable to the participants. This requires that the system is aware of the behaviour of its visitors and subsequently adapt to them. Our drama connectors were scheduled to start at exact time, and sometimes instead of helping conversation, they stopped it by their starting. We understood that events should not be only scheduled timely, but based on level of observed behaviour and conversation of participants.

Participants found the tool appealing and engaged in further discussion around the presented material, and they also expressed preference for seeing also other types of museum or also other distant places. As one of the participants commented: "I have found the system very useful and would use it again for seeing other museums too". One participant, fond of painting, expressed a wish to visit modern art museum, or to visit Venice biennial event. Another participant, inspired by our approach suggested to offer interactive visits of zoos also. From this we also understood that our system can be seen as an extension to a real place, a magical door to places where older adults would like to go. We plan to explore this possibility, to go visiting not only museums but any distant places, in a future research.

Limitations

The research presented in this paper has a number of limitations. The study involved 12 older adults which is relatively small sample. A bigger sample is needed to understand if the discovered findings are generalisable to larger audiences. Our older adults were generally proactive, well educated, so thus may not be representative of the older adult population. Future work is needed to see whether our findings hold for larger, more diverse samples of older adults. In addition we learnt that technology for scenarios like ours has to work perfectly. Our technology was not perfect, there were frequent changes in the audio levels and they affected the experience people had related to the use of the system. The participants complained when the quality of the audio was not good enough. We had to postpone two sessions, due to poor connectivity and thus bad audio

quality. We plan to address this technical problems with future development efforts to assure the stability of the system.

Additional, more general limitation of our approach is that we did not provide a way in which our participants would feel as they are in control of the visit. They had the option to communicate verbally any desire to see something specific, but they could not move inside the “virtual museum” on their own. They felt as they are actively participating in the visit, but they did not have the opportunity to change the flow of events. This was additionally confirmed by our observations, one of the participants commented: “[Onsite visitor name], you are in charge, you are in control!”. Or another one: “It was fun, but we could not do anything.” The next step in our work would be to study ways how to allow that both of the sides can take control of the visit and mutually shape the experience.

7.5 Discussion

This study investigated the use of system by older adults with mobility constraints to remotely participate in a museum visit from a care homes. The study showed that the technology successfully integrates the older adult in the visit. The experienced levels of engagement, enjoyment and social closeness were quite high that only confirm that we are on a right track. When we explored the relationship between the different aspects of the user experience, we found an effect of social presence and enjoyment on engagement.

The collaboration that occurred, enrolling a range of objects from the environment together with the interactive story, played a central role in how participants experienced the museum. Through social interactions the place of the museum evolved, not only as a place where knowledge is presented, but as a place where a short authentic experience happened. Our participants reported that visiting with drama was fun, and a large part of the interaction revolved around an elaborate descriptions of the personal interpretations of the observed content, as well as the facts covered by the story. We believe that both audio channel and interactive story were important for creating an affective virtual experience: the audio channel increased the sense of togetherness, while the interactive story made the visit more fun. The theatre interface aided the creation of this affective experience, some of the participants commented that they found it stimulating and interesting for conveying the story of the museum.

Chapter 8

Visit the Louvre: exploring video-mediated participation to museum visits

8.1 Introduction

Video-mediated communication (VMC) systems present a rich form of communication [118], providing a live window between remote spaces. Conventional video mediated communication (VMC) systems (like Skype) do not typically support users who want to interact in a shared video space and do not provide support for shared activities. Although possible with current technologies, there are very few communication platforms that facilitate creative interaction at a distance [119].

This chapter sums my experience on the CompEIT project, in which we investigate video-mediated participation for older adult in museum visits. We came up with a new virtual tour through part of Louvre and we discuss the results we obtained after we tested our approach with older adults. All the studies presented in this Chapter took place in the Netherlands.

SharedSpaces is a design prototype from the EU-funded FP7 project COMPEIT [120–122]. COMPEIT explores the future of connected media and creates a web-based system for highly interactive, personalized, shared media experiences.

The prototype SharedSpaces is a result from ongoing EU research and invites users to seamlessly move between real and virtual spaces by integrating a range of previously separated media channels. It adds a spatial quality of experience by representing the users side by side in a shared virtual space. Further, it offers a fun, novel and aesthetically

appealing approach by engaging users in multiple locations to manipulate their real-time video-streams, thereby co-creating a shared space where they can control features to fit contextual needs. It supports social dynamics by allowing users to draw and paint together and to move and resize video streams. It enhances grounding and social cues by merging video-streams and space, representing users as if they were in the same space.

In order to understand the values of our users, and to better inform the design process, we performed a diary study. The aim was to:

1. Understand the social networks of older adults and in which way social relationships are supported as of today
2. Understand the role of places they visit and their effect on social relationships
3. Understand the role of ICT and their role in supporting social relationships and activities

At TU Delft, we performed a creative session workshop in which we took as input the diary study findings and the SharedSpaces prototype. Among the proposed ideas, we choose the idea to visit Louvre from home.

We designed a small tour, showing 5 statues of the Louvre, examining the following research questions:

1. How older adults behave when remotely participating in a virtual tour using SharedSpaces?
2. Do older adults experience social, spatial presence, naturalness, immersion and engagement when participating in a virtual tour from home using the SharedSpaces?
 - Does the interaction technique of the guide have an effect on the extent to which older adults experience these aspects?
 - Does the number of participants (group size) have an effect on the extent to which older adults experience these aspects?
3. Which aspects of the prototype could contribute to different aspects of the experience? Which aspects could be improved (for example: quality of presentation, interaction with the prototype, interaction between people)?

8.2 Methods

The design of the diary study was based on a method already developed and implemented for the needs of the CompEIT project, where the values and needs for children as a target group for CompEIT were investigated [123, 124].

In the diary study, older adults were asked to fill out diaries for one week. The participants kept track of:

- people they see from their social network (8.1),
- places they visit (8.4) and,
- ICT and social media they use (8.3),
- their activities, writing down with whom, where and why they did these activities and whether they liked the activities or not, and whether any technology was used (8.4)

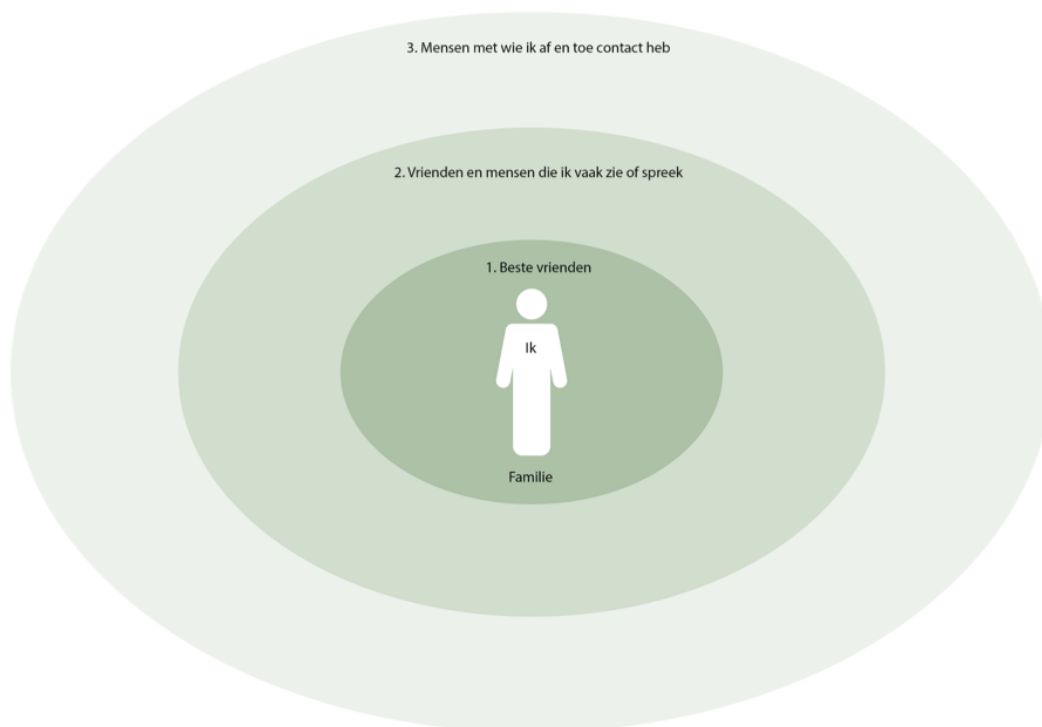


FIGURE 8.1: Social network page of the diary: participants fill in which people fit in which circle: best friends (1), people that I know (3). Designed by Bart! Grafisch ontwerp © UX Tools

The aim of the diary study was to help the researchers understand better older adults in Netherlands, their behaviours (activities), goals, attitudes, aspirations, motivations,

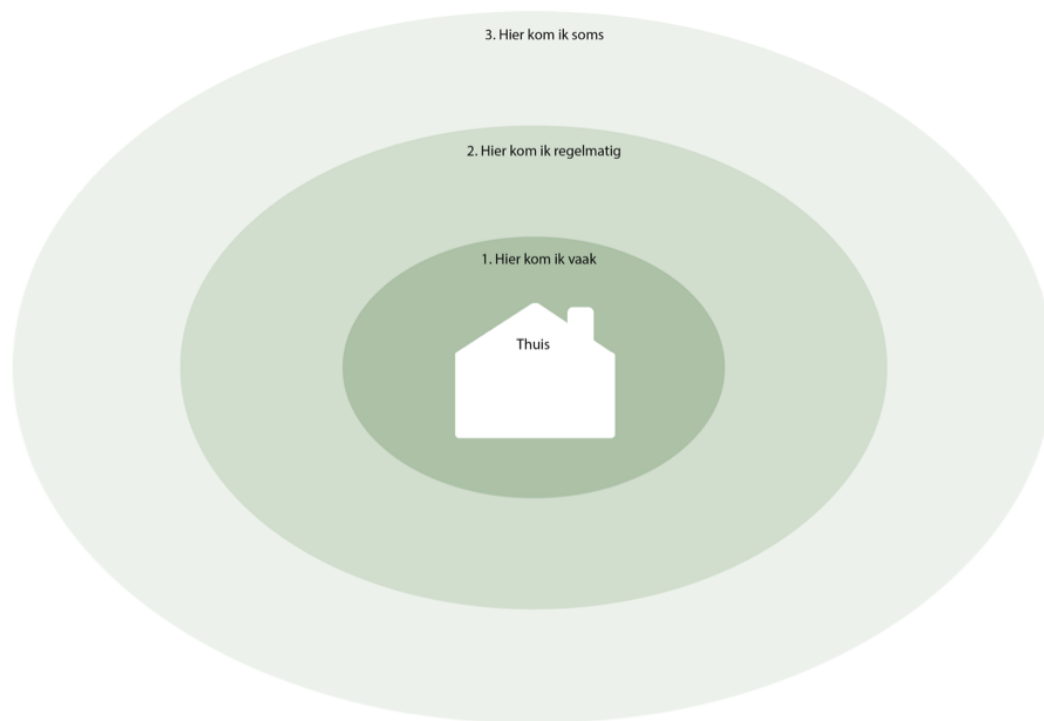


FIGURE 8.2: Places older adults visit: page in the diary where participants fill in places they visit often (1), regularly (2) and sometimes (3). Designed by Bart! Grafisch ontwerp © UX Tools

and the opportunities these provide for further designing and developing CompEIT technologies. The main goal of the diary study was to obtain detailed insights in how older adults experience activities and communication with others combined with specific places important to them or playing a role in their lives.

In addition to keeping a diary schedule for every day for one week additional questions were asked and assignments were given to obtain additional insights in specific places and people that they would like to stay in touch. Often these assignments were based on storytelling and creative thinking (tell us how you liked a specific situation; how would you deal with this situation differently). The additional questions were the following:

What are the most fun and least fun things you did today and what made them fun or least fun? Can you think of two examples of two places you would like to connect with a magic door and can you tell us why you want to connect these places? Imagine you have a set of flying ears and eyes, where would you send them and why? If you had a machine that could take you anywhere and with anyone, with whom would you go and where?

After we obtained the results from the diary study, we performed a creative facilitation session, according to a *contextmapping* method [125]. Contextmapping is an approach



Vraag 2: Wat gebruikt jij nog meer voor jouw plezier, of om contact met anderen te hebben of om samen dingen te doen? Vul ze hieronder maar in!

Ik gebruik ook nog:

1) _____	2) _____
3) _____	4) _____
5) _____	6) _____
7) _____	8) _____
9) _____	10) _____
11) _____	12) _____

FIGURE 8.3: Page in the diary where participants circle the communication tools they use.

to design in which designers use people's everyday lives to inform and inspire themselves for ideations and by this to ensure a good fit between the design and the use of a

Vandaag is het: _____

	Wat heb ik gedaan?	Met wie?	Waar?	Waarom? Wat vond ik ervan?	Met welke technologieën?
05:00					
06:00					
07:00					
08:00					
09:00					
10:00					
11:00					
12:00					
13:00					
14:00					
15:00					
16:00					
17:00					
18:00					
19:00					
20:00					
21:00					
22:00					
23:00					
00:00					
01:00					
02:00					
03:00					
04:00					

Vul de cirkels "Met wie ga ik om" aan!

Vul de cirkels "Op welke plaatsen kom ik" aan!

Vul "Welke technologieën gebruik ik" aan!

FIGURE 8.4: Page in the diary where the participants fill in their daily activities: what did they do, with whom, where, why and if some technology was used for the activity. Designed by Bart! Grafisch ontwerp © UX Tools

product. The aim is not just to uncover user insights, but also to carry this through in product concepts and product development. The creative facilitation session took place inside TU Delft, on Sept 18th 2015. The group consisted of 6 design students. The session lasted 4 hours and participants were paid 10 euros for their participation. Quotes and ideas from the diaries here hanged on the walls and of the room where the session took place to facilitate the process. More specifically, people were asked to come up with an idea that encourages and supports older people to collaborate over distance with SharedSpaces. The idea was to choose one scenario during the creative session to further develop it within the project. We gave as input the results from the diary study, as well as the the possibilities of the SharedSpaces prototype. The group came with 6 different ideas, but we decided to proceed with the one in which the involved researchers were the most familiar with, in the area of museums.

We choose a setting in the SharedSpaces prototype, a virtual representation of a room inside the Louvre museum (Figure 8.5 (a) map of Louvre with the room that we presented highlighted in blue, Figure 8.5 (b) the map of the room, Figure 8.5 (c) the outlook of the room). Based on our own experience from Chapter 7, we chose to implement an approach based on storytelling. Enriching visits through storytelling has shown to be a proven practice for museums, it both, educates and entertains and provides a more

engaging, adaptive and fundamentally enjoyable visitor experience [72, 126]. It is a natural extension of the purpose of the museum per se i.e to tell the story behind the presented content. In order to develop the tour we followed the suggestions presented in [127]. (see Appendix C for the full script of the guided tour text).

We envisioned a solution as realistic as possible. Our intention was to make the experience assimilate a real one, so we envisioned that people would stand while they participate. In our scenario the guide meets the participants at the meeting point in the virtual room, and brings them to see the presented statues one by one, by changing the background to a zoomed in presentation of the statue of interest. Participants interact with the guide while having the possibility to point to the detail of interest and ask additional questions on the spot.



FIGURE 8.5: The map of the whole lower floor of the Louvre museum (a), the map of the room together with the statues that we showed to our participants (b), the actual look of the room and the actual arrangement of the statues (c)

We performed a controlled experiment in a research lab in order to test our concept live. One guide (in our case a researcher) was involved in the experiment. We studied

multiple variants of using the prototype, based on two variables:

1. *interaction technique* the guide gives either a free exploration tour i.e. the guide does not require any further participation by the participants and participants interact only upon their own request, or guided participatory tour where the guide asks the participants for collaboration at certain points of the tour
2. *group size* the participant follows the visit alone (only with the guide) or two participants follow the visit together at the same time (from two different locations, always accompanied by the guide)

The study was conducted inside the Usability lab, in TNO, Groningen and inside TU Delft University, one of the experimental setup is shown in Figure 8.6(a)

Once the participants understood how to use the tool, they were guided in a visit of the five exhibited statues (Figure 8.6(b)), one after each other (Figure 8.6(c)). In the *free exploration* tour the guide was just showing the statues, telling more information about the story behind them. In the beginning of this setting, the participants were welcomed to interrupt the guide in the tour and ask questions if they have any additional curiosity about the presented content. In the *guided participatory tour* a small reflection talk or a small collaboration task about the presented content was triggered by the guide after each presented object. After the experiment participants were presented with a questionnaire (on the same screen) containing 13 items measuring the constructs of interest. 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.

Measures We used a validated questionnaire by a previous research for measuring the constructs of social, spatial presence, immersion, engagement and naturalness [124, 128]. The questionnaire contains 13 items, each item is a statement, and we invited participants to state the level up to which they are or disagree with the statement on through 5-point Likert scale, with 1 = “totally disagree” and 5 = “totally agree”. During the experiment, the researcher was taking observation notes on the predefined observation sheet. Additional observation notes were taken by the researcher immediately after the experiment, when the participants were filling in the questionnaire. Additionally, we had a semi-structured interview with the participants in the end.

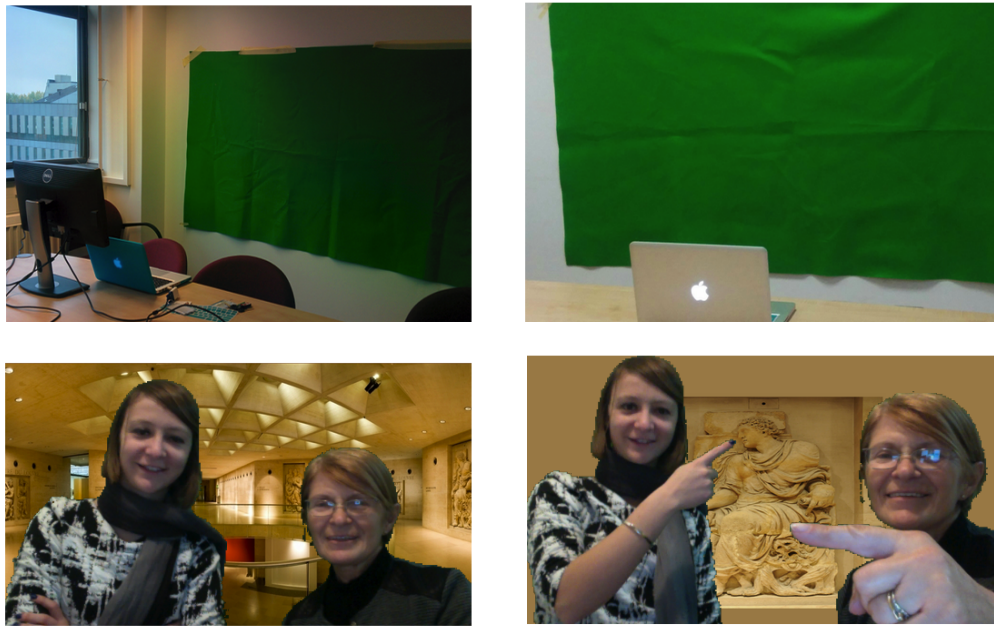


FIGURE 8.6: The look of the stations used for testing (a) and (b), the Rotonde Hall, place where the guide initially meets the participant(s) (c) and a closer look at one of the exhibited statues (d)

8.3 Participants

In total 10 diary study booklets were distributed via the social networks of the researchers and via older adults involved in this study. Five booklets were returned. Each older adult that returned a fully filled out booklet received a voucher of 20,- euros. It was mandatory to sign a consent form stating they were informed about the research and acknowledged their participation in it.

We recruited 8 older participants for the study through word of mouth. The participants were 5 males and 3 females. Five participants reported prior use of communication technologies like Skype or Google Hangouts. The participants again received a 20,- euro voucher for their participation. We had 4 participants participating in groups of 2 (and with the guide), and 4 participants participating alone with the guide. One of the groups followed participatory tour, while the other followed a non-participatory tour. Two of the individual participants followed a participatory tour and two followed a non-participatory one. (details in Table 8.1)

TABLE 8.1: Overview of participants and variants.

	Free exploration tour	Guided participatory tour
Individual	P3 and P4	P5 and P6
In pairs	P1 paired with P2	P7 paired with P8

8.4 Results

In the following subsections we summarize the results from each of the steps in the process.

8.4.1 Diary

The diary results told us the following information.

Social networks of older adults The inner social circle includes: sister(s), brother(s), partner(s), son(s), daughter(s), sister(s) in law, brother(s) in law. The middle circle (friends and people I often see or talk to, I am related to but not in the same way or as close as to the people in my inner circle) include: partners of the kids, friends, acquaintances through hobbies. The outer circle (people with whom I have contact every now and then) include: neighbours, old colleagues, ex classmates.

Places older adults visit Places they visit often include: town, balcony, garden, friends' or brothers' or sisters' home, tennis club. Places they visit regularly include: sister or brother in law, aunts, friends. Places they visit sometimes include: daughter, grandchildren, friends

Technologies they use Technologies for staying in touch: Facebook, Telefon, Google+, Facebook Messenger, Twitter, Skype. Technologies for pleasure: TV.

Examples of daily activity entries

Most common activities included: preparing and having breakfast, reading newspaper(s), preparing and having lunch, grocery shopping, staying in touch with family members, watching TV, preparing and having dinner, participating in cultural events or hobbies (tennis club) and having visits from the kids usually on weekends.

Most and least fun thing you did today

Among the most fun things that our participants did were: drinking tea with a friend, playing games on iPad, playing chess, cooking, organising photos. When asked what made them fun, the participants provided the following reasons: because it was cosy and it is a pleasure to perform the activities, or in the case of playing games because they won the game. Among the least fun things participants mentioned: partner being sick, or received mail that brought bad news, or not feeling good. On the questions what made them least fun participants responded that in the case when the partner or they were not feeling good, that they could not move around.

If you can connect two different places with a door, which places would you connect

Participants proposed different places to be connected, some of the ideas were: connecting the house to an island, bali, coast, places where kids live. Types of activities they want to perform when they would go to beach/island/coast: walk, seat and read, listening to the waves, relax, ride a bike. In the case of connecting the house with the places where kids live: to catch up with people, drink coffee, be together with them.

If you have pairs of 'flying eyes and ears' where would you send them?

Participants expressed desire to see grandchildren in order to see how they are doing, or brother and sister in law, and family members in general for the same reason.

If theres a machine that can take you and people you care about to any place, where that would that be, and who you would take?

Participants would like to go to visit a museum, or somewhere to drink something, and somewhere to eat something. Some participants wanted to go to events where authors speak about the books and they are signing books later. Also participants expressed preference to walking through the streets of unknown cities and admire the architecture.

Reflect on the diary

Some participants reflected that when one get older and sick the amount of friends is getting smaller; to go out is really important. The telephone and ipad are important to be and stay in touch. Some reflected that having family and close friends is really important and that they enjoy quality time with them.

8.4.2 Creative Facilitation

Each of the participant in the creative session presented one final scenario where SharedSpaces can be used for older adults:

Sightseeing and trying out new things: A guide gives a tour of a city while the older adults sees and participants in the tour live from home. The guide can show Eifel tower or shows Louvre it in real time. Older adult can attend a conference

Get together: Family goes on a biking trip, the older adult joins from home on static bike. One family member is equipped with a camera on the bike and the older adult at home sees the stream and is projected in the video of the family.

Recipe sharing at distance: An experienced older adult cook gives an online lesson and guides a cooking session. All other participants are close to the cook and seeing and

learning how to cook from the older adult

Virtual waiting room and virtual medical examination: The older adult can go for a medical visit from home. The older adult waits in a waiting room together with other older adults that wait for a medical visit. When the doctor is ready, the doctor and the older adult move to another room where they are alone. The background of the room is picture of a human body that the older adult can use to point the parts where (s)he feels pain.

The crafting room: The older adults gives a tutorial for knitting, the participants are interested young adults that want to learn how to knit.

Lets discuss: People participate in political gatherings in public spaces (squares) through big screens where they are projected in the crowd.

8.4.3 User Study with prototype

1. How older adults behave when remotely participating in a virtual tour using SharedSpaces?

When participants were ready for starting the tour, 3 of the participants wondered whether they should sit or stand in front of the green screen. They were free to choose so 5 of the participants just stood and 3 immediately took a sitting position. Two of the people that took a sitting position were in the couple condition (P1 and P2), and one in the free tour condition (P4). After the start of the tour participants usually followed with attention, commenting on the specific poses of the statues, or asking for additional explanations why authors have decided to represent them in that position. They commented on the presented details too. Two of the participants (P5 and P7) tried to imitate the pose or to make a funny pose that assimilates the presented one. P6 nodded in sign of approval that she understood the presented content. The participants having deeper interest in the content asked more details about the historical contexts around the objects. When participants talked outside of the presented material (which happened with 3 of the participants, P6, P7, P8), it was mainly comments on how similar technology has been applied and used in movies or for weather forecast news. Five tried to point out in space, and two tried to point on the screen (erroneously) to ask for detail of interest. Two of the female participants (P6 and P7) tried to make their appearance better by making adjusting hair or makeup. We sum up all the behaviours we observed by our participants in the experiment In Figure 8.7).

In the participatory condition, when the guide commented to a detail of the statue, the participant(s) usually followed by directing their views towards the presented detail.

SharedSpaces in this condition made it easy for the participant to show and tell to the guide “I want to know more about this” and point to the specific detail.

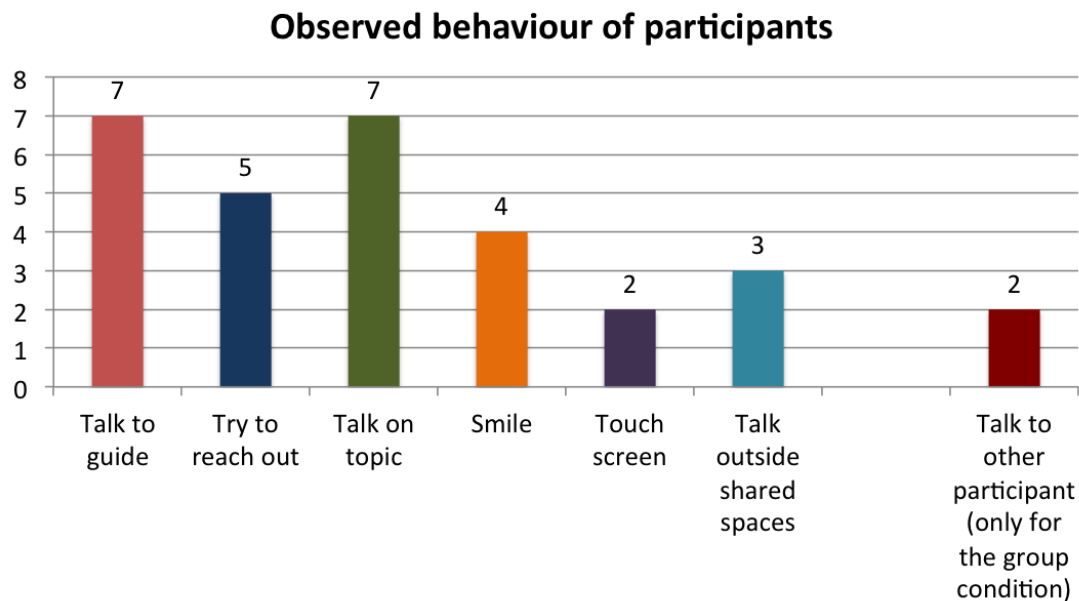


FIGURE 8.7: The observed behaviour of our participants: mainly participants talked with the guide and talked around the presented content, some of them tried to reach out and point to details of presented statues.

In the participatory condition, when the guide pointed to a detail, the participant(s) usually followed by pointing their views towards the presented detail. Participants found it easy to show and tell to the guide “I want to know more about this” and point to the specific detail.

2. Do older adults experience social, spatial presence, naturalness, immersion and engagement when participating in a virtual tour from home using the ShredSpaces?

Mean experience assessment of presence was 3.91 (SD = .76), immersion and engagement 4.29 (SD = .80), and naturalness 3.91 (SD = .88) (Figure 8.8) Based on these results, we conclude that participants felt presence, naturalness, and immersion and engagement.

The mean assessment on the measure of social closeness was 5.25 (SD = 1.59).

In our experiment we had 4 participants visiting alone (and consequently 4 participating in groups of two participants) and 4 participants in guided participatory tour (and consequently 4 participants in free exploration tour). Given the small sample, we decided to pursue rather a qualitative approach in order to extract findings. We performed t-test analysis on the constructs between the conditions just to understand if striking differences between the different conditions will emerge.

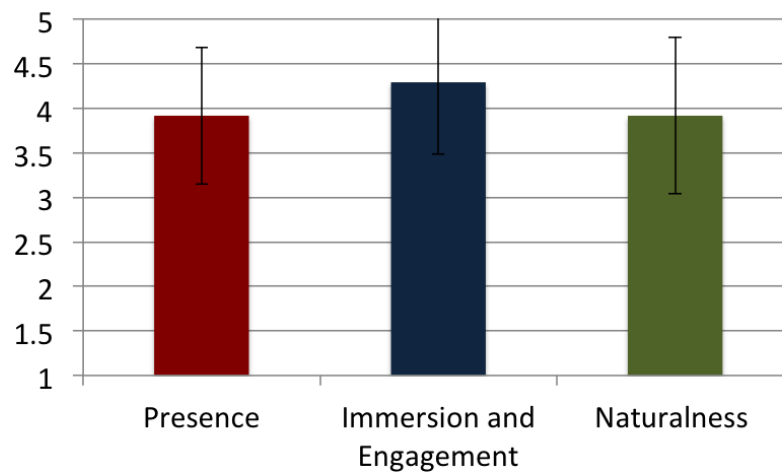


FIGURE 8.8: The means and the standard deviations of the constructs.

2.a. Does the interaction technique of the guide have an effect on the extent to which older adults experience these aspects?

We didn't observed any particular effect on the freedom of interaction on the extent to which people felt presence, immersion, engagement or naturalness. Participants across both of the conditions (free exploratory or guided participatory) commented that they feel as they are in the same space with the guide or that the interaction in it feels natural for instance. (We also didn't find any statistically significant difference in the interaction technique condition after the t-tests analysis: Presence, $t(46) = 0.74$, $p = .46$, Naturalness, $t(22) = 0$, $p = 1$ and Immersion and Engagement, $t(22) = 0.75$, $p = .46$.)

2.b. Does the number of participants (group size) have an effect on the extent to which older adults experience these aspects?

We also didn't observe any particular effect of the number of people participating on the constructs, although we note that this can be influenced by the size of the participants. Namely, in one of the two groups participants were too corpulent and the room became too crowded. In the other group, participants took fixed position across the whole experiment and they reported high levels of experienced presence, immersion and naturalness (also for this question we explored correlation in statistical terms and we didn't find any based on the t-test comparison: Presence, $t(46) = 0.19$, $p = 0.85$, Naturalness, $t(22) = 0$, $p = 1$ and Immersion and Engagement, $t(22) = 1.28$, $p = 0.21$.)

We note that we had a small sample and a further investigation with a bigger dataset is needed to explore the subtle differences between the conditions and to further explore

the possible effects of the manipulations on the constructs.

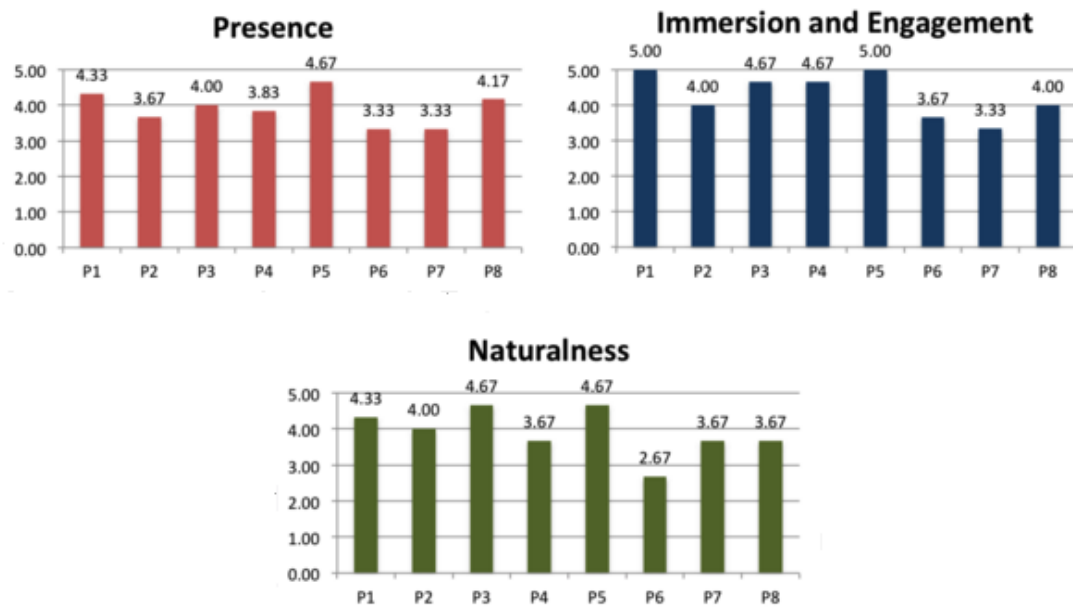


FIGURE 8.9: The scores for each participant for each construct.

3. Which aspects of the prototype attribute to different aspects of the experience?

In the post-experiment debrief we asked our participants to reflect upon various aspects related to the experience. We asked general questions: whether they liked the activity, what was their general impression, and what did they liked and disliked in particular. We discussed further the problems participants encountered and reflected how can we improve the system.

The observations and interviews afterwards provided us with qualitative information in relation to the measured constructs.

Presence Our approach allowed users to see the others users only when facing directly the camera. Participant P4 (that participated alone and scored low on presence) noted that it feels weird for him to speak with someone when in portrait position of the head: in that situation one neither see the screen, neither the guide. This feeling of lack of presence can also occur when participant try to see some of the objects presented on the edges of the space, i.e if they want to admire a statue peripherally or want to address specific detail about it. This we believe that negatively attributed to the sense of presence experiences by our participants.

Participants P6 and P7 (that scored low on presence) noted that the different size of guide influenced their feeling of co-presence with the guide in the same space. The participants noted that they felt different about the other person in the environment if

the video stream of the others is not as same as theirs. Also the direction and inclination of the camera attributed this sense of co-presence. In one of the sessions the camera of the guide was inclined towards back; participant noted that it felt confusing.

Immersion and engagement We observed that participant P7 (that scored low on immersion) was too corpulent for the setup and found it quite difficult to adapt especially because of the overlapping problem with the guide. This we believe negatively attributed to her sense of immersion. The same participant encountered additional problems with trying to pointing out to some specific parts of the statues on the side in room (3D). She commented that this approach is more suited for seeing paintings and other more 2D objects

Naturalness

Participant P6, that scored low on naturalness, expressed difficulties in understanding where is left and where is right. Sense of orientation and direction was found a bit confusing for her. She noted that the first time it may feel weird and one needs to get used to it.

3b. Which aspects could be improved (for example: quality of presentation, interaction with the prototype, interaction between people)?

Quality of presentation

The approach we took, guiding the visitors through the sculptures by presenting small stories around them, was found appealing to our visitors. It provided an additional meaning to the presented content and it immersed participants into the subject. We believe that stories were important for subject's immersion. One of the participants that recently traveled to Israel, commented:

“The first day I walked without a guide. It was such a waste of time to walk around and not to understand all the important things that I was surrounded. The second day I joined a guided tour and I realized that the previous day I passed next to a place where the hand of Jesus was placed and I didn't even know! Having the person to point out the details is important, otherwise it is really easy to miss important information.”

Participants commented that in busy places as museum one can easily miss an important object just because (s)he doesn't know that it is an important object. Having a guide helps, because you are sure that you get to know all the important things.

Some participant found the topic of the exhibition interesting and some said that it does not fit their interests in general. Some of the participants showed additional curiosity and asked to have the names of the statues and asked the presented content to be send

by email, so they can inform more around them from home. Usually they found the duration of the explanation quite adequate for the purpose:

“I think for me it was just the right amount of information, not too much not too less”

Additional comment was that in a huge museum like Louvre there won't be stories behind each presented statue. They proposed to have a longer version of the tour, uniting more statues, connecting them across similar themes. Additionally they suggested to have the approach tailored for kids, commenting: “Kids like scary stories”

They commented that it would be nice if one can discuss before and agree with the guide what kind of tour to have. Different people can have interests in different type of information about the content: more details about the style and materials, the story behind it, or more information about the author. Participants also asked for a more connected approach: to highlight the connection between objects in museum, and to connect different arts on the same topic (poems, paintings, music inspired by the same theme). They proposed to present information across 4 dimensions: content of the object, context (historical and physical), the artist details, and technique. We believe that if incorporated, these presentation aspects can significantly influence the level engagement and immersion.

Interaction with the prototype

To visit the museum from home, without to have to leave your own seat, was found really appealing for our participants. One of the participant commented:

“In a real museum they write all the information on a plate near the object and you stand close to the plate and you have to read. In this scenario, when you visit from home, and someone tells you all this information. Additionally, you can consult on Wikipedia immediately if something seems really interesting.”

Our approach allowed older adults to avoid the crowds around objects that sometimes can be found tiring for older adults that can't stand too long. In this way exhibitions and museum in general can become more enjoyable and cosy.

Some participants commented that this approach is more suited for seeing paintings and other more 2D objects. The participants encountered problems with trying to pointing out to some specific parts of the statues in our room.

Interaction between participants

Different patterns of interactions emerged from in the sessions. Some of the people were negotiating their positions between themselves or/and the guide in the way that leaves space so that the statue can be seen. Some other participants were less sensitive to

the change in the background and did not try to adjust, so the guide was supposed to specifically point out that there's a statue just behind them.

In one of the group sessions (with two participants at the same) time the room became too crowded since the participants were quite corpulent. This left no space for the participants to see the objects. The involved parties tried to move behind each other, but since the videos are overlapping it was difficult to find the right position. The person positioned behind another person was disappearing from the scene and was trying to reach out from behind the person which was not always comfortable. We believe that providing the right spatial affordance can be a factor influencing the experience.

8.5 Discussion

We found that older adults found our video-mediated tour interesting. Participants in general talked with the guide and talked on topic of the exhibition. Many of them tried to reach out and point to specific details of the presented content. The experienced levels of presence, immersion and engagement and naturalness were rather high that showed us that we are on the right track. We didn't find statistically significant difference on the constructs on between the conditions (interaction technique and group size), however we note that a wider sample is needed in order to explore such relation further. We understood that we can significantly improve the approach if the guide can discuss before hand with the participants and tailor the tour based on the interest of the participants according on the following dimensions: content about the object, historical and physical context around the object, the artist details, and technique. The sense of orientation could be improved by having a video stream that is not mirrored.

Chapter 9

Conclusion

Technology is used more and more frequently for museums and other cultural spaces such as cultural heritage, architectural, historical sites and so on. Understanding how technology can help people to overcome social and spatial barriers, especially for people that need this the most as older adults, has become important. Applications that bridge the physical distance between remote and onsite visitors hold a good potential and we need to understand the best user practices to allow for experiencing cultural spaces from home.

Generally, this thesis has sought to understand the use of tablet applications to make cultural spaces more accessible to older adults. We investigated practices how to facilitate the process of sharing museum experiences with older adults with or without cognitive impairments and how to include in the best possible way older adults from home in museum visits of friends and families.

This chapter summarizes the findings of the studies as a whole and revisits the important findings.

9.1 Contributions

With this dissertation, we iteratively designed, developed and successfully tested in real-life settings a software application running on an iPad that enables older adults to participate from home in museum visits of friends or family members. The application bridges the physical distance between the remote older adult and the onsite visitors inside the museum. The virtual representation of the museum content automatic adapts as the onsite visitors move through the museum, and an audio channel allows all participants to communicate freely. The guide through the museum is based on an automated narration

(drama) that connects and explains exhibits and replaces a conventional museum guide. The work builds on a set of ethnographic studies on the sharing behavior of museum visitors involving hundreds of visitors and a set of incrementally developed prototypes tested for usability with dozens of older adults. According to the user study with the final prototype, the developed system engages all participants in the visit and encourages conversations. It was consistently perceived by older adults as useful and suitable for the task and was able to create an atmosphere of social closeness and enjoyment during its use.

We address the findings from the research we performed from each study in the following subsections.

9.1.1 Sharing without technology

The results of the ethnographic study of what people share in museums told us that without technology, visitors share mainly emotions. Sharing emotions is generally easier than sharing content, and visitors share more emotions. The visitors that do share content (11% in MTSN and 27% in MART) share supported with additional materials as brochures, books or souvenirs bought in the museum shops. The results also told us that visitors have the intention and would like to share information (based on interviews in museum), but they rarely do it in practice (based on the questionnaire one week after their visit). We understood that there is a lack of interaction design that makes it easy and fun for people to share during the visits.

The study also suggested that visitors often share memories of museum visits with older relatives at home, and they try to use the possible range of resources, such as photos, videos, and souvenirs. The results also suggest that sharing at home involves engagement in direct communication from both sides and that it involves storytelling and interaction around content (photos and videos of the exhibition), which act as facilitators for discussion and interpretation.

9.1.2 Sharing with technology

From our research we understood that visitors are interested in having a virtual reminder of their museum visit, and they promptly accepted the invitation to create a virtual reminder of the museum visit, in form of a digital booklet. An easy and lightweight approach to “saving” and later accessing content from home, like in our case, significantly increases sharing. Visitors that used the opportunity to create booklets, shared 3 times more than visitors without booklets. We understood that our bookmarking technology

is an attractive solution for the museums: we've been invited to repeat the experiment again, and one of the museums allowed public use of photos (especially for the booklet) from their artworks that they did not do before.

9.1.3 Booklets for older adults

We tested the booklet application with two groups of participants: cognitively impaired and non-impaired older adults. We understood that non-impaired participants were well able to use the booklet application, while cognitively impaired participants were able to use it to some extent. The participants that had problems with using the booklet could not find the right sensitivity in order to operate the tablet or had shaking hands. Zooming in or out a picture, or closing the picture after the picture had been opened in zoomed-in mode was difficult and non-intuitive to the cognitively impaired participants. We understood that we could improve the interaction significantly if we simplified those interactions and made them more intuitive. Additionally, we can simplify use if we implement interactions that require less precision and make the application more responsive to different sensitivity and shaking hands.

9.1.4 Feasibility of remote participation

Older adults are well able to understand remote museum visits, engage in contextual conversations around objects, and enjoy the experience without major inhibitions. 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. Different designs of the software, however, strongly influence the ability of older adults to follow a visit from remote. Among the three designs implemented (interaction-free, interactive and virtual reality), participants liked most the appeal of the 3D virtual reality design, yet this is also the design they had most problems to operate. The interactive booklet design seems to provide the best trade-off between content consumption ability, freedom of navigation and user satisfaction. The presence of the audio channel turned out to be fundamental to keep engagement high. We observed that interactive tours are more suitable for active older adults, whereas frail adults can participate only through interaction-free tours.

9.1.5 Remote participation in a museum visit: drama-based approach

We proposed a new method for visiting museum from home based on drama, that we named drama-based approach. In this drama-based visit the remote participant joins the onsite visitors in their visit with help of tablet application. The visual information, delivered to both onsite visitors and remote older adults, adapts as the onsite visitors move through the museum. Both of the sides are connected with an audio link, and the information about the objects are presented in form of a story / drama connecting the objects in the exhibition. We understood that older adults find such approach interesting, they enjoy and engage in the visit. Participants experienced high levels of enjoyment, engagement and social closeness and scored low on the construct of spatial presence. Both, the audio channel and interactive story were indicated as important for creating an engaging virtual experience for the participants: the audio channel increased the sense of social closeness, while the drama makes the visit more fun and engaging.

9.1.6 Visit the Louvre: exploring video-mediated participation in a museum visit with a guide

The approach we took, guiding the visitors through the museum by presenting small stories around the presented objects (in this case statues), was found appealing to our visitors. Participants talked with the guide, discussed further the content of the exhibition, and tried to point out to specific details of the sculptures. Participants scored high on the user experience aspects of presence, immersion and engagement, and naturalness in our setting independently of the interactivity of the guide or the number of participants in the session. Additional mechanisms should be investigated to provide better sense of orientation (the mirror video was found confusing) and provide for better interaction in such space as currently the system allows only for face-to-face communication.

9.2 Limitations and future work

One of the major limits of our work lies in the inability to compare the results across different studies. We provided different methods to participate from remote and we measured different aspects of the systems so comparing the methods between themselves is not possible under the data presented in this thesis and we can't say if some of the methods works better than the others. A more complex user study with many participants is needed to compare the methods between themselves.

Furthermore all the pilots were conducted by us and not by people totally external to the research. With our personal presence in the settings we could have introduced a thread to the validity of the results.

The work we describe in this thesis represents a research in a context that is of growing interest to society at large, i.e., increasing the participation of older adults in social activities. This opens up the road for dedicated software solutions and further, detailed studies.

For instance, one future work can explore the incorporation of interactive games to stimulate collaboration among visitors and remote participants. Specifically, our results hint that we can increase enjoyment within small groups of visitors through interactive games, such as trivia or hangman, that involve both the onsite visitors and the remote ones. The idea can be to involve the older adults at home in the game in such a way that their contribution is necessary for the onsite visitor too. In this way, they will not only participate in the experience but also feel that they contribute to it.

Another interesting future work is to examine if the spatial arrangement of the museum (or the *museum sequence* as called in architecture literature) influence the levels of perceived spatial presence when the museum is mediated by remote communication technologies. In Chapter 7 we mediated a museum that has a linear sequence and in the Chapter 8 we mediated museum that has circular sequence. The different nature of the experimental designs and data we collected does not allow us to compare and to look if there are differences in both of the cases. Future experiment, involving several museums with different spatial arrangements, can investigate further if there's such an effects on the feeling of experienced presence based on the arrangement of the museum.

Cultural differences between older adults in Italy and the Netherlands have been observed and reported by previous research [129]. From our experiments with older adults in both of the countries, we also observed that there are strong cultural differences that influence patterns of adoption and usage of tools between older adults. We observed that the participants in Italy were quite reluctant to the idea to use technology but were much more open to share and participate in experiences, while the participants in Netherlands were much more enthusiastic to use technology but in the same time they showed much more concerns about privacy when participating from remote. We believe that the underlying differences in needs and values between the different groups are the main cause of this, however what the differences suggest is that a further in-depth study is needed to understand the practical implications for design of virtual remote visits for older adults from different cultures.

Additionally, future research with long-term use of the proposed tools is needed to determine whether older adults enjoy and engage in experiences like the one we proposed here permanently and whether they affect their subjective wellbeing of elderly. This future work will have to include in-depth qualitative and quantitative measures to estimate the effect of active remote participation in museum visits on the factors associated with quality of life for older adults and realistically perceived social support. In the future, given the rapid growth of the elderly population, we hope to see more and more specifically dedicated ICT-based solutions for older people like ours.

Appendix A

Sharing habits questionnaire

This Appendix contains set of questionnaire that e used in Chapter 3.

The first one is a generic questionnaire we used for the Phase I investigation (Chapter 3.1) where we asked our participants if they shared their experiences, what did they share (emotions or content) with whom, and if and why they checked the museum website before and after the visit.

The second questionnaire is the email questionnaire we sent to the participants in Phase II from MTSN, asking if they shared their experiences with someone, and if yes with who.

The third questionnaire is the questionnaire we sent in Phase II to participants from MART, again asking participants if they shared their experiences with someone, and with who.

The forth and the fifth questionnaire respectively are the questionnaire used for the second part of the study, where we investigated sharing with older adults at home (Chapter 3.2). The forth questionnaire is the semi-structured questionnaire we used for the purpose, and the fifth questionnaire is the scheme for the structured interviews. Both of them examine if visitors share experiences with older adults at home, what means they use for the purpose and how we can improve sharing with technology.

Condividere esperienze dopo una visita al museo

1. Generalmente, dopo una visita al museo, Lei condivide qualcosa con i Suoi amici e/o familiari?

- sì - informazioni per contenuto (per esempio opere d'arte o installazioni presentati al museo)
- sì - emozioni ed esperienze originati dalla visita
- no

2. Condivide qualcosa anche sulla Sua rete sociale (es: Facebook, Twitter)?

- sì, informazioni (discussioni, commenti, opinioni)
- sì, multimediali (fotografie e/o video)
- no

3. Ha visitato il sito web del museo prima della visita?

- sì
- no (passa alla domanda numero 7)

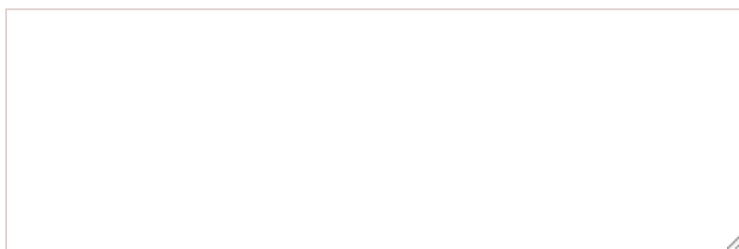
4. Se sì, qual'era il Suo scopo/obiettivo?

- informazioni logistiche (gli orari di apertura, la locazione, il prezzo del biglietto)
- informazioni per decidere se andare al museo o no
- informazioni sul contenuto delle mostre per prepararsi alla visita
- Övrigt:

5. Ha preso appunti durante la visita al museo?

- sì, appunti scritti
- sì, foto delle didascalie
- no

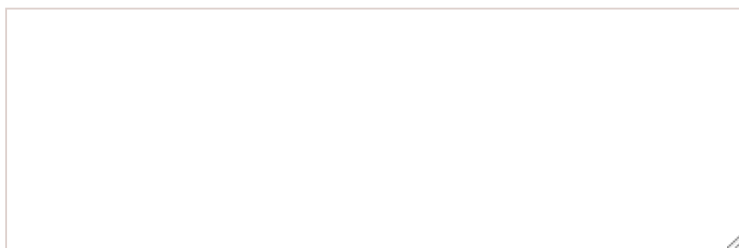
Perche' ha preso appunti, cosa ha scritto?

**6. Quanto è durata la Sua visita alla mostra?**

- 1 ora
- da 1 a 3 ore
- più di 3 ore

7. Potrebbe gentilmente lasciarmi la Sua e-mail? (non la utilizziamo per scopi pubblicitari)**8. Categoria del visitatore:**

- singolo
- coppia
- famiglia con bambini
- gruppo di amici
- Övrigt:

Provincia di provenienza**9. Commenti/suggerimenti:**

Skicka aldrig lösenord med Google Formulär

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Condividere abitudini dopo la visita al Museo delle Scienze

1. Dopo la visita al museo, ha condiviso qualcosa?

- sì, informazioni (discussioni, commenti, opinioni)
- sì, emozioni (impressioni, esperienze, racconti)
- sì, fotografie
- sì, libri, cataloghi della mostra
- no (passa alla domanda numero 5)

2. Con chi ha condiviso?

- famiglia
- amici
- compagno/a
- colleghi di lavoro
- alunni e professori
- Other:

3. Quale modalità ha utilizzato per condividere i contenuti della mostra dopo la Sua visita?

- solo racconti orali (es: discussioni, commenti, opinioni)
- racconti con l'ausilio di materiale multimediale (es: foto, video, DVD)
- racconti con l'ausilio di materiale cartaceo (es: libri, cataloghi)
- racconti con l'ausilio di giochi scientifici e souvenir
- Other:

4. Ha condiviso qualcosa anche sulla Sua rete sociale (es: facebook, twitter)?

- sì, informazioni (discussioni, commenti, opinioni)
- sì, fotografie
- sì, video
- no

5. Dopo la visita, ha visitato il sito web del museo?

- sì
- no

6. Al termine della visita, ha effettuato qualche acquisto?

- sì, libri, cataloghi
- sì, gadget, giochi scientifici
- questa volta no

7. Commenti/suggerimenti:

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Condividere abitudini dopo la visita al MART

1. Dopo la visita al museo, ha condiviso qualcosa?

- sì, ho fatto vedere delle foto, libri, o materiale sul web collegato alla mostra
- sì, emozioni ed esperienze (impressioni, sensazioni, racconti)
- no (passa alla domanda numero 4)

2. Con chi ha condiviso?

- Parenti di eta' minore di 70 anni
- Parenti piu' anziani (70 ed oltre)
- compagno/a
- amici
- alunni e professori
- colleghi di lavoro
- Other:

4. Ha condiviso qualcosa anche sulla Sua rete sociale (es: facebook, twitter)?

- sì, emozioni e impressioni
- sì, link a contenuti
- sì, altro
- no

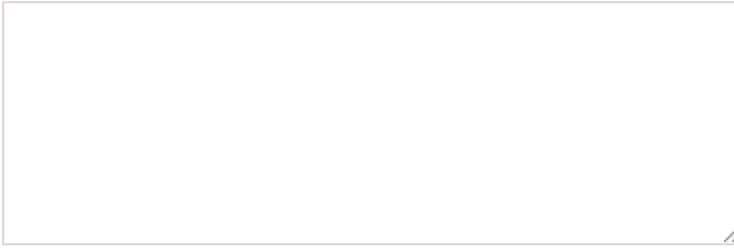
5. Ha suggerito ad amici e famigliari di visitare il museo come attività interessante da svolgere nel tempo libero?

- sì, tramite rete sociale (es: facebook, twitter)
- sì, con altri mezzi (a voce, al telefono, per email, ...)
- no

6. Dopo la visita, ha visitato il sito web del museo?

- sì
- no

7. Commenti/suggerimenti:



Le chiediamo di nuovo la sua email. La disturberemo solo una volta con altre brevissime domande come queste. Se accettera' saremo lieti di riconoscere, se lo ritiene, il suo contributo citandola nei ringraziamenti sui nostri articoli scientifici.

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Coinvolgere gli anziani in una visita al museo da casa

1. In generale, i Suoi parenti anziani visitano i musei? Se no, perché?

2. Di solito, i nipoti raccontano ai parenti anziani la loro visita al museo? Se no, perché?

3. Secondo Lei, tra tutto ciò che ha visto, cosa potrebbe essere interessante per il parente anziano?

4. Quale oggetto Le è piaciuto di più e come intende a dividerlo con il Suo parente anziano?
(se non ci sono idee, passa a domanda numero 5 e 6)

5. Tipi di giochi che piacciono di più al parente anziano?

- quiz
- indovinello
- ordina oggetti in modo cronologico
- indovina la parola (impiccato)
- indovina l'oggetto sulla base di suggerimenti
- puzzle
- Other:

6. Se adesso potesse comunicare la sua esperienza museale con il parente anziano, quale delle prossime opzioni sarebbe più efficace:

- chat
- voce
- mandare foto
- mandare la localizzazione
- mandare materiali aggiuntivi
- Other:

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Coinvolgere gli anziani da casa durante una visita al museo

1. Ha un parente anziano?

- sì (passi alla Dom. 2)
- no (fine)

2. Mi potrebbe gentilmente dire la Sua età?

- 65 - 75
- 75 - 85
- più di 85

3. Qual è la Sua relazione di parentela ?

- padre/madre
- nonno/a
- amico/a
- fratello/sorella
- zio/a
- Other:

4. Il parente anziano vive:

- in casa con Lei
- in una RSA (Residenza Sanitaria per Anziani)
- nella Sua abitazione coadiuvato da un supporto esterno temporaneo o continuativo (per es.: servizio domiciliare, badante ecc.)
- da solo
- Other:

5. Se non vive insieme a Lei con quale frequenza si reca a trovarlo?

- tutti i giorni
- una-due volte alla settimana
- una-due volte al mese

- una volta all'anno
- mai

6. Quando la famiglia partecipa ad un evento culturale riesce a coinvolgere in tale attività anche il parente anziano ?

- sì (passi alla Dom. 8)
- no (passi alla Dom. 7)
- talvolta (passi alla Dom. 8)
- raramente (passi alla Dom. 8)

7. Nel caso di risposta negativa, mi può dire per quale motivo non viene coinvolto?

- problemi di deambulazione
- problemi cognitivi
- scarso interesse per le tematiche culturali
- Other:

8. Il parente anziano utilizza lo smartphone e/o il tablet ?

- sì (passi alla Dom. 9)
- no (passi alla Dom.10)
- non possiede alcuna tecnologia (passi alla Dom. 10)
- Other:

9. Se sì, qual è il livello di utilizzo ?

- basso (effettua solo chiamate e invia messaggi testuali)
- medio (legge/scrive le email)
- alto (scarica ed utilizza le principali applicazioni con disinvoltura)
- Other:

10. Quanto spesso viene al museo con parenti o amici, anziché per conto proprio?

- sempre
- spesso
- ogni tanto
- quasi mai
- mai

11. Nel corso della visita resta sempre con il Suo gruppo?

- sempre
- spesso

- ogni tanto
- quasi mai
- mai

12. Di solito quando è al museo parla con i Suoi compagni di visita?

- sempre
- spesso
- ogni tanto
- quasi mai
- mai

13. Parlare Le fa sentire di stare disturbando altri visitatori?

- sì
- no
- non mi pongo il problema

14. Dopo la visita, con quale frequenza condivide la Sua esperienza museale con parenti e/o amici?

- sempre
- spesso
- ogni tanto
- quasi mai
- mai

15. Quanto spesso avrebbe voluto rendere partecipi della Sua esperienza le persone che non erano presenti alla visita?

- sempre
- spesso
- ogni tanto
- quasi mai
- mai

16. I drammi (in teatro o alla radio) sono un genere gradito al Suo parente anziano ?

- sì
- no
- non lo so

17. Et :

- 18 - 35
- 35 - 55
- 55 - 75
- >75

18. Mi potrebbe gentilmente lasciare la Sua email ? (Non viene utilizzata per scopi pubblicitari)

19. Commenti/Suggerimenti:

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Appendix B

Drama-based Approach: Story Content

Area: (1)

Theme: Introduction

Characters: Alien1, Alien 2

Short summary of the story piece: The characters wake up after being a sleep for a long time. They understand that they are near the planet Earth, and more specifically near the museum MUSE, place where people conserve knowledge. They find an object that they have left long time ago, capable of collecting data regarding the evolution on Earth, and decide to explore them further.

Area: (2)

Theme: The birth of Earth

Characters: Alien1, Alien 2

Short summary of the story piece: The characters see a projection from the object they left, regarding the birth of the planet Earth. They understand that water is fundamental for creation of first life and that photosynthesis is the key process that has started everything.

Area: (3)

Theme: Ediacara biota and burgess

Characters: Alien1, Alien 2

Short summary of the story piece: In this story segment the characters understand that the planet Earth has made many [unsuccessful] attempt to create life, before finding the right solutions. All the forms of life that has disappeared are referred to Ediacara e Burgess.

Area: (4)

Theme: Dinosaurs

Characters: Alien1, Alien 2

Short summary of the story piece: The characters see an object of dinosaur and understand that it is a remaining of spices that dominated the planet Earth million years ago. Additionally, they understand that some of these huge creatures had wings and were able to fly. They understand that people also invented legends specific type of such dinosaurs, called dragons and that in reality, remaining of such creatures were never found.

Area: (5)

Theme: The extinction of dinosaurs

Characters: Alien1, Alien 2

Short summary of the story piece: The characters listen a part of the presentation from the object where the extinction of dinosaurs is explained. The story tells that 65 million years ago a meteorite fell on the planet earth causing volcanic activity in all the vulcans present on planet Earth. A big storm that lasted for days and days destroyed any possible form of life. The event has been explained in different cultures and books: in the Bible, the old Chinese stories, and the story about Gilgamesh.

Area: (6)

Theme: Marine reptiles

Characters: Alien1, Alien 2

Short summary of the story piece: After the big storms that brought to extinction of dinosaurs, planet Earth had to develop new form of life, appropriate for living under water. One of the first forms is Atlantic lizardfish that was a terrible predator, or nothosaurs, similar to seals of today.

Area: (7)

Theme: Mammals

Characters: Alien1, Alien 2

Short summary of the story piece: The characters hear a description about mammals: the main characteristics that differentiate mammals from reptiles is that mammals have warm blood, and don't need to stay hours and hours in the sun in order to regulate their body temperature. They are extremely complex and they take time to socialise with other members of their species. They create herds, that function as a sort of society.

Area: (8)

Theme: Conclusion

Characters: Alien1, Alien 2

Short summary of the story piece: The characters hear description about humans, and understand where their race was wrong: they should take about their children. They understand that instead of humans learning from them, they learnt something new from humans. They decide to go back home and to tell the big discovery with the rest of their members. The story segments end with the characters saying bye to the planet Earth.

Appendix C

Visit the Louvre: Guided tour text

The Rotonde hall, where we are meeting now, leads to series of rooms presenting the history of Louvre as a palace and museum. Louvre was initially constructed as a royal residence in 1202. However, under King Francis I, in year 1564, it received its final shape as Louvre Palace as we know it now. Pierre Lescot was a French architect active during the French Renaissance, “the man who was first responsible for the implantation of pure and correct classical architecture in France”. King Francis I of France took him into his service, and appointed him architect in charge of the building projects at the Palais du Louvre.

The five statues that we see around us are part of the Renaissance facade constructed by Pierre Lescot and they were removed upon a wish of Napoleon I. They form a small exhibition entitled Piety and Justice (Figure C.1).

Zaleucus was the Greek lawgiver who lived in Reggio Calabria, in Italy, said to have devised the first written Greek law code. In the first sculpture we can see his son, who has one eye punctured. In the same sculpture we can also see depicted the assistant of the punishment. *Participatory style: What is especially important to be noted is the richness of hair and the materials of clothings, they are extremely elaborate especially when we think that it is made out of marmar. Can you find the intruder?*

The Symbol of Justice (Zaleucus himself) is presented in the next statue. Zaleucus, himself, passed a law in which if an adult person was found guilty (s)he was punished with blindness. His son was convicted too, however he refused to enforce the law on him, so instead the volunteered so that one eye is taken from him. *Participatory style: Folds*



FIGURE C.1: The Rotonde Hall and the five statues exhibited in it.

of drapery are to be noticed. All the figures from the period of 1500 are dressed in sheer cloths, clearly revealing their body forms beneath. All the figures are usually elongated.

The next status is called Roman Charity, and dates from 1560 - 1564. It depicts a girl named Pero as she is breastfeeding her father, Cimon. The story goes that Cimon was in prison and sentenced to death by starvation. She goes to the prison secretly breastfeeds him so he can survive longer. The guard finds her out and tells the officials. The story impressed the officials and wins her father's release. *Participatory style: In this statue it is important to observe that her father has his prison chain coming down on his right arm. In this statue his arm is not tied to the wall and we see Pero feeding her father while she's seated. In other representations of the same story they have been depicted taking other positions. He has been depicted with his arm actually tied to the wall, and she has been depicted as she's standing.*

Two Lictors is next statue. Lictors were people that were enforcing the law in the time of the Roman empire. The statues depicts Lucius Brutus and his friend. Brutus is shown as he's grieving for his sons. His sons became rebels, and they tried by force to change the government and to bring back the Roman empire as to monarchy. Brutus had to order their death so to maintain the republic. Thus, Brutus was the heroic defender of the republic, at the cost of his own family. *Participatory style: If we take a closer look, at their clothing, like for instance their shoes, we can see that they are different, or their uniform, there's a belief that this statues were realized by two different authors.*

Lastly, we can see statue called Justice of Cambyses. It tells a story that in the time of King Cambyses a judge accepted a bribe from a person in the village and he made a judgment in a favor of the person in a lawsuit. Cambyses found out, arrested him, and punished him in a cruel way. He killed him, and take out his skin, and with the skin, we make a cover for his seat. To replace the judge, Cambyses took his son (Otanés) and reminded him to bear in mind the source of the skin on the seat upon which he would sit to hear evidence,, and deliver his decisions. *Participatory style: If we take a close look, in this picture we can find an intruder too. Who do you think the author tried to present?*

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