Take a Photo for My Story: Social Connectedness for the Elderly

Xu Lin(✉), Xuechen Liu, Matthias Rauterberg, and Jun Hu

Eindhoven University of Technology, 5612AZ Eindhoven, The Netherlands
X.Lin@tue.nl

Abstract. Along with the declining physical and mental condition, the living range and the social circle of elderly people shrink gradually, which indicates a relatively negative effect on the social connectedness of the elderly. The rapid development of the Internet and related technologies, however, bring new opportunities for researchers and designers to help improve elderly people's feeling of being connected and reduce their risks of becoming socially isolated. This paper presents the case study of MemoriesSharing Project, a participatory platform designed for senior residents in care homes to connect with other people and local communities through location-based story sharing. This design consists of an interactive installation and an online platform. Through 2 iterations, we introduce the design and implementation of the system, share the insights for design in care home contexts, and discuss the potentials of interaction design in semi-public spaces for improving elderly peoples' feeling of connectedness.

Keywords: Elderly people · Social connectedness · Care home · Story sharing · Interactive installation

1 Introduction

Since 1980, the number of people who is 60 or over has been doubled, and the number of people aged 65 or over will be more than the population of the children under age of 14 before 2050 [1, 2]. Ageing has become a serious topic for modern society and brings critical challenges not only in safety, mobility and physical health, but also in mental health and social well-being [3, 4].

In recent years, with the maturing of Internet and the rapid development of ICT and IoT technology, people are becoming much more connected with each other through different kinds of smart devices, services and networked environment. The merging of our cyber and physical life also brings new potentials to involve the ageing group, who are relatively away from the digital life, back into the public and mainstream networks through tangible solutions and embedded technologies in real-life context [5, 6].

In this paper, we take the local care homes in Eindhoven as examples to share our understanding about senior residents' social life in long-term care environment. Based on our investigation and design practice, we present the case study of Project MemoriesSharing and discuss the possibilities of embedding the interactive products

N. Streitz and S. Konomi (Eds.): HCII 2019, LNCS 11587, pp. 390–407, 2019.
https://doi.org/10.1007/978-3-030-21935-2_30

and systems into the daily environment of semi-public spaces inside local care homes to support senior residents' social well-being.

The following sessions of the paper include the preliminary studies and investigation with the care givers and residents in local care homes, as well as the design process of two main design iterations and the initial user test in real-life environment.

2 Background and Related Works

2.1 Social Connectedness for Elderly People

Along with the decline of physical and mental health and the shrinking social circles, elderly people usually suffer from the gradually limited mobility and less engagement in social activities. Meanwhile, many of the elderly people also face with the growing threshold in technology caused by the high learning load and the high-speed changes of modern technology. The gap between the ageing group and the mainstream media with new communication tools also increases the difficulty for elderly people to be active and engaged with others. These changes may lead to the increasing risks of being socially isolated, which is claimed to be highly related with the poor physical and mental health in many research studies [7, 8].

In the study of Giummarra et al. [9] on the relationship between ageing and social isolation, the interviewed older people considered social connectedness and social activities to be strongly associated with their overall health. They described social and mental health as being even more important than their physical health. The health professionals interviewed in the study also reported mental and physical health deteriorating when older people were socially isolated. They claimed social health to be at least as important as mental and physical health. Maintaining a good level of social connectedness and preventing social isolation are considered to be important for keeping elderly people's life quality.

However, social connectedness is a complicated concept which can be hardly explained with a universal definition or measurement. A lot of factors can influence how people experience social connectedness, such as age, context, gender, personality, culture, individual preferences, previous social relationship and so on [10, 11]. According to the review of different research studies and investigation tools [12–14], we consider social connectedness as a concept with three main aspects: (1) the quality of social relationship (including factors like the range and scale of the social circle, the frequency and quality of contact etc.); (2) the engagement in social interactions and activities (including general social interactions in daily living environment, the involvement in public social activities, voluntary work etc.); (3) the subjective feeling of being connected and perceived quality of social contact.

2.2 Related Design Works

There have been many solutions and explorations in the direction of improving or maintaining elderly people's social connection with other people. So far, more studies are focused on the bonding between elderly people and their families. For instance, the multi-player games, smart home products [15], photo sharing system, story sharing devices [16] and so on.

Although the social tie with family members is one of the most important parts in most elderly people's life, it should not be the only support for a good social life. In the context like a care home, the interaction between residents, and the connection between people living inside the care home and the local society also have essential influences on elderly's social connectedness. Both intimate and peripheral relationships in elderly people's social circles can provide a sense of connectedness and contribute to their social wellbeing [17–19].

There are also research studies and design explorations aiming to improve elderly people's social connection in care home contexts. So far, the main solutions to provide social support is to provide activities and services to encourage senior residents to share experiences and meet people, like the social groups, recreational activities, workshops, and home visiting [12, 20]. These solutions have strong influences in improving the social interaction between elderly people and others, but meanwhile they also need relatively heavy investments in organizing, managing and maintaining for keeping the activities and services sustainable. Besides, the support from the programed activities is lack of continuous influence on elderly people's feeling and behaviour. When there are no activities, residents have to entertain themselves, while most of the people turn back to the mode of doing nothing at home.

To have sustainable influence as well as to support the social activities ambiently, another direction of designing interactive products or smart environment derives in recent years. At the beginning, many of the explorations still looked into solving mobility and safety problems, but currently there are more and more studies turning to the direction of supporting and improving elderly people's social life experience and other emotional needs. Uitkijkpost [21, 22] is an interactive installation employing the real-time photo sharing experience as a way to build up the connection between people inside and outside the care homes, taking advantages of the strong emotional connection between elderly people and places. The Photostroller [23] is a device presenting the photos retrieved from Flickr website to engage senior residents in the living room and trigger conversation between them. Closer-to-Nature [24] is an interactive installation using the pumping metaphor to trigger elderly people's memory of farm life and facilitating the feeling of being connected to the outdoor nature space.

In most of the projects, elderly people are playing a role as the receiver of the information and services, while there may be possibilities for them to be involved as the generator of the content as well. In MemoriesSharing project, we are not only interested in the exploration to design interactive products and systems in the daily environment to support elderly residents' social needs, but also expect to see whether senior people can be involved into the system as a role to provide meaningful contribution to other stakeholders.

3 Context of Local Care Institution

In order to get a better understanding of senior residents' daily life in local care homes, the researchers in MemoriesSharing team did preliminary studies in three care institutions (Home G, Home B and Home K). The user studies mainly included the ethnographic observation and semi-structured interviews. The observation was

conducted to understand elderly people's daily routine and social activities. The interviews were focused on basic information and more detailed questions on social interaction with different groups in elderly people's social circles. Considering the private issues, video recording was not employed. Instead, the observers took notes for the key variables with a semi-structured form manually. In total, we interviewed 24 residents and 2 care givers in this step.

In this paper, we take Home B as an example to present the basic lifestyle in a local care home in Eindhoven. Home B is a senior apartment with more than 200 apartments, providing care services not only for its residents but also for some people living around in the neighbourhood. Half of the residents (around 100–120 apartments) live in the apartment for the care service, and the others rent rooms but live more independently. On the ground floor, there is a small library next to the entrance of the building, a coffee area along the hallway, a big canteen as the activity center and a small rest space next to it. There are daily services (e.g. the coffee hours and regular meals), weekly activities (e.g. Bingo) and monthly activities (e.g. Chorus and Historical Day) organized for the residents by the care providers. There are also activities open to both residents and people outside the care home.

According to the interviews with the care givers in Home B, many of the residents taken care by them are from different areas of the city, while now they spend most of the time inside the care home due to the mobility and safety concerns of going out. Happiness and excitement can be easily found when families and familiar friends or volunteers come to visit, and the mood depression can also be noticed after the visits. These contacts are important but also limited in elderly people's daily life. More social activities that can keep the seniors cheered up and connected with other people are needed. This is also one of the reasons why they hold many events to involve both residents and the people from the neighbourhood around.

Meanwhile, many residents in the care home stick to their daily routine and resist to have changes. During the observation, noted by the researchers, it was always the similar group of people doing the similar things at the same place. Even in different kinds of activities, the people who would like to join were very likely to be the similar group of residents. Small social groups also gradually formed within these people, and the new comers sometimes reported difficulty of joining the social circle inside the care home. In the coffee area on the hallway, the situation was quite similar, and there was another phenomenon that many residents spent hours sitting and looking outside through the big windows, doing nothing.

Most of the residents in the care home are not familiar with new technologies like computers and smart phones, except some individuals who are able to contact families and friends with emails, Facebook and WhatsApp. The major of the residents still stay with the traditional media like TV, telephone and newspapers. Photos play an important role in their social life, not only providing the way for them to recall the old memories, but also trigger new conversations with other peers or visitors. Some of the residents even bring their important albums together with them every day, in order to show other people with the photos of their old experiences or families.

During the interviews, many people showed a great passion in talking about their stories and experiences in the old days. If there was a suitable trigger like the photos, a map or a news, they would like to talk for a very long time, with personal opinions and

some experiences from the old days which younger generations can hardly know. Usually, it is the family members like the children and grandchildren who listen to them talking about the stories. The residents who joined our interviews admitted that they would like to share those stories with more people, but normally they would not take the first step to actively post or share the experience, since they did not have a way to share and also were not sure whether other people, especially the younger generations, would be interested in those talks or not. When there were organized activities specially for memory sharing, like the Historical Day or workshops for storytelling (Fig. 1), they were willing to join and open to talk. The residents told us if there were people listening to them carefully, it could give them a feeling of being concerned and respected.

Fig. 1. Photo wall from story sharing workshop in care home

4 Design of MemoriesSharing System

Inspired by the related works and the preliminary studies in local care homes, we choose memories sharing as a trigger to build the connection between elderly people and others, taking advantages of elderly people's passion of storytelling and their strong emotional connections with the places and things related to the past. Besides, the rich experience and memories of elderly people can also be considered as a part of the local history, which is meaningful for the younger generations to know. This is also a reason for a lot of social communities and care institutions to organize workshops and activities for intergenerational communication on local history.

Design Process and Methods

Following the process of research through design, the whole study included 3 design cycles, in which the approaches like brainstorming, interaction prototyping, constructive storytelling, Wizard of Oz, semi-structured interview, and observation were employed to help designers conduct analysis, synthesis, simulation, evaluation and decision [25].

In this project, the first design cycle included the preliminary study and concept generation. Ideas were generated through brainstorming, based on the information we collected from the ethnographic observation and interviews. The design concepts were described in storyboards, concept videos and paper prototypes. 4 potential target users were invited to use and evaluate the concept in the early stage.

The second cycle was the first iteration of the design concept, the implementation of the mid-fi prototype on tablet and the user test. In this cycle, another 4 residents were invited to try the prototype with the Wizard of Oz method, in order to simulation the real experience of sharing stories and receiving photo feedbacks.

The third cycle was the second iteration based on the knowledge from cycle 2. In this phase, the concept was refined into a combination of an indoor interactive installation and an online platform. A 3-week initial field trial was conducted in one of the local care homes and 19 people joined for the initial qualitative study.

4.1 Concept Generation and Evaluation

In the first version of the concept, the target users were the senior residents who have unforgettable memories somewhere and would like to visit or have a look at the places again. They were invited to share the memories and express their wishes at the end of the stories. They could share the stories through different ways, including handwriting, audio recording, video recording and face-to-face storytelling to a volunteer. For each story, the key information like time and location would be highlighted by the volunteers and readers online, so that the stories could be recommended to more suitable people. The people outside the care homes could use a map application to receive the stories when they appeared at the location near the stories. They could leave comments or took photos to realize the wishes for the elderly if they liked the stories. If a story received a lot of feedbacks, the story and the replies would be re-organized into a small brochure or a nice poster that could be presented inside the care home.

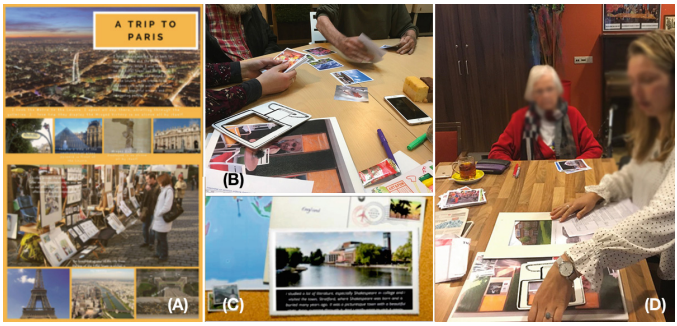

Fig. 2. (A), (B) Props for interview; (C) Screenshot of video sketch; (D) Interviews with residents.

Paper Prototypes and Concept Evaluation

Taking a memory of a trip to Paris and England as an example, the initial concept was made into a simple scenario with a short video sketch and a paper prototype for a quick evaluation (Fig. 2). The physical evidence in the concept (the brochure and the poster) were made for elderly users to understand the concept more easily. During the evaluation, the research assistant (native Dutch speaker with good English level) explain the background and goal of the concept, played the video sketch and explained the

scenario with the video to the interviewees. Then the props in the set of the paper prototype were showed to help them experience the concept. After introducing the concept, prepared questions were asked to make sure the interviewees understand the concept and see how they liked or disliked the design. Feedbacks were collected in notes and audio recordings for analysis.

4 residents (1F, 3 M) were randomly chosen and interviewed in Home B. In general, all the 4 interviewees liked the concept and gave their opinions. The first interviewee (S1) started the discussion particularly on the concrete example in the scenario. He hated the places in the story for personal reasons but would like to see similar stories happened in the country he liked. He also emphasized that he would like to know the local life from real people instead of the introduction written in books. Two interviewees (S2 F, S3 M) used to travel a lot around the world, thus they liked the concept very much and would like to see the photos of current days in those places. The female interviewee reached this goal mainly with the help from her daughter since she hurt her hips seriously and had limited mobility from then on. The man didn't mention any related experience with family's help and was looking forward to the product. Besides, he also expressed curiosity to the countries and places where he didn't have chances to go. One of the interviewees (S1, M) mentioned one common reaction that he thought he didn't have stories (worth) to share with others. Many elderly people held similar opinions that they assumed younger generations might not be interested in listening to or reading an old person's old story. This can be solved with two ways: (1) recommend and push the information to the suitable potential users who are interested in historical stories or the topics mentioned in the story (e.g. the certain location, events, hobbies etc.), and the feedbacks with interest may encourage the senior people to share; (2) encourage the residents to explore other people's stories and get inspired from the shared topics. The feedbacks from the 4 interviewees also indicated that the residents were to some extent interested in personal and real-life experiences shared from other peers.

4.2 First Design Iteration: Touch Screen Application & Website

Design Concept Iteration

The first design iteration was mainly a website with mobile application and webpage versions (Fig. 3A). The basic functions of sharing and exploring stories were implemented. A special interface for public interaction on touch screen were also designed, which was expected to be used by the residents in the semi-public space to share memories and explore other people's stories.

The preliminary study showed that most of the residents were not familiar with computer and Internet, while the care givers mentioned that it would be possible for the residents to try if the interface and the operation were simple and clear enough for them to understand. Most of the people who came downstairs to meet people in the canteen every day were relatively open to the new things, especially when the products meet their interests. Besides, there were also residents who could use smart phones and computers, and were very familiar with touch screens. For this group, either the touch screen in the canteen or the website would work.

Considering the major group of the users often sit and chat with each other during the coffee time, a desktop size was suggested for the prototype, so that the users would stay at the table and use the system together. In this way, the prototype could not only combine the groups inside and outside the care home, but also became a trigger for residents to start more various topics in their daily conversations, instead of repeating the superficial conversations like "good weather".

The basic idea of the design concept was similar to the initial one, but the details were revised. The way of sharing stories was clearly described as posting stories on the website or using the touch screen in the canteen. The concept of promoting the stories was also described in details as recommending the stories to the people who were near the location where the story happened before or the ones who were interested in certain topics.

Fig. 3. (A) Interface of the touch screen version; (B), (C), (D) Interviews with residents.

Mid-Fi Prototype Implementation

Due to the time limitation and the needs of fast prototyping for evaluation, the system was built with the prototyping tool called Mockingbot. The basic interaction of the system was implemented in the mid-fi prototype, and the system of posting stories and receiving feedbacks were simulated with the method Wizard of OZ.

The interfaces on the tablet was kept simple. Most pages are fixed without sliding bar, and the interactions with double tap or holding operation were reduced, so that all the information could be directly seen when the elderly users took the screen, and the system can be easily explored though several buttons.

The start page was a slideshow to introduce the whole project with a sample story. At the bottom, there was one big button with small ones on each side. The big button was the visual center to draw people's attention. It was the starting point of story sharing on this platform. The small buttons were linked to the detailed introduction of the whole project (left) and the showcase of the shared stories (right). Clicking on the start button, users would go to the page of the story map centered by the current location of the device. After choosing the place where the story happened through touching the map or typing the location in the search bar, the users went to the second step of choosing how to tell the stories. At the moment of the first iteration, there were three possible ways: typing, handwriting for photo taking or scanning, and audio recording. After sending out the stories, users would receive messages when the story

receives feedbacks. They could also check the stories in the showcase or through the account information at the top-right corner. Besides reading the replies and checking the photos, the elderly storytellers would also react and edit the content together with the photo, or even add the photo into their original story. The system would automatically generate a layout for either a poster or a brochure style with both the stories and the replied comments and photos, which could be printed out as a physical evidence and a small reward.

Prototype Evaluation

4 people (3 Female, 1 Male) were invited for the user test in this step to see elderly people's acceptance of the version on touch screen and collect the feedbacks on usability (Fig. 3). The interviewees were chosen randomly from the canteen of the care home. 2 of them were not familiar with computer and Internet, the other 2 said they used computer and Internet before.

Similar with the first concept evaluation, the user test started with the introduction of the background and the goal of the project. Then, a sample story of using the product was introduced through research assistant's storytelling and the video sketch. After the introduction, interviewees were invited to recall their own experiences that might be similar with the story as a warm-up, and were triggered to imagine if they were the person mentioned in the story, what they would like to share and what they wished to receive as the reply. Based on the conversation, interviewees were invited to try the system. At the beginning, they were asked to explore and try finishing the tasks of sharing stories and checking replies by themselves. If they met problems and could not reach the goal on their own, the research assistant would give hints and help them to finish the steps. All the conversations were audio recorded for qualitative analysis.

Although showing a lot of interest in the project, the 2 interviewees who did not ever use computer expressed high threshold in adopting technologies in different perspectives. One of the ladies (S1) refused to use the tablet on her own since she did not know how to deal with the device and it was still difficult for her to understand the logic in the interface, even though there were only 3 buttons. The other lady (S2), however, felt it difficult because of her poor eyesight. She spent most of her life in Eindhoven and did not really have a chance going out to other places. Before this concept, she did not think about that she can share the memories with others. Instead of the places and events, she was more interested in animals like horses and dogs, and would like to see more content related to her interests.

For the 2 interviewees who could use computer, the touch screen was much more easily accepted, while the man (S3) preferred the traditional keyboards rather than the soft keyboard on the screen. Both of the interviewees understood the concept and talked about their own experiences. They both chose to type the stories, but none of them finish a detailed and complete story in a short term (10–15 min). The typed content was short with some simple content mentioned in their stories. As mentioned by S3, they needed to think of the wording for written version of the stories, and this would take time and need concentration, which was difficult in a semi-public environment.

According to the user test, it was still difficult for senior residents with little experience of using computer or related technologies to understand and accept the

unfamiliar interaction on smart products, although the care givers were optimistic with their openness towards new things. A tangible solution with intuitional interaction or suitable metaphor of traditional lifestyle was needed to involve the users in this generation.

4.3 Second Design Interaction: Interactive Installation and Online Platform

Design Concept Iteration

According to the feedback from the evaluation of the first iteration, an interactive installation with tangible interactions was considered to be employed for reducing residents' difficulty in using technology.

A metaphor of "writing a letter" was introduced for the elderly people to share their stories and memories. In this version, we designed an interactive mailbox to collect stories in semi-public space, and provided participants with the special letter cards to write stories. On the letter cards, simple questions like when and where the story happened were asked as a hint for participants to highlight the key information, so that the story could be marked on the story map easily and sent to more suitable target readers.

Although most of the residents were not familiar with smart products, the public screen and television were not strange to them at all. To achieve a better effect on presenting the stories and drawing people's attention for participating, a big screen was installed together with the mailbox. The nice sentences and interesting paragraphs of the stories as well as the photos and replies would be presented for more people to see.

Meanwhile, the interaction on the webpage were kept and revised for the users who did not go to the shared spaces regularly but were able to use computers at home.

Ideally, the written stories should be recognized automatically by the system. Due to the technology limitation, in current version, we used the crowdsourcing way to transcribe the documents. There were two solutions: one was to hide the personal information and use the existing online crowdsourcing platform like Mechanical Turk, which would make some cost but the service was relative stable; the other one was to take advantages of the power of social media, while the quality and efficiency needed to be estimated.

Prototype Implementation

The final iteration of MemoriesSharing (Fig. 4A) consisted of the interactive installation in the care home (a special mailbox and a big screen), a website with both gallery and map version for presenting stories, and the social media accounts for promotion.

In details, elderly people who wanted to tell their stories could share the contents via the special mailbox by "writing a letter". The stories would be presented and promoted on a collective "story map" online based on the location data of the stories. On the big screen with the mailbox, the senior storytellers could check the feedbacks to their stories and read other people's stories as well. On the other side, people who were interested in the stories, could receive the stories via social media, or search the stories near them or at particular locations through the "story map". If they liked the stories,

they could leave comments or help enrich the stories by taking new photos of the places, or spreading the stories to more people. Through the interaction between readers and story-tellers, the stories were expected to be continuously updating on the platform, connecting the past and the current local life. The growing stories with new photos and comments, in turn, would also be sent back to the elderly people in a nice visual and physical style as a reward.

Fig. 4. (A) Set-up of MS project; (B), (C) Photos of people using the prototype in care home.

Interactive Installation to Collect Stories (Mailbox)

In the prototyping phase, with the consideration of lower the cost and being flexible to change, the mailbox (Fig. 5A) was made of Mdf and the inside structure for embedding cameras and sensors was created by laser-cutting. The box was in a size around 30 × 40 × 68 cm, covered with the good-quality wallpaper with wood patterns to form a natural and vintage style, which was suitable for the indoor environment in the care home.

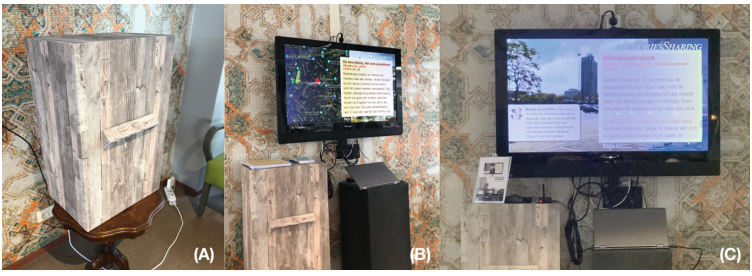

Fig. 5. (A) Mailbox; (B) Set-up of MS installation; (C) Screen layout.

Inside the mailbox, a photoelectric sensor (TCRT5000), a camera and a LED ring (WS2812B) were installed and controlled via an Arduino Nano, connected to a laptop. Arduino, processing and python 2.7 were used to build up the system of letter sensing, data collecting and uploading. The work process of the mailbox was: (1) when the user put the letter card into the box, the photoelectric sensor installed near the entrance sensed the paper and sent out the signal; (2) the laptop hidden in the mailbox

received the signal and turned on the LED ring and the camera on the inner top of the box; (3) After 8500 ms (the duration for elderly user to fully put the letter into the box), the processing program took a photo of the letter card automatically and saved it into a particular folder; (4) 2000 ms later, the camera and LED ring would be turned off again; (5) the photo would be sent to the work email address via Wi-Fi and counted in a backup txt document.

Showcase of Stories (Big Screen)

Stories and feedbacks would be presented on the big screen (Fig. 5C) in the semi-public area like a canteen via the showcase of the system. The stories would be showed on the right side, automatically scrolling-up to show the full content. On the left side, the replied comments and photos through the social media would be captured and presented. If the story was too long, a group of selected paragraphs would be showed instead of the full story. The interface showed on the screen was built with html5 and JavaScript, and a python program was employed to provide content resources for the showcase by monitoring and capturing the data from the Twitter account of the project.

In this version, Twitter, as a mature social media. was one of the main ways to collect feedback. A Twitter account named MemoriesSharing was created to post new tweets when new stories were collected. The readers could leave comments and photo reactions under the story tweets. The python program used the Tweepy API to monitor the twitter account and captured the data from it. For each tweet, a folder was built by the python program. The tweet content (description of the story, and image version of story content), the replied contents (comments, photos, account information) would be captured and saved into different folders under the tweet folder. The data would be read by the JavaScript program and used as the content resource for the html5 interface on the public screen.

Website and the Story Map

Based on html5, the online website was built to show the stories in gallery style as well as the map style. People who were interested in the project can explore the stories on the website, and even joined to help as a volunteer for promoting the stories or transcribing and translating the stories for more potential users.

The story map was an important part of the website. It was a search page built with Google Maps JavaScript API. According to the geographic information (latitude and longitude) of the location where the story happened, the icons representing the stories were created and marked at the certain locations on the map. When the mouse hovering on the icon, visitors could see a short introduction of the story. Double-clicking the icon, visitors can go to the particular story page directly. Through the map, people could explore stories according to the location information, which might also remind the visitors of their own experience in a place and facilitate some emotional connection between the readers and the storyteller.

Initial Field Test and Result

For the second iteration of the project, an initial field test was conducted for about 3 weeks. Several weeks before the field trial formally starting, we set up a pilot experiment at the corner of the canteen of Home K. This corner was a part of the big canteen, where a lot of residents visited every day in the morning and afternoon for the free

coffee. There was a TV on the wall which was convenient for us to connect the mailbox and the MS system without building up new constructions to interrupt elderly residents' daily activities.

The pilot experiment was conducted every morning from 10:00 to 12:00, and 4 residents joined short interviews to give feedbacks for the improvement in details of the design and the preparation of the formal field trial. Based on their comments, several changes were made: (1) the fonts and layouts were slightly adjusted to become easier for the residents to read at the tables (1.2–1.8 m away from the screen), and the details like the speed of scrolling were also adjusted for better reading experience; (2) the sample stories were changed into the ones more related to the local life and typical memories of the generation (e.g. the old life after WWII); (3) cooperation with the local college on historical storytelling was employed and promotion materials like the flyers and posters were created to attract more residents.

After the pilot study, we revised the design, took a warming-up step with the introduction day and then formally started the field trial. In this paper, we reported the initial qualitative feedbacks in the first phase of the field trial.

Introduction Day

To prepare for the field trial, we organized a 1.5-h workshop in Home K (Fig. 6). A presentation was made by a research assistant (speak both Dutch and English) to introduce the background and the goal of the project, as well as to show the residents how to use the system with a prepared example. Questions from residents were answered after the presentation, and the promotion materials including the introduction of the project and a schedule of the whole field trial were given to the participants, working as a reminder of the project and also a potential promotion to the elderly people's family members.

Field Trial and Initial Feedbacks

Fig. 6. Photo of the introduction day.

The field trial took place at the same location with the pilot study, from 9:30 am to 4:30 pm every weekday. One table in front of the screen was regularly assigned to our project. The other one next to our table was occupied by a group of ladies every afternoon. They did not mind us doing experiment next to them, but insisted very much

to sit at that corner and refused to move to the bigger table 3 m away, due to the noise of the radio above that table. Thus, the final set-up of the project included the special mailbox, the big screen of the canteen and one set of the table and chairs. At the beginning, there were 7 sample stories presented on the screen: 3 samples were collected from the residents before the formal field trial, and 4 samples were prepared by MS team.

19 residents were invited for interviews. Most of them were already invited to the introduction day, while some of them noticed the project later by themselves. In order to guarantee that the participants understand the concept clearly, the research assistant shortly repeated the concept and the goal of whole project again. Then the semi-structured interviews started with the basic information and their recent use of the system.

Due the preferences of the elderly people, 11 interviewees were interviewed individually and 8 interviewees were interviewed in pairs and groups (1 couple, 2 ladies together, and 4 ladies insisted to join as a group together). Some of the interviewees did not finish the whole question list. The interviews looked into the following aspects: whether and how much the residents liked the concept; which aspects contributed to their motivation of using the system; how they actually interacted with the installation; whether there were any social interactions with others triggered by the project; personal preferences and expectations in the content on the platform; feedbacks and suggestions on interaction, as well as the input and output way (e.g. handwriting, audio recording, or video recording for input); and their expectations on the quality and frequency of the feedbacks.

In general, most of the interviewees liked the project and the concept, but some of the participants were questioning about the feasibility in technology and the applied context of the system as it looked into a quite new field in their mind. “I am not sure if the installation would actually work” said by one of the interviewees. “It’s funny, but you have to have something to talk about to start it” another interviewee mentioned since she was wondering whether it would be difficult for people without interesting memories to join the project. One of the interviewees who was active and sometimes worked as a volunteer in the care home suggested the project could be connected to other on-going projects, like the project they had for different people to meet and talk on specific topics every month. When discussing that some of the residents might be afraid of using the installation, one interviewee said “It is easy to use”, “just create some groups at the beginning and let them use the concept together with a care giver to get familiar with it”. These comments might indicate a further development direction to combine with the social activities in the care home and to involve the care givers more into the system.

About the feedbacks on input and output methods, most of the residents still chose handwriting as the first priority of sharing the stories, while one man expressed his worries about the feasibility of handwriting for some of the residents, not only because some of the elderly people were too old to write, there were also worries that some of the residents were not able to write properly and were even bullied because of their poor grammar. Some people preferred voice recording because of the “efficiency”, and “easier and faster than writing”. Face-to-face was chosen by 1 interviewee because she could “do it during the coffee time”.

For the story content and the expectation on the feedbacks, some interviewees mentioned that some stories were "too far away" and "hard to connect with", since they prefer to read the stories of the local neighbourhood around them or shared by the people similar with them in age or experiences. When asked about what kind of feedbacks they would like to see and how often they would like to receive the feedbacks, most of the residents were interested either in the comments talking about similar experiences or reactions from different generations which would be new and fresh for them. They did not hold any expectations on the frequency as many of them were not confident enough about their stories to get replies. "I appreciate all the feedbacks. Any time will be good if there are replies" said one interviewee who was quite active in participating the project.

In the beginning, due to the lack of promotion online and outside the care home, the feedbacks were not enough, thus some of the comments during the first weeks were given by the MS team members. Later, other designers and friends were invited to read the stories and help commenting and promoting the project to more people.

In the first 5 days, many letter cards on the table were taken away and 6 stories were collected through the mailbox, 2 stories were sent directly to designer's email address. The 6 hand-writing story providers chose to take the postcards away and wrote their stories in other places, few people really sat at the table in the canteen and wrote their stories, according to our observations. One of the participants explained in the interview that he preferred to recall the memory and write in a quiet and private place. One storyteller sent a very long story through email and he said that typing was faster for him for such a long story. The other storyteller who used email had Parkinson Disease and said he could type but not write.

5 Discussion and Future Work

Based on the lessons and insights from the iterations in this case study, we discuss the possible directions for design interventions in care home contexts to improve and to better support elderly people' s social life.

Tangible and Intuitive Interaction with Suitable Metaphor

In all of the iterations in this design case, we noticed that the preference of elderly people on tangible interaction and metaphor of traditional behaviour was still very strong. Although in recent years, more and more elderly people are becoming familiar with the new technologies, there are still a large group of senior users who have difficulties in adopting new technologies. Furthermore, some of the senior people in the care homes are with relatively high age and have to face with the decline in physical and mental health, which is also one of the reasons for people to be afraid of using technologies and smart products. For most of the senior residents, an interaction that can be understood intuitively or associated with traditional life styles can always be more friendly and easier to try.

However, there are special situations as well. Taking the examples of our storytellers, there are also people with problems of using the traditional way, like the writer who has stories far too long for handwriting and editing, and the participant with PD

who can think and type clearly while writing is a big challenge. Thus, even though the tangible solution is widely recommended, the best choice is still based on the specific context of the design.

Multiple access for Information Input and Output

In the design practice, we started to notice that within the ageing group, individuals were very different from each other, not only because the varieties in aspects like characteristics and personal preferences, but also because their mood, thought and decisions were highly influenced by the health condition, sometimes as well as the changes in social relationships.

Thus, for different residents, the feasible methods are often different, and it is difficult to find a universal solution that can satisfy all the participants in the project. There is a need for the design in a care institution to leave space for openness in content and interaction, which means providing multiple accesses for people to join in their preferred ways.

Sustainable System and Long-Term Evaluation

MemoriesSharing Project is a platform combined the installation and the online service. In the whole project, elderly people are not the only user group. The ideal context of memory sharing experience should be a sustainable and long-term experience, so that the casual interaction and communication between storytellers and the readers can actually bring influences on elderly people's social behaviour and subjective feeling of social connectedness.

One of the possible directions for MS project is to cooperate with the existing social activities, like the activity mentioned by one of the interviewees that people meet and talk on certain topics every month. Compared with the traditional solutions, the advantages of system like MS is the low cost of human resource in maintaining and organizing activities, as well as the continuous effects embedded in the daily environment, so that the residents can join the interaction in a more flexible and casual way.

However, no matter it is the current version of the MS or the future direction, MS project requires the service system that involves different kinds of stakeholders in elderly people's social circle, like the care givers, family members, other residents etc. A suitable service system is needed for further iteration, especially the design to involve care givers and the public readers. Care givers as stakeholders are important since they sometimes have strong influences on elderly people's decisions and behaviours, but at the same time, they are always too busy to join any extra activities. Thus, how to properly involve the care givers without bringing extra burden for them is a critical challenge in the following iteration. In MS project, the participation of the public readers is also very important. However, although the life stories from the ageing group are expected to be a motivation for people to join the project, it cannot be the only motivation and reason. More reasonable triggers are needed to attract the public, especially the younger generation to join the system.

With the consideration of the service system and the sustainable influences on elderly people's social connectedness, project like MemoriesSharing should be evaluated in a longer time period in the real-life environment. This need also raises up the design needs for better details and a more stable system for long-term run.

6 Conclusion

MemoriesSharing Project was a participatory platform designed to enrich elderly people's social interaction by encouraging them to share memories and co-create stories with other people in a crowdsourcing way. The whole design process of the project includes 3 design cycles with 2 main design iterations. According to the insights from the preliminary study, the possible design intervention in this case aims to provide new activities or services for the senior residents in local care homes to enrich the social interaction in their daily environment, especially help improving the connection between residents inside the care home and the people outside.

Through the presenting of the design and evaluation process of the, we share the findings and lessons from our practice, and introduce the typical lifestyle in local care institutions in Eindhoven, the Netherlands. Based on our users' feedbacks, MemoriesSharing project needs to consider the improvement in: (1) tangible solutions with intuitive interaction; (2) multiple accesses for input and output to better meet users' different preference; (3) exploration and design of sustainable system that can cooperate with different stakeholders; (4) longer field evaluation for more reliable feedbacks.

Acknowledgement. We thank all the participants of the experiment, and the cooperation from Vitalis Berckelhof, De Horst/Kronehoef, Genderstate and Summa College. We also thank China Scholarship Council for support with the research.

References

1. World Health Organization: World Health Day 2012 - ageing and health - toolkit for event organizers
2. Tinker, A.: The social implications of an ageing population. Mech. Ageing Dev. **123**(7), 729–735 (2002)
3. Hilt, M., Lipschultz, J.: Elderly Americans and the Internet: E-mail, TV news, information and entertainment websites. Educ. Gerontol. **30**(1), 57–72 (2004)
4. Namazi, K., McClintic, M.: Computer use among elderly persons in long-term care facilities. Educ. Gerontol. **29**(6), 535–550 (2003)
5. Townsend, A.M.: Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia. W. W. Norton & Company, New York (2013)
6. Alves Lino, J., Salem, B., Rauterberg, M.: Responsive environments: user experiences for ambient intelligence. Ambient Intell. Smart Environ. **2**(4), 347–367 (2010)
7. Findlay, R.: Interventions to reduce social isolation amongst older people: where is the evidence? Ageing Soc. **23**(5), 647–658 (2003)
8. Pettigrew, S.: Reducing the experience of loneliness among older consumers. J. Res. Consum. **12**, 1–14 (2007)
9. Giummarra, M.J., Haralambous, B., Moore, K., Nankervis, J.: The concept of health in older age: views of older people and health professionals. Aust. Health Rev. **31**, 642–650 (2007)
10. Global Council on Brain Health: The brain and social connectedness: GCBH recommendations on social engagement and brain health. Technical report, AARP Policy, Research and International Affairs; AARP Integrated Communications and Marketing; and Age UK (2017). www.GlobalCouncilOnBrainHealth.org

11. Davis-Owusu, K., Owusu, E., Marcenaro, L., Regazzoni, C., Feijs, L., Hu, J.: Towards a deeper understanding of the behavioural implications of bidirectional activity-based ambient displays in ambient assisted living environments. In: Ganchev, I., Garcia, N.M., Dobre, C., Mavromoustakis, C.X., Goleva, R. (eds.) Enhanced Living Environments. LNCS, vol. 11369, pp. 108–151. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-10752-9_6
12. Nicholson, N.R.: A review of social isolation: an important but underassessed condition in older adults. J. Primary Prevent. **33**(2), 137–152 (2012)
13. Cordier, R., Milbourn, B., Martin, R., et al.: A systematic review evaluating the psychometric properties of measures of social inclusion. PLoS One **12**(6), 0179109 (2017)
14. Zavaleta, D., Samuel, K.: Social isolation: a conceptual and measurement proposal. In: Oxford Poverty & Human Development Initiative (OPHI) (2014)
15. Schell, R., Hausknecht, S., Kaufman, D.: Barriers and adaptations of a digital game for older adults. In: Proceedings of ICT4AgeingWell2015, Portugal, pp. 269–275 (2015)
16. Biemans, M., van Dijk, B., Dadlani, P., van Halteren, A.: Let's stay in touch: sharing photos for restoring social connectedness between rehabilitants, friends and family. In: 11th International ACM SIGACCESS Conference on Computers and Accessibility, Pittsburgh, PA, USA, pp. 179–186 (2009)
17. Ten Bruggencate, T., Luijkx, K.G., Sturm, J.: Social needs of older people: a systematic literature review. Ageing Soc. **38**(9), 1745–1770 (2018)
18. Steverink, N., Lindenberg, S.: Which social needs are important for subjective well-being? What happens to them with aging? Psychol. Aging **21**(2), 281–290 (2006)
19. Register, M.E., Scharer, K.M.: Connectedness in community-dwelling older adults. West. J. Nurs. Res. **32**(4), 462–479 (2010)
20. Dickens, A.P., Richards, S.H., Greaves, C.J., Campbell, J.L.: Interventions targeting social isolation in older people: a systematic review. BMC Public Health **11**(1), 1–22 (2011)
21. Lin, X., Kang, K., Li, C., et al.: ViewBricks: a participatory system to increase social connectedness for the elderly in care homes. In: Intelligent Environments (Workshops), pp. 376–385 (2016)
22. Kang, K., et al.: Designing interactive public displays in caring environments: a case study of OutLook. J. Ambient Intell. Smart Environ. **10**(6), 427–443 (2018)
23. Gaver, W., Boucher, A., Bowers, J., et al.: The photostroller: supporting diverse care home residents in engaging with the world. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 1757–1766. ACM (2011)
24. Valk, C., Lin, X., Feijs, L., Rauterberg, M., Hu, J.: Closer to nature interactive installation design for elderly with dementia. In: 3rd International Conference on Information and Communication Technologies for Ageing Well and e-Health, ICT4AWE 2017, pp. 228–235. SciTePress (2017)
25. Roozenburg, N.F.M., Eekels, J.: Product Design: Fundamentals and Method. Wiley, New York (1995)