




Interactive Gallery: Enhance Social Interaction for Elders by Story Sharing

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Abstract. At present, the most effective way to deal with the demographic shift of elders is encouraging them to live in nursing homes for more effective health care. However, such move dramatically increases their risk of social isolation. A contextual inquiry in a local nursing home revealed that most elderly people have few connections with the outside environment because of their decreased mobility and have difficulty establishing relationships with fellow residents. In addition, they show great interests in sharing stories. Based on the above findings, we present Interactive Gallery, a system consisting of a cluster of specially designed camera kits and a gallery-like interactive installation utilized with the metaphor of gallery and postcards. This system aims to make the elders feel more connected to the outside environment, stimulate them to reminisce, and further facilitate their sharing of stories with fellow residents and citizens from local communities.

Keywords: Elderly · Story · Social interaction · Interactive installation
Tangible interface

1 Introduction

An increasing number of older people spend their lives in nursing institutions. While living in a nursing home benefits the elderly, it has disadvantages as well. On one hand, a nursing home is a relatively enclosed environment that elderly people cannot leave without supervision. On the other hand, elderly people are disconnected from the mainstream social circles due to the lack of technology and devices that resonate with them [1]. This disconnection is because mainstream user interactions are not based on existing mental models of technology that the elderly already understand [2], which intensifies the possibility of the elderly living in nursing homes to suffer from social isolation.

According to previous studies, people lacking social contacts are more susceptible to diseases, infarction, stroke, and the onset of Alzheimer's disease [3, 4]. Loneliness and social isolation among elderly people are of significant concern.

Recently, more researchers have explored how social technologies can be used to alleviate the elderly's experience of loneliness and social interaction, especially with the development and popularization of the Internet of Things (IoT). The idea that the convergence of the IoT and the social network world is possible, or even advisable, is gaining momentum [5].

In the current paper, we introduce an interactive gallery consisting of a group of specially designed camera kits and a gallery-like interactive installation combined with IOT technologies to facilitate the story-sharing of elderly people in nursing homes with fellow residents and citizens from local communities. We first discuss related theories and representative relevant cases. In the contextual inquiry section, interviews with the caregivers and elderly are conducted. Then, the design requirements are specified, followed by the details of project design and implementation. Conclusions, limitations, and recommendations for future work are found in the final part of this paper. The research methodology includes contextual inquiry, scenario creation, and prototyping.

2 Related Work

The study project links the following areas of research: social interaction of the elderly, life-story, reminiscing, and storytelling. The range of studies within these areas is extensive. In this section, we first discuss related theories, such as memory cues of reminiscence and place attachment theory and then briefly discuss some representative related cases.

2.1 Memory Cues of Reminiscence

Psychologist Webster defined “reminiscence” as: the process of recalling memories from our personal past that is an activity engaged in by adults of all ages at different points throughout their lives [6]. Humans have memory triggers that set off very strong recollections of past experiences. Memory cues are significant aspects of reminiscence and a broad range of external memory cues could be employed as triggers to evoke memory and experiences.

According to S. Tejaswi Peesapati’s research, common memory cues are classified as: things, places, people and experiences, as shown in Table 1 [7].

Table 1. Memory cues by category.

Things	Places	People	Experiences
Entertainment: <i>Music, Books, Games</i>	Homes	Family: <i>Parents, Siblings, Pets</i>	Medical
Technology	Outdoors	Loved ones	School
Appearance	School/Work	Friends	Work
Food			Travel
Events: <i>Sports, Parties</i>			

Interactive devices can support reminiscing using captured images and other data as memory cues, provided design efforts are based on a solid understanding of what makes people remember their past [8].

2.2 Place Attachment Theory

Before elderly people moved into nursing homes, they live in the city for many years and are familiar with the city, lots of places in the city keeps memories and stories of them. Their lives and personal memories are punctuated by meaningful interactions with places. However, when the elderly move into nursing institution, they couldn't leave easily for the lack of mobility.

According to the place attachment theory, a place is not simply a bounded geographical area, it is a space which is imbued with meaning or resonance to an individual or a collective [9]. Place contains a wealth of different experiences and stories especially for the elderly. A place is vibrant and ever transforming and can take differing forms to every individual or collective who experiences it [10].

2.3 The Elderly and Social Technology

Much research has been carried out in theory and practice on how to increase the social connections for the elderly by lowering the threshold of the elderly getting access to social technology. Related research in this area can be summarized into 3 aspects: (1) Increase the elderly's social connections with intergenerational family members: Audio-Enhanced Paper Photos is a hybrid paper-digital approach to sharing photos that is a tool for intergenerational communication, reminiscence, and social engagement [11]. (2) Facilitate social interaction between fellow residents in nursing home: "Bring Dichein" is a local, service-oriented collaborative consumption platform called with the purpose of facilitating social interaction across generations as well as the trade of peer-to-peer services [12]. (3) Meet the needs of keeping up with far-away relatives and friends: "insight" invites elderlies to interact with their loved ones in a playful, intuitive, and non-intrusive manner, all achieved through the utilization of a simple interface metaphor [13].

2.4 Reminiscence of the Elderly

Most of current related research consider reminiscence as a way of therapy for people with AD and other forms of dementia because reminiscence therapy is a proven method of stimulating long-term memory to evoke communication.

Many interactive systems provide digital memory cues to evoke the user to recall memories: Picgo is a game-based reminiscence service that enables elders to capture memories, annotate photos, and iteratively reinforce the annotation of photos in a storytelling process. Which is able to provide meaningful reminiscence materials to caregivers and occupational therapists in reminiscence therapy [14]. Vardit Sarne-Fleischmann introduces a personalized reminiscence program, which was developed specifically for use by patients and their caregivers in the treatment of mild to moderate Alzheimer's disease [15].

2.5 Storytelling of the Elderly

Based on the facts that the elderly have abundant life memories and experiences, they prefer to express themselves in terms of their life achievements and life stories, they love to tell and share their own stories. Some studies try to aid the elderly to tell stories either by interactive installation: Storycubes is a system that helps residents of independent living communities make connections through sharing stories, and express their identity in terms of their unique background, interests, and values [16]. Some others are by the means of tangible interfaces: TopoTiles [10] employs Tangible User Interfaces, which is designed to aid storytelling, reminiscence and community building in care homes. Aiming to use tangible interfaces to aid storytelling and further encourage inclusivity in group sharing situations in an indirect or peripheral manner.

3 Contextual Inquiry

To understand the patterns of socialization of elderly people, interviews were individually conducted with the caregivers and elders in a local nursing home in a contextual inquiry phase. Caregivers have the most contact with the elderly and could provide us information from a relatively objective perspective, whereas the elderly in nursing homes serves as the target group that could provide firsthand feelings and experiences of their social lives.

3.1 Interview with the Caregivers

Four semi-structured interviews were conducted with caregivers in a local nursing home, and each interview was audio-recorded. The main goal in this phase of interview is to obtain information on the following aspects: major roles and responsibilities of the caregivers, collective activities in the nursing home, abilities of reading and writing of the elders, daily routines of the elders, and their connections with their fellow residents and the outside environment.

Table 2. Daily routine of a typical resident under care service.

8:00	Wake up and take a shower
8:30	Cook breakfast by themselves
10:00	If they stay in their apartment, they usually have nothing to do
12:00	Some have lunch in the canteen, and others need a caregiver to deliver the food to them
13:00	After eating, most return to their apartments, while some stay in the canteen
17:00	Dinner
22:00	Bed time

Information gathered from the caregivers are summarized as follows:

- (1) The daily routines of elderly people remain the same. They move from sleeping area to eating area, as shown in Table 2.

- (2) Most of the elderly prefer to do nothing in their own rooms rather than attend collective activities.
- (3) Elderly people encounter difficulty in connecting with their fellow residents.
- (4) Elderly people would like to share their lives and stories with the caregivers, though in most cases the stories are the same.

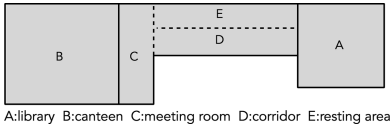


Fig. 1. Layout of the ground floor in the nursing home.



Fig. 2. Canteen and meeting room in the nursing home.

- (5) Elderly people often feel depressed because they could not do some things they could before (Figs. 1 and 2).

3.2 Interview with the Elderly

A total of 11 semi-structured interviews were conducted with older adults (65 years or older) in the local nursing home, and each interview was audio-recorded. Our main objective for this phase is to obtain information from the following aspects: their familiarization with technology, their way of obtaining information, and their connections with fellow residents and the outside environment.

The interviews indicate that although every elderly person knows their fellow residents, the relationships between them are not profound and there are no close bonds. For instance, when talking about whether they had someone to talk with in the nursing home, one interviewee said:

It's always "Good morning," "Good afternoon," "Did you have a nice meal?," or something like that. But real talking? No. They are all very friendly and do it very well, but a real friend? No.

One of the reasons for such disconnection is that they do not understand each other's backgrounds and hobbies, and therefore have no mutual topic to start a conversation. For example, when asked why he/she did not talk too much, one interviewee said: *Well, they're all strangers. There are a couple of people who play cards on the table and we meet very often. But I don't like playing cards.*

Another interviewee said:

Usually it's like "how are you" and so forth. I don't know their hobbies; if you know something about them you might be able to talk about that, but I don't know any of that. I quickly get emotional as well. Then you have no idea how to get through it.

Lack of mobility caused by physical decline also leads elderly people to stay in their own rooms. For instance, one interviewee said:

Every day I hear the same nonsense. As I am also not that mobile anymore, I'd rather stay in my own room. It's always the same topic and so boring.

Information gathered from the elderly are summarized as follows:

Elderly people in the nursing home have alienated relationships with their fellow residents.

Although most of the elderly people's family members visit them at least once a week, the residents feel lonely again when family members leave.

In the nursing home, the only chance for interaction for the elderly people is the time for collective activities. They are connected because they play together; however, there is no significant interaction between them and the activities do not match their interests. Thus, collective activities could not be a medium to establish social connections.

Most elderly people suffer from decreased mobility, which prevents them from leaving the nursing home without the company of caregivers or family members. The nearest supermarket is the maximum distance to reach independently for most elderly people. In short, the nursing home is a relatively closed living environment.

Moreover, most elderly people are greatly interested in sharing stories with others to express their rich life memories and experiences.

3.3 Summary of Contextual Inquiry

Major findings in the above contextual inquiry could be summarized as follows: (1) nursing home internal social interactions comprise the relationships between residents, and (2) nursing home external social connections comprise the social connections between nursing home and outside environment.

In terms of nursing home internal communication, most residents have difficulty establishing meaningful relationships with fellow residents.

With respect to the connection with the outside environment, most elderly people are rarely connected with the outside environment because of their decreased mobility.

Furthermore, the strong desire of the elderly to share their stories could be the breakthrough subject of our design concept.

4 Design of Interactive Gallery

We could construct a design concept based on the findings acquired from the above interviews:

- (1) We could enhance the elderly people's connections with the outside environment by transmitting real-time scenery photos to the nursing home.
- (2) Based on the findings that elderly people enjoy telling and sharing their own stories, we could enhance their understanding of one another by story sharing and further build and improve their social interactions with fellow residents.
- (3) Citizens from local communities could also be involved as volunteers sharing sceneries with elderly people as well as receivers of stories told by the elderly.

- (4) Scenery photos attached with locations could motivate elderly people to reminisce.

4.1 Design Requirements of Interactive Gallery

Elderly people are a special group that lacks experience in using digital devices and suffer from age-related physical decline. Additional design requirements must be considered.

- (1) Tangible interface: physicality

The first concern in designing for the elderly is accessibility and usability, as most interviewees do not use computers or smartphones. Elderly people still rely on paper and prefer physical interaction and operation. Therefore, a tangible interface could be employed to overcome the challenges of traditional screen-based interfaces and lower the threshold of manipulating an interactive installation.

- (2) Metaphor: familiarity and simplicity

Elderly people are greatly interested in traditional physical objects such as handicrafts and radios. They also prefer simple interaction channels like letters and handwritings. Interaction should be based on existing interaction styles that elderly people could rely on to help them manipulate the devices easily [2]. A metaphor could be employed in the design to enhance familiarity and simplicity.

- (3) Share: collaboration and delivery

On one hand, story sharing is a rewarding and engaging process, and it makes sense only when the stories are being listened to. On the other hand, one elderly person telling a story could also cause others to recall their memories. The process is not solitary but collaborative. Thus, the design must provide a way to deliver and share the stories effectively.

4.2 Usage Scenario

As illustrated in the previous section, photos facilitate communication and support reminiscence, while locations contain different experiences and stories. They are both effective methods to trigger our memory and experience of the past. In the concept of Interactive Gallery, scenery photos attached with locations shared from local citizens spark reminiscence for elderly people.

Interactive Gallery is a system consisting of a cluster of specially designed camera kits and a gallery-like interactive installation employed with the metaphor of gallery and postcards. The system aims to make the elderly feel more connected to the outside environment, stimulate them to reminisce, and further facilitate their sharing of stories with fellow residents and citizens from local communities.

Interactive Gallery consists of two parts: the scenery-collectors and an interactive gallery. The former is distributed to the citizens to share outside sceneries, while the latter is placed in the nursing home and used by the elderly people. The design concept and usage scenario of Interactive Gallery are illustrated in the following storyboard (Fig. 3).

- (1) Scenery-collectors are distributed to the citizens from local communities.
- (2) Citizens could put the scenery-collectors wherever they want to share sceneries with the elderly people in nursing homes. Scenery-collectors automatically take pictures of outside views at certain intervals and transmit these to the interactive gallery in the nursing home.
- (3) The interactive gallery displays the scenery photos attached with locations transferred from scenery-collectors. The elderly could print photos in the form of postcards by pressing the installation button. If the scenery photo reminds elderly people of memories and experiences related to the photos, the elderly could write them down on the back of the postcards.

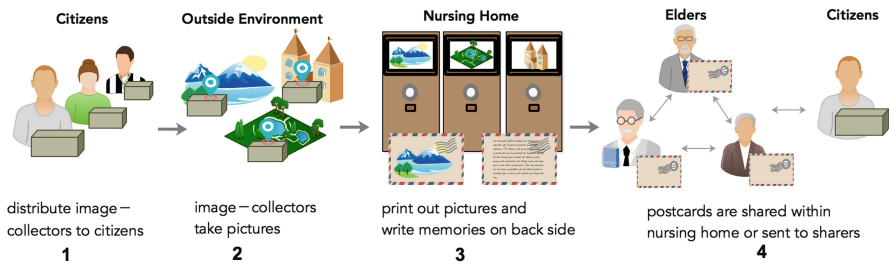


Fig. 3. Storyboard of interactive gallery system.

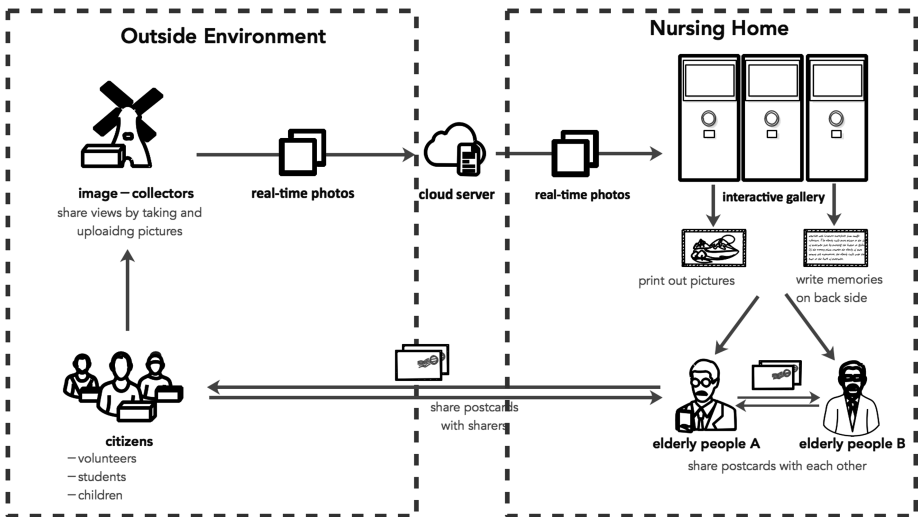


Fig. 4. System architecture of interactive gallery.

- (4) Then, the postcards could be either exchanged with the elderly people in the nursing home or sent to the citizens who share the view (Fig. 4).

4.3 Scenery-Collectors for View Sharing

Scenery-collector is a group of specially designed camera kits. The appearance of the scenery-collector is a brick-like cuboid, which is portable and easy to carry. The shell is made of transparent acrylic covered with cement which is waterproof and unobtrusive in an outdoor environment.



Fig. 5. Scenery-Collector and its interior structure

The interior structure of the scenery-collector is as shown in Fig. 5; it has a built-in portable battery, Raspberry Pi, 3G USB dongles, and a Pi camera module.

Scenery-collectors are distributed to the citizens from local communities. Citizens could put them wherever they want to share sceneries with the elderly in nursing homes. The scenery-collectors could automatically take pictures of sceneries and upload these to the online server at certain intervals. Subsequently, the interactive gallery in the nursing home would download the photo sequence from the online server.

4.4 Interactive Gallery for Story Sharing

The Interactive Gallery, which is a cabinet-like wooden installation, is placed in the nursing home and used by the elderly people. The vintage style is in line with the aesthetic view of the elderly. The installation consists of three units, with each unit equipped with one high-definition monitor decorated with a frame and a large button. A simple interaction channel and the metaphor of gallery and postcards are the two features of the Interactive Gallery, which is easily accessible and easy to use for elderly people.

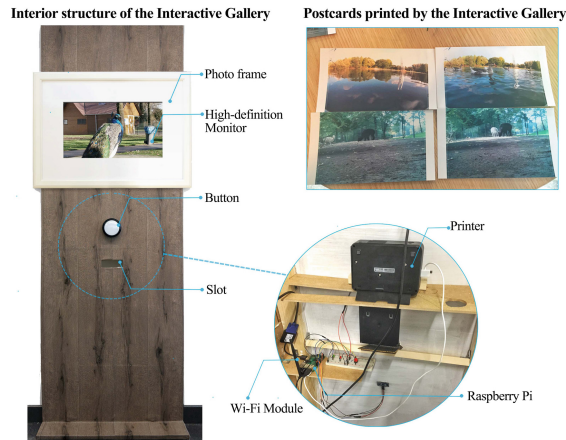


Fig. 6. Interactive gallery and its interior structure

The interior structure of the Interactive Gallery is as shown in Fig. 6; it has a built-in Raspberry Pi, Wi-Fi module, printer, and button.

The interactive gallery displays the scenery photos attached with locations transferred from scenery-collectors. Elderly people could print photos in the form of postcards just by pressing the button on the gallery. If the scenery photo reminds the elderly of past memories and experiences, the elderly could write these down on the



Fig. 7. Implementation of the interactive gallery.

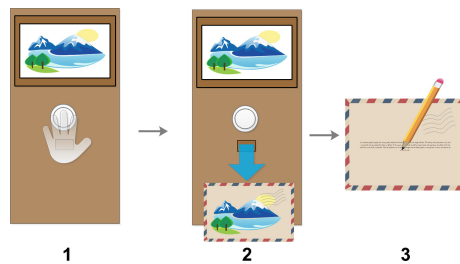


Fig. 8. Interaction process of printing postcards by the interactive gallery.

back of the postcards. Then, the postcards can be either exchanged with the elderly people in nursing home or sent to the citizens who share the view (Fig. 8).

5 Conclusions

Through a user-centered research, we find two prominent problems of elderly people living in a nursing home and attempt to alleviate the problems by design, resulting in the Interactive Gallery.

The Interactive Gallery has two corresponding core functions: (1) Scenery photos attached with locations, which generates reminiscence; (2) and Interactive gallery and post cards, which act as the medium to facilitate the sharing process.

This installation system explores the contents created by elderly people to build and enhance the social interaction of their fellow residents and the citizens from local communities. Two significant considerations should be emphasized during the entire process: triggers and share.

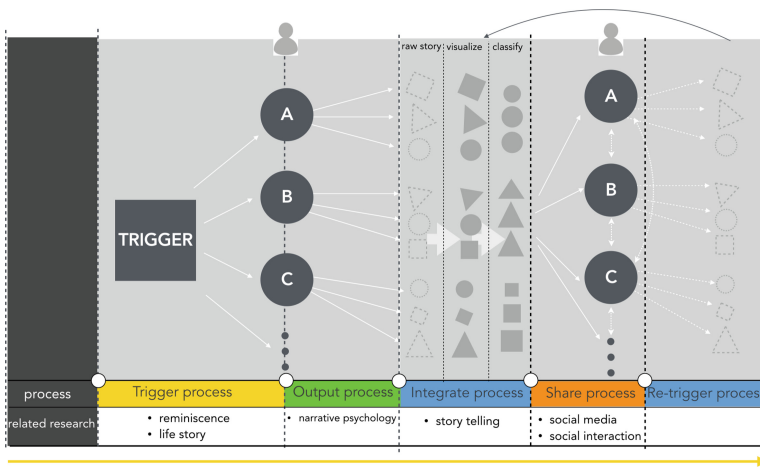


Fig. 9. Five steps for triggering and sharing stories.

Triggers lower the technology threshold of inducing reminiscence for elderly people. We use the metaphor of gallery and postcards, which are familiar to the elderly people, to reduce the learning cost.

Sharing facilitates the process for making the delivery of stories more effective. Story-sharing should be a rewarding and engaging process, in which responsive receivers are needed. In our case, the responsive receivers are elderly people’s fellow residents and citizens from local communities.

Figure 7 shows that the process could be further abstracted as a model that involves the following steps:

- (1) Trigger process: The process of selecting appropriate memory cues as triggers to evoke reminiscence.
- (2) Output process: The various forms (e.g., text, audio, drawing) of the story-creation process.
- (3) Integration process: The process of classifying and visualizing the raw stories.
- (4) Share process: The process in which the created stories are delivered to the audience.
- (5) Re-trigger process: The process in which the stories created by someone could be a new trigger to others (Fig. 9).

6 Limitations and Future Work

Despite the considerable enthusiasm of the elderly people in using the installation, the attraction of the interactive gallery gradually declines. In addition, how to encourage volunteers to share sceneries with the elderly people and sustain the entire process in a long-term and containable way must be considered.

Usability and user experience of the installation must be improved in future iterations. For the current version, although the installation is simple enough, not all the elderly people feel comfortable understanding and using it.

In addition to employing photos and locations as memory triggers, this work will continue exploring the interactive gallery in a variety of triggers in subsequent studies. The first step is using photos of different subjects to explore the most effective trigger for the elderly, and the next is using other types of triggers such as physical objects and music.

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