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Towards the Senior Resident Social Interaction System: A Case Study of Interactive Gallery

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Abstract: The number of older adults residing in nursing institutions is increasing, and many of them experience social isolation. The social interaction of older adults constitutes a complex system that involves multiple stakeholders, including fellow residents, caregivers, members of the local community, etc. This paper proposes an Interactive Gallery, comprising a cluster of scenery collectors and an interactive installation resembling a gallery. It aims to promote social interaction among nursing home residents and members of the local community, as well as between senior residents within the nursing home. We conducted a field study that employed behavior observation and semi-structured interviews. Our findings show that the Interactive Gallery had a positive impact on the social interaction of senior participants, and it also stimulated their interest in sharing their experiences with individuals outside of the nursing home. The implications of our field study are significant. We highlight the social interaction system and behavioral characteristics of senior residents, strategies for enhancing social interaction within the nursing home, and strategies for promoting social interaction between senior residents and members of the local community. The Interactive Gallery presents a novel approach to addressing the issue of social isolation among senior residents in nursing homes. Our field study findings demonstrate its potential to improve the quality of life of seniors by promoting social interaction and engagement.

Keywords: senior residents; nursing home; tangible interface; social interaction

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1. Introduction

The world's population is rapidly aging. Meanwhile, the number of senior residents living in nursing homes is increasing. Though nursing home residents often experience losses in physical health and functional independence, their psychosocial needs remain essential [1]. Social interaction is a critical factor that affects the quality of life of older adults. The quality and quantity of personal social relationships are linked to mental health and have implications for both morbidity and mortality [2]. Lack of social contact can leave individuals more vulnerable to disease, infarction, stroke, and the onset of Alzheimer's disease [3]. Nevertheless, social isolation is widespread among older adults in nursing homes, with senior residents' social connections being limited [4]. Even in nursing homes with high-quality care, residents often experience inactivity, motionlessness, and feelings of loneliness [5].

Entering a nursing home disrupts an individual's social world, significantly altering their relationships with family and friends [6]. According to socioemotional selectivity theory, a lifespan developmental perspective suggests that, as healthy individuals age, their social networks' breadth will be limited by the loss of friends [7]. Additionally, older adults are often disconnected from the mainstream social circle due to a lack of technology that resonates with them [8], and they are generally less likely to use technology than younger adults [9].

In response to the increasing need for social connection among older adults in nursing homes, we propose an Interactive Gallery, which has two primary objectives: to establish

social connections between nursing home residents and citizens from the local community, and to facilitate social communication among the residents within the nursing home. To evaluate the effectiveness of the Interactive Gallery, we conducted direct behavior observations, including both baseline and intervention observations, as well as semi-structured interviews in the field study. The results indicate that the Interactive Gallery had a positive impact on social interaction among the residents within the nursing home and stimulated their desire to share their lives with individuals outside of the facility.

This paper's contributions and features are as follows. The social interaction of older adults constitutes a complex system that involves multiple stakeholders, including fellow residents, caregivers, members of the local community, etc. Previous research has primarily concentrated on strengthening the existing social relationships among nursing home residents. The Interactive Gallery aims to promote social interaction among nursing home residents and members of the local community, as well as between senior residents within the nursing home. We identify the social interaction system and behavior characteristics of nursing home residents. Based on a long-term deployment of the Interactive Gallery, we also outline strategies for promoting social interaction both among residents within the nursing home and between residents and local communities.

2. Related Work

2.1. Theoretical Framing and Anthropological Studies of Social Interaction among Older Adults

The concept of social isolation, particularly in the context of aging, refers to the inevitable loss of social and community ties [10]. Nicholson Jr has identified five broad causes of social isolation, including the absence of quality relationships, physical and psychological barriers, and socio-economic and environmental factors [11]. The literature has consistently shown that the quality and quantity of an individual's social relationships are related to their mental health and mortality [2,12]. Loneliness, which is associated with social isolation, has been defined in various ways, including the lack or perceived absence of satisfactory social relationships, a discrepancy between the relationships people have and the relationships they desire [13], and the amount of time spent alone due to a lack of social networks [14].

Directions of related anthropological studies are extensive. Gillian Harper Ice's study investigated how nursing home residents spent their day, and the conclusion was that older residents spent most of their time in their own rooms, sitting and alone [5]. Other researchers have further studied specific areas: Carstensen et al. have pointed out that older adults' social and emotional goals were directed towards strengthening existing emotionally fulfilling relationships rather than pursuing novel social partners [15]. Hilary Davis et al.'s study focused on the grandparent–grandchild relationship and e on intergenerational play in particular, identifying its pertinent features [16]. In recent years, more researchers have explored the question of how to apply social technologies to the easing of the social isolation of older adults. In this context, Alexis Hope et al. conducted interviews with older adults to understand their communication preferences for social media. They found that seniors articulate many concerns with social media, including the time required for participation, expectations of reciprocity, content irrelevance, and privacy [17]. In addition, some researchers use persuasion techniques to promote the social interaction of elderly people: John Paul et al.'s research focuses on developing a persuasive model employed by virtual agents for encouraging social interaction and lowering the risk of social isolation among older adults [18].

2.2. Applications of Older Adults' Social Interaction and Interactive Installations

The applications for alleviating social isolation among older adults can be categorized along two main directions: (1) strengthening the connections between older adults and their existing social circles, primarily composed of family members; and (2) expanding older adults' social networks within the nursing home setting.

For strengthening the connections, some designs attempt to combine an older adult's everyday objects with a display to enhance communication with family members. For example, Tsujita and Abowd designed SocialMedicineBox, a communication system for older adults using a medicine box [19]. Computer-mediated games, such as the adoption of a game console, such as a Wii, could play a role in supporting inter-generational interaction between older adults and youths [20]. Photographs are also seen as compelling media that facilitate communication: a paper–digital photo album could provide a focal point for communication between older adults and family members [21].

To expand the social circles, a system called StoryCube was developed to help residents of nursing homes to make connections through the sharing of stories and the expression of their identity [22]. Waycott, J. et al. investigated the role of digital content created by older adults in forging new relationships among strangers [8]. Their findings demonstrate that creating and sharing content provides opportunities for older adults to build new social connections within a small peer community.

Interactive installations designed for nursing homes have received attention in the literature, with a particular focus on dementia residents. For instance, the authors of one study developed an interactive wall to assess the responses of nursing home residents with dementia to an interactive art installation, aiming to determine its effectiveness in reducing wandering behaviors [23]. In another study, a robot cat was designed as an artificial companion to provide interventions to older adults with dementia [24]. Moreover, the use of interactive robots has been explored to facilitate social interaction among older adults, such as the sociable robot "Paro," which was placed in a nursing home to encourage social interaction among residents [25]. Additionally, an interactive wall was developed to decrease the number of wandering behaviors of people with dementia [26].

2.3. Designing Technology for Older Adults to Enhance Health

In recent years, there has been increasing interest in the design and development of technology for older adults. Ioana Iancu has provided a comprehensive literature review on the design principles and device features necessary to meet the needs of older people, serving as a valuable starting point for researchers and practitioners [27]. Giuliano Grossi's review focuses on frameworks involving computer vision and machine learning to promote elderly well-being, including cognitive, physical, emotional, and social aspects [28]. Achraf Ammar highlights the importance of innovative ICT-based solutions, such as the ICT-COVID-Companion, to improve physical and mental health among older adults, especially during pandemics. The study emphasizes the use of smart digital solutions, including emotional/social computing, open social platforms, interactive coaching, gamification, fitness trackers, and the internet of things, to provide safe personalized health surveillance [29]. Hacer Guner's study provides data from elderly citizens in Turkey, comparing their use and acceptance of ICT to that of younger adults. Their findings suggest that older adults have a positive attitude towards the use of technology, but still face some barriers, such as limited digital literacy and lack of awareness [30]. Keya Sen's study focuses on identifying how older adults can benefit from affordable and accessible technology use and how to tailor interventions to maximize their beneficial effect. Their study suggests that mobile technology-based applications not only help families stay connected but also link older adults to healthcare resources and encourage physical and mental well-being [31].

These studies highlight the importance of designing technology that meets the unique needs and preferences of older adults. By incorporating innovative approaches and smart digital solutions, technology can enhance physical, mental, and psychosocial health among older adults. Furthermore, these studies emphasize the need for tailored interventions that promote digital literacy and awareness among older adults to maximize the potential benefits of technology.

2.4. Summary

Existing research and applications have primarily focused on strengthening the preexisting social relationships of older adults, while giving less consideration to the involvement of individuals outside of the nursing home. However, both intimate and peripheral relationships in the social networks of older adults contribute to their social well-being, making a comprehensive study of their social interaction crucial. To obtain both subjective and objective information, our field study included inquiries from both elderly residents and caregivers. Furthermore, we aimed to develop a technology probe—an Interactive Gallery—to explore two dimensions of older adults' social interactions: how to establish connections between older adults and citizens from local communities, and how to promote social interaction among senior residents within the nursing home.

3. Design Intervention

3.1. The Current Social Interaction of Senior Residents

In order to gain a comprehensive understanding of the social behavior patterns of older adults, we conducted interviews with both senior residents and their caregivers. A detailed description of the research process can be found in [32]. The following summarizes the main findings related to the current social interaction of senior residents.

First, our findings indicate that senior residents tend to have alienated relationships with their fellow residents. Despite the fact that most older adults receive regular visits from their family members at least once a week, they still experience feelings of loneliness when their family members leave. The only chance for interaction among senior residents is during collective activities, which they engage in together. However, these activities are not sufficient to establish and maintain meaningful social connections. Moreover, most senior residents experience decreased mobility, which limits their ability to leave the nursing home without the company of others. As a result, the nursing home can be considered a relatively closed living environment for them. Overall, our study highlights the need for innovative interventions that can facilitate and enhance social interaction among senior residents.

3.2. Interactive Gallery System

Our design concept was developed based on the observation that senior residents frequently engage in sitting and watching outside of the nursing home through the window (Figure 1). Due to their limited opportunities for external interaction, we aimed to simulate the experience of being "outside" within the nursing home. We also drew inspiration from literature on the use of metaphor to reduce the barriers to technology adoption. A product designed with familiar metaphors has the potential to facilitate ease of use and reduce the learning curve associated with new technologies [33]. As a result, we adopted the metaphors of a gallery and postcard-sending, allowing for simple operations that the senior residents could utilize with minimal or no learning required.

Figure 1. Watching outside of the nursing home through the window.

The Interactive Gallery system comprises two main components: scenery-collectors and a gallery-like interactive installation. Scenery-collectors are distributed to volunteers

from local communities to share real-time scenery photos with senior residents. The gallery-like interactive installation is situated in the public space of the nursing home and allows senior residents to view and print scenery photos into postcards by simply pressing a button. These postcards can be used to communicate with the sharers or be shared with others. Additionally, the Interactive Gallery can also provide topics for the residents to communicate with each other. A use scenario of the Interactive Gallery system is presented in Figure 2: (1) The proposed system involves the distribution of scenery-collectors to citizens in local communities, which they can place wherever they choose to share scenic views with nursing home residents. The scenery-collectors are equipped with automatic cameras that capture the views at pre-determined intervals and transmit them to a gallery-like installation in the nursing home. (2) This installation displays the scenery photos and the addresses transferred from the scenery-collectors. (3) Senior residents can print photos as postcards by pressing a button on the installation. If the scenery photo reminds them of memories and experiences related to the photos, they could write them on the back of the postcards. (4) The postcards can be either exchanged with the senior residents or sent to the citizens who shared the view.

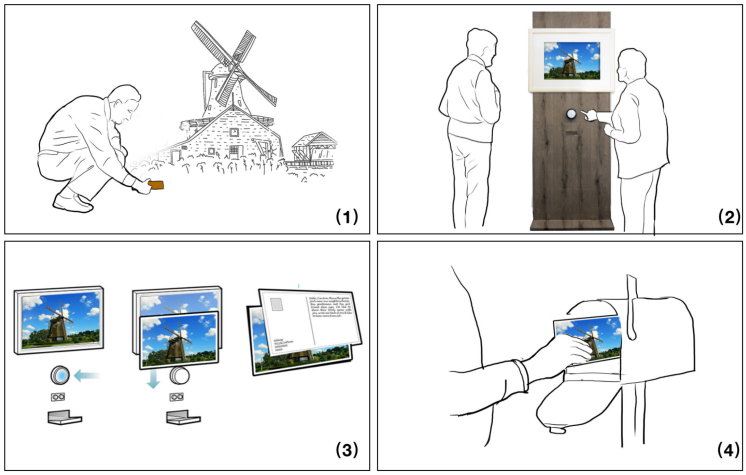


Figure 2. Use scenario of the system.

To be specific, the Interactive Gallery detects the location and behavior of senior residents as they approach, triggering a dynamic 30-s slideshow of still pictures in a time-lapse animation format. This allows elderly residents to observe delicate changes in views over the course of several hours. Following the conclusion of the slideshow, the photo frame stops at the latest image and continues updating at a rate of one image per minute. To further enhance the experience, we have included a button that senior residents can push if they are particularly drawn to a specific scene, allowing them to receive a real postcard from a slot featuring a corresponding image.

The distribution of scenery-collectors to volunteers is a crucial aspect of the system as it enables the real-time sharing of local scenery with senior residents. The gallery-like interactive installation allows the residents to experience the scenery photos in a tangible and interactive way, which enhances their engagement with the content. A tangible user interface (TUI) is a user interface in which a person interacts with digital information through the physical environment [34]. The purpose of a tangible interface is to empower collaboration, learning, and design by giving physical forms to digital information, thus taking advantage of the human ability to grasp and manipulate physical objects and materials. By printing the photos into postcards, the system also facilitates communication between senior residents and the outside world. The provision of topics for communication could potentially reduce social isolation and loneliness among the residents. Figure 3 illustrates the practical application of the Interactive Gallery system,

which can be replicated in other nursing homes or care facilities to improve the well-being of senior residents.

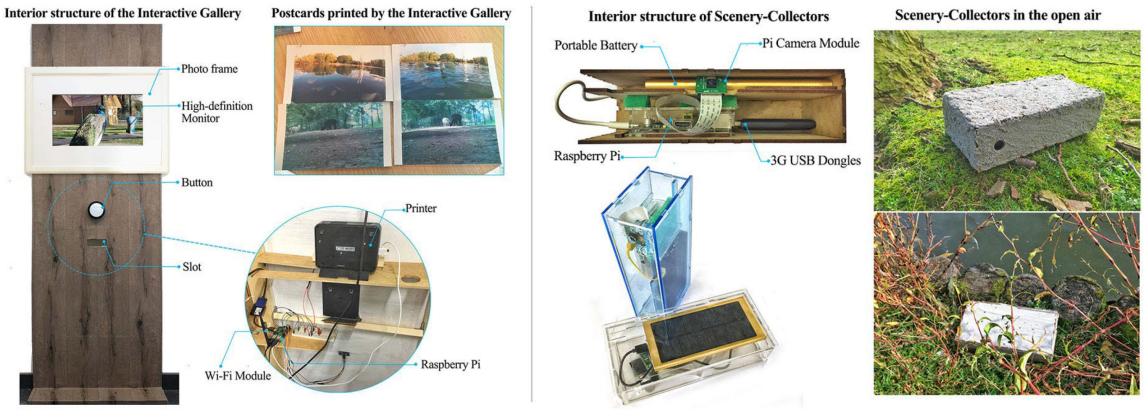
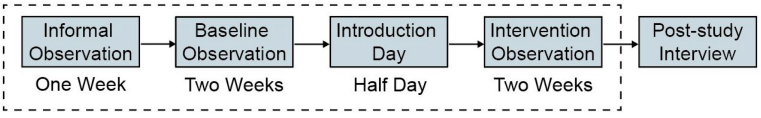


Figure 3. The Interactive Gallery and its interior structure (**left**) and its scenery-collector and interior structure (**right**).

Scenery-collectors for view sharing. The proposed system consists of specially designed camera kits, referred to as scenery-collectors, which are based on the Raspberry Pi platform (Figure 3). The camera kit has a robust brick-like cuboid appearance that is easy to position, and its shell is made of transparent acrylic covered with cement, making it waterproof and unobtrusive in outdoor environments. These kits are distributed to citizens in local communities who can place them wherever they choose to share scenic views with nursing home residents.

Gallery-like installation used by senior residents. The gallery-like installation used by senior residents is placed in the nursing home and comprises three units, each equipped with one high-definition monitor, framed and decorated with a large round button below (Figure 4). The installation displays scenery photos, including location names transferred from the scenery-collectors, which can be printed as postcards simply by pushing the button. The postcards can be either exchanged among senior residents or sent to the citizens who shared the view.



Informal Observation	A one-week period was dedicated to familiarize the observers with the research site and its inhabitants
Baseline Observation	A two-week period followed to measure the senior residents' normal levels of social activity in the public space through systematic observation
Introduction Day	A half-day session was conducted, during which the researchers introduced the Interactive Gallery to a group of senior residents
Intervention Observation	A two-week period followed, during which the senior residents' social interaction level was measured during the deployment of the Interactive Gallery, and a comparison was established with the baseline observations.

Figure 4. Field study procedure.

4. Field Study

4.1. Methods, Procedure, and Research Site

4.1.1. Research Methods

The study was conducted at a Dutch nursing home, where the Interactive Gallery system was deployed in the public space. A set of scenery-collectors were distributed to volunteers in the local community to share real-time scenery photos with the senior residents. The deployment of the system lasted for two weeks and involved two research methods: direct behavior observation and semi-structured interview.

- **Direct behavior observation** was utilized to examine the potential behavior changes that the Interactive Gallery system could bring to the senior residents in the public space. Due to privacy requirements, video recording was not permitted on the research site. As a result, the researchers adopted direct behavior observation to capture the social interaction level of the senior residents. This method provided insight into when, where, how often a behavior occurred, and how long it lasted [35].
- **Semi-structured interviews** were conducted with the senior residents to understand their reflections on the use of the Interactive Gallery. The interviews were conducted in their own environments after the deployment, and the data analysis was deemed more realistic than laboratory data [36]. A pre-determined set of open-ended questions were used to prompt further discussion [37]. The analysis of the interview data provided valuable insight into the senior residents' experiences with the system and their suggestions for future improvements.

4.1.2. Procedure

The observation was carried out by two trained observers, namely the first and the third authors, with the aim of studying the behavior changes in senior residents due to the deployment of the Interactive Gallery system. The field study consisted of three rounds of observation, namely **informal observation**, **baseline observation**, and **intervention observation**, as illustrated in Figure 4. The observers used a standardized protocol to record the participants' behaviors.

4.1.3. Research Site

The average age of the senior residents in our selected nursing home was approximately 85 years old. Approximately twenty residents who suffered from dementia were not included in the study. The public space on the ground floor of the nursing home included a meeting area, a library, and a restaurant/café, which were open to all. Among these areas, the restaurant/café and meeting space were the most frequently occupied by senior residents. As such, we selected these two locations as the research sites, as shown in Figure 5.

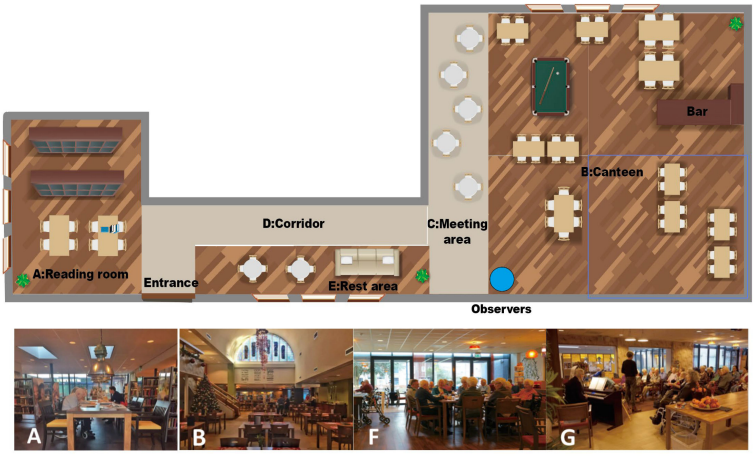


Figure 5. The layout of the ground floor and observer position.

4.1.4. Data Collection of Observation

Prior to the formal **baseline observation**, a short-term **informal observation** was conducted for one week to become acquainted with the observation area. During this period, observers recorded and summarized the behaviors of senior residents in the area (Table 1).

Table 1. Descriptive data of observation.

Location	The senior participants in the public space could be found in the canteen (Area B), meeting space (Area C), or outside. To better record each participant's location changes, each desk within the canteen and meeting space was numbered	
Behavior	**Social behaviors**	Chatting, billiards, order (food), and playing cards
	Passive behaviors	Reading, eating, daze, drinking, watching billiards, watching cards, and smoking (outside)
	Other	Infrequent or difficult to designate, includes watching laptops, sending letters, taking pictures, etc.
Time duration	For each participant, their time spent in each behavior and location was observed and recorded. Duration was recorded in increments of one minute, and less than one minute was recorded as one minute	

We recruited a sample of eleven senior residents who frequently appeared in the public area. According to our one-week-long informal observation, we observed a total of around ninety senior residents that appeared in the public space, however, not all of these residents could be eligible to be participants. The reason for this was that most of these senior residents appeared intermittently, which means they appeared in public spaces only a few times a week, and stayed in the public spaces for short durations. However, as we focused exclusively on the elderly peoples' behaviors in public areas, therefore, the behavior data for those who did not appear in the public areas was extremely limited, and they were less suitable candidates for the study.

Based on the above, our selection criteria were threefold: First, participants had to frequently appear in public areas, these senior participants appeared in public space almost every day. This high frequency of public space attendance facilitated their increased involvement in our field study, allowing us to capture a more comprehensive understanding of their behaviors in these environments. Second, participants had to consent to anonymous observation. Third, we excluded individuals with significant physical impairments as an additional criterion. Additionally, we treated participants' gender, educational background, and previous occupations as random variables in our study.

Observation of senior residents in Areas B and C (the canteen and meeting area, respectively) was conducted by two observers for a duration of two hours each day, excluding activity days in the nursing home. To minimize observer bias, unobtrusive observation techniques were employed, with observers sitting inconspicuously in corners of the public areas and refraining from interacting with the senior residents. The aim of this method was to make the act of observation and recording unnoticeable to those being observed [38]. Senior residents were free to engage in their usual activities without any disruption.

4.1.5. Descriptive Data of Observation

The descriptive data in our study were obtained from a previous work [5], and were based on the model presented by Gottesman [39]. We divided the activities of senior residents into two categories, **social Behaviors** and **passive Behaviors**. We recorded various information about the senior residents, including their **locations**, **behaviors**, and **time duration** of their activities. A detailed description of the observation data and the observation checklist can be found in Figure 6.

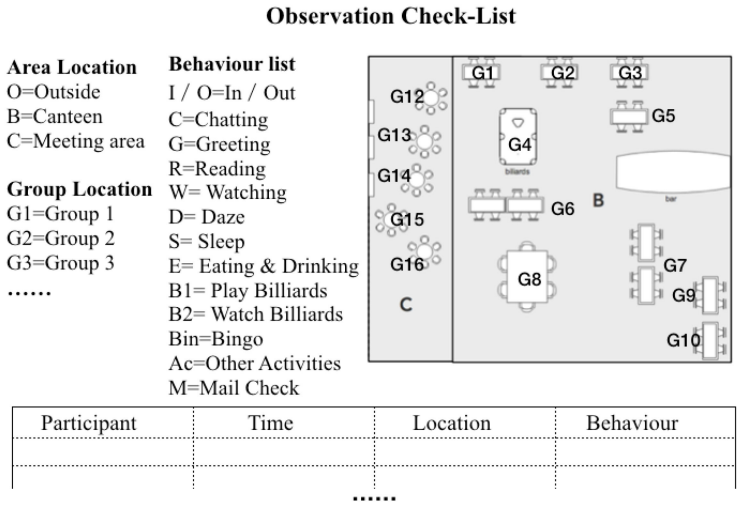


Figure 6. Observation checklist.

4.2. Baseline Observation Results

Before the deployment of the Interactive Gallery, we conducted a **baseline observation** to measure the social behavior of eleven participants in the public space. This initial observation was carried out for two weeks, in order to establish a starting point for the study. As shown in Table A1 we calculated the percentage of time that each participant spent engaging in different behaviors and locations. This was done by adding the number of observations in each category and dividing it by the total number of observations for that participant. The results show that the participants spent most of their time engaging in passive activities in the canteen (Area B), such as reading, eating and drinking, and watching billiards. This finding is consistent with previous research [5], which indicates that passive activities are a common form of social behavior among elderly individuals.

4.3. Design Intervention

4.3.1. Deployment of the Interactive Gallery

Our observations indicated that a majority of senior residents frequented the dining hall in Area C daily, walking along the corridor to participate in public activities. To cater to this foot traffic, we strategically deployed an Interactive Gallery composed of three units along the corridor wall in this area, as illustrated in Figure 7. The deployment was designed to last for two weeks and required no intervention from the researchers. The senior residents were free to interact with the units at their leisure.

Figure 7. Deployment and postcards printed by Interactive Gallery.

The scenery-collectors used in our study were simple to operate, making our recruitment process for volunteers straightforward. We recruited three individuals from our university and local communities who expressed an interest in sharing scenic photographs with senior residents. For instance, one of our volunteers shared a photograph of an alpaca from the zoo, accompanied by a message that read, "*I am sharing this picture of an alpaca because I find it adorable, cuddly, and gentle by nature. I hope that this image will bring you joy and brighten up your day*".

Our field study procedure involved the following steps: firstly, we provided a detailed introduction to the project and distributed scenery-collectors to the volunteers. Next, we advised the volunteers to place the scenery-collectors in natural landscapes with minimal pedestrian traffic to avoid violating the privacy of others in outdoor photographs. The chosen locations included a landmark in the city center, a lake in the northern city, a river that ran through the university, a zoo in the northern city, a building in the southern city, and the city stadium. Lastly, each volunteer was requested to include a brief introduction to the scenery and their contact information (name and address) while sharing the photographs with the senior residents. This added a personal touch to the scenic photographs and facilitated the establishment of a connection between the volunteers and the older adults.

4.3.2. Intervention Observation

The researchers conducted an intervention observation lasting two weeks after the Interactive Gallery was installed. The observation data collected during the intervention phase was compared with the baseline data to determine if there was a significant difference in the eleven senior participants' social interaction behaviors.

During the **intervention observation**, the researchers included an additional behavior category, "Interacting with Interactive Gallery," which comprised three subcategories: watching Interactive Gallery, printing postcards, and sharing postcards. These behaviors were recorded alongside the behavior categories of the baseline observation. Table A1 presents the results of the intervention observation. By analyzing the data, the researchers were able to gain insights into the senior residents' interactions with the Interactive Gallery, as well as its impact on their social behavior.

4.3.3. Comparing Baseline and Intervention Observations of Senior Participants' Behavior

Our hypothesis is that the deployment of the Interactive Gallery leads to an increase in social interaction among participants. More specifically, it is believed that the eleven senior participants allocated a greater amount of time to conversing with one another and also increased their time spent in the meeting area where the Interactive Gallery was situated. Therefore, we conducted a paired-sample *t*-test analysis to compare two sets of data: baseline observation and intervention observation. The first comparison focused on the percentage of time spent chatting, and the results show a significant difference between the two conditions. Specifically, the mean percentage of time spent chatting increased from 26.89% (SD = 21.61) in the baseline condition to 28.00% (SD = 22.47) in the intervention condition, $t(10) = -2.25$, $p = 0.048$. These findings suggest that the installation of the Interactive Gallery had a positive impact on social behavior, as the eleven senior participants spent more time chatting with each other.

The second comparison focused on the percentage of time spent in the meeting area (Area C) in both conditions. The results show a significant difference between the baseline and intervention conditions, with a significant increase in the percentage of time spent in the meeting area (where the Interactive Gallery was located) in the intervention condition. Specifically, the mean percentage of time spent in the meeting area increased from 0.03% (SD = 0.05) in the baseline condition to 0.33% (SD = 0.44) in the intervention condition, $t(10) = -2.34$, $p = 0.042$. These results suggest that the installation of the Interactive Gallery in the meeting area was effective in attracting more residents to this space, thereby promoting social interaction among them (Table 2).

Table 2. Paired sample *t*-tests results comparing baseline and intervention.

	Baseline Mean (SD)	Intervention Mean (SD)	*t*-Value	*p*-Value
Percentage of time spent in chatting	26.89 (21.61)	28.00 (22.47)	−2.25	0.048 *
Percentage of time spent in the meeting area	0.03 (0.05)	0.33 (0.44)	−2.34	0.042 *

Note: SD = standard deviation. * $p < 0.05$.

The results suggest that the eleven senior participants spent a significantly higher percentage of time chatting and in the meeting space (Area C) during the intervention when Interactive Gallery was placed. This finding, along with the interview results, suggests that the Interactive Gallery had a positive impact on the social interaction of senior residents in the public space of the nursing home.

4.3.4. Senior Residents' Usage Frequency of Interactive Gallery

In addition to the observations and interviews, we also tracked the number of times senior residents printed postcards using the Interactive Gallery each day from 13:00 to 15:00. The results are presented in Figure 8, showing a peak on the fourth day and a gradual decline thereafter. This trend suggests that the initial attractiveness of the Interactive Gallery increased but did not sustain over time. This finding highlights the need to consider strategies for maintaining and enhancing the engagement of senior residents with the Interactive Gallery.

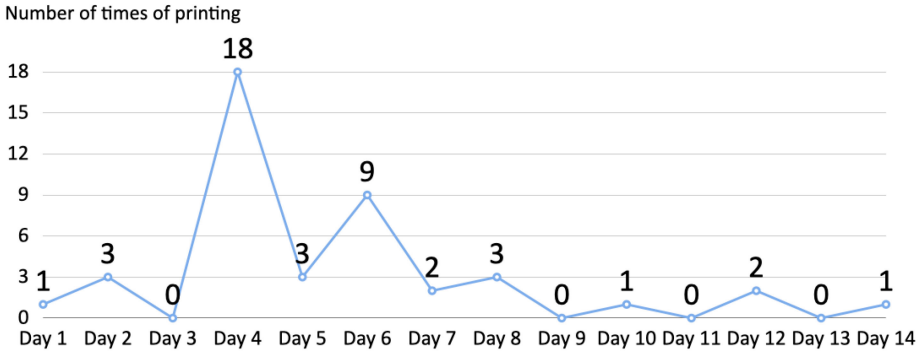


Figure 8. The frequency of postcard printing per day (from 1:00 PM to 3:00 PM) during the observation period of the intervention.

4.4. Post-Study Interview

In this study, we conducted interviews with thirteen residents to gain insight into their use of the Interactive Gallery. The participants were selected through purposive sampling and their demographic information is presented in Table 3. None of the senior residents reported any significant physical impairments that may have affected their ability to use the Interactive Gallery. The participants' educational backgrounds and previous occupations were considered as random variables to ensure a diverse sample. The interviews were designed to explore six key aspects of the participants' experiences with the Interactive Gallery (Table 3). The interviews were conducted in a semi-structured format to allow for flexibility and in-depth exploration of each aspect. The questions were open-ended, and participants were encouraged to elaborate on their responses. The data collected from the interviews were analyzed using thematic analysis to identify common themes and patterns across participants' responses. This method allowed us to gain a rich understanding of the participants' experiences with the Interactive Gallery and provided valuable insights for the development of future interactive installations.

Table 3. Post-study interview procedure.

Post-Study Interview Procedure													
The purpose of the interviews was explained to the older adults													
The older adults were then asked to sign the consent form													
A video was shown to introduce the Interactive Gallery													
Each interview lasted 30 min and was conducted with care to collect comprehensive data													
Semi-structured interview topics													
Overall	Overall impression and evaluation of Interactive Gallery												
Interaction	Interaction frequency, including watching and printing postcards, and recognition of the real-time local photos												
Content	Participants' feelings after viewing the scenery photos and their photo preferences												
Sharing	Whether participants discussed Interactive Gallery with others, shared postcards with others, and if they were willing to share anything else with volunteers												
Usability	Identification of problems encountered when using the Interactive Gallery												
Comments	Comments on potential improvements												
Demographic information of the senior participants (F = Female, M = Male)													
Participant	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
Age, gender	84, F	81, F	79, F	83, M	87, F	78, F	84, M	83, M	90, F	88, F	86, F	90, F	87, F

The Interview results are as follows.

4.4.1. Overall Impression

The vast majority of interviewees provided positive feedback regarding their experience with the Interactive Gallery. They found it enjoyable and captivating, as one participant noted, "*I was able to see places that I cannot physically access. It's a great experience*". Many expressed their fondness for the scenery pictures displayed within the Interactive Gallery. The reasons for their appreciation can be summarized as follows:

Firstly, due to their physical limitations, many of the participants were unable to leave the nursing home independently. As one interviewee stated, "*There are two things that greatly impact my life: limited mobility and poor eyesight*". (P7, M). Another participant shared, "*I used to go to the city center often, but now it's challenging for me. As I am in the early stages of Parkinson's disease, my daughter does not feel comfortable allowing me to go alone*" (P2, F). The Interactive Gallery provided them with a means of experiencing the beauty of the outside world from the comfort of their home.

Secondly, the scenery photos stirred up fond memories for the residents. One interviewee, who was a former photographer, showed great interest, stating, "*I find all of the photos quite lovely. Despite my love of photography and my possession of a small camera, my limited mobility now prevents me from taking pictures outdoors*". (P5, F).

Lastly, the residents were curious about the changes occurring outside of the nursing home, as one participant explained, "Having traveled extensively when I was younger, I am curious to see how the places have changed since then". The Interactive Gallery provided them with an opportunity to stay connected with the world outside of the nursing home.

Overall, the positive feedback from the interviewees suggests that the Interactive Gallery has the potential to positively impact the well-being of senior residents in the nursing home.

4.4.2. Interacting with Interactive Gallery

Frequency of watching the Interactive Gallery. The frequency of watching the Interactive Gallery among senior residents varied, depending largely on their daily routines. Three interviewees reported watching it almost every day, as they regularly went downstairs. One interviewee explained her daily routine: "*Each day, I typically make my way*

downstairs to the public space to enjoy a cup of coffee and check for any new updates to the Interactive Gallery display"—(P8, M). Seven interviewees used the Interactive Gallery approximately every other day. Three others watched it occasionally, either due to infrequent visits to the public space or a gradual loss of interest. As one interviewee stated, "The scenery images stay the same in most cases. I feel it is unattractive afterwards". (P2, F).

Scenery photos of Interactive Gallery. Recognition of scenery photos in the Interactive Gallery varied among the interviewees. Most of them, except for two, recognized that the photos were of local city scenery due to their familiarity with the area. For instance, one interviewee stated, "*I believe the first picture is of the northern city lake. I used to visit the place frequently, but that was a long time ago when I was with my children*". (P11, F). On the other hand, the two interviewees who could not recognize the scenery were non-natives who originally came from other cities. As one of them explained, "I am not local, I spent only a little time here, I am not familiar with this city" (P9, F).

However, some of the scenery photos were difficult to recognize due to significant changes in the scenery over the years. For instance, one interviewee commented on the photo of the zoo, "*When I used to live there, the area was barren with nothing but sand. However, since then, a zoo has been established, and it is home to donkeys and giraffes*". (P5, F). Therefore, the titles attached to the photos were essential clues for the interviewees to recognize them. As one of them pointed out, "*I used to frequent that place often, but it has been a long time. The changes were so significant that I didn't recognize it at first, until I finally noticed the address*". (P12, F).

Most interviewees did not realize that the scenery photos were real-time since the picture changes were subtle. Hence, changing the frequency of the photos could increase their attractiveness. Additionally, it was noted that the frequency in which they watched the Interactive Gallery varied and depended on the interviewees' daily routines. While three interviewees watched it almost every day because they went downstairs frequently, seven watched it every other day, and three watched it occasionally due to lessening attractiveness.

Understanding user interactions with the Interactive Gallery. During the study, most of the interviewees interacted with the Interactive Gallery by pressing the button to print postcards. However, there were two interviewees who did not press the button. One interviewee mentioned that the Interactive Gallery was too novel and unfamiliar to her: "*I have never seen this kind of installation before, so I am not sure how to operate it*". (P12, F) The other interviewee felt anxious when using it: "*To be honest, I was hesitant to press the button, so I asked my son to print the postcards for me*". (P4, M).

Among the interviewees who did use the Interactive Gallery, some attended the introduction day and understood how to operate it. However, others simply followed suit and pressed the button without understanding its purpose. One interviewee stated, "*Initially, I was unsure about the purpose of the button and simply followed suit when I saw others pressing it*". (P10, F) In addition, three interviewees expressed that they did not press the button very often because they found the printing process time-consuming.

Overall, the findings suggest that familiarity with the Interactive Gallery plays a crucial role in user interactions. While some users may require an introduction or a demonstration to understand how to operate the installation, others may feel too anxious or unfamiliar with the technology. Additionally, the time required for printing can also affect user behavior.

4.4.3. Content Preferences

Figure 9 illustrates the interviewees' content preferences. Firstly, the majority preferred hometown scenes, especially those where they were born or spent their childhood, as these places were full of cherished memories that were now difficult to access. This reflects their nostalgic feelings, as one interviewee expressed: "*A picture of a mill would be particularly interesting to me. It would bring back memories of when I used to play with a doll carriage and run around the mill when I was twelve*". (P11, F). Other interviewees echoed similar sentiments:

"*Seeing those pictures again brought back memories from the past. I miss those times, but now that I can't drive anymore, it's difficult to go back there. The pictures takes me back to the moments when I used to go to the park with my kids*". (P10, F). Another shared, "*My childhood home was situated behind a garden and in front of cornfields. I have fond memories of spending time outdoors there, and I miss being able to do so*."—(P9, F). One interviewee from Indonesia had an album of hometown photos and shared, "*Whenever I miss my hometown, I find solace in looking through old photo albums. I think about my hometown every day and long to visit again someday. It is my hope that I will have the chance to return and see my hometown once more*."—(P12, F). Another interviewee stated, "*I have a deep interest in preserving the memories of my hometown and have compiled three picture books of the area. I enjoy sharing them with others*".

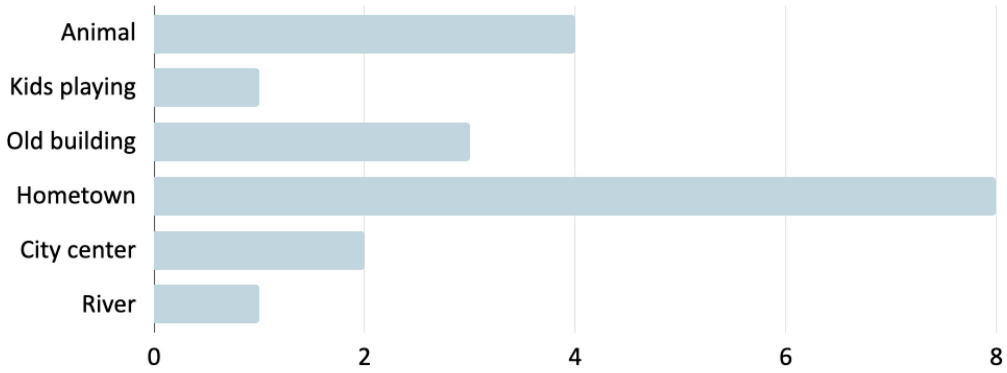


Figure 9. Preferences for scenery.

Secondly, the interviewees preferred dynamic pictures over static ones. Scenery photos containing animals were particularly popular, as they made the photos appear more vibrant. As one interviewee explained, "*I found the ones with zoo animals particularly captivating because they feature dynamic and ever-changing subjects. But the static scenery pictures don't offer the same level of excitement*".—P4, M. Additionally, animal photos reminded them of their own pets. Some interviewees preferred photos from a kindergarten, which could bring back fond memories of their childhood: "*Watching pictures of children playing brings back fond memories of my own childhood. It's as if I'm able to relive those moments of youthful innocence*".—P6, F.

4.4.4. Sharing of Interactive Gallery and Postcards

Talking about Interactive Gallery with others. When asked about whether they shared the Interactive Gallery with others, the majority of interviewees mentioned discussing the scenery photos with other fellow residents, caregivers, and family members. For example, one interviewee said, "*The cute alpacas reminded me of my cat, and I talked about it with someone next to me*". Another interviewee shared, "*I told my friend here that there is TV-like stuff downstairs, and I also mentioned it to my caregiver*". Additionally, one interviewee shared the installation with their family members, stating, "*I shared the installation with my son and we interacted with it together*". These responses indicate that the Interactive Gallery not only has the potential to provide entertainment for residents, but also to facilitate social interaction and conversation between residents and their peers, caregivers, and family members.

Use of postcards. Although all interviewees expressed liking for the postcards, they surprised us by revealing that they preferred to share the postcards with their family members face-to-face rather than writing on them. This preference was largely due to physical limitations, as one participant shared, "*We grow older and have difficulties writing. In my case, I have sight loss, and my hands tremble*". (P7, M). Two interviewees who did send postcards included memories related to the scenery photos and expressed curiosity about the sharers, with one participant stating, "*I am interested in learning more about the individuals who share their scenic experiences with us*" (P4, M).

For those who did not send postcards, concerns centered around privacy, time constraints, and lack of confidence. Some participants believed that their memories were too personal to share with volunteers, while others found postcard writing to be time-consuming and tedious compared with other communication tools, such as phones. As one interviewee stated, "*I used to write cards, especially around Christmas. However, nowadays, cards are becoming less common and people tend to use phones instead. As a result, I don't find many occasions to send letters*". (P4, M). Another participant expressed concern that volunteers might not be interested in her memories and expressed a lack of confidence, stating, "*I think I might not be smart enough, but if it's easy, I would still like to try volunteering*". (P3, F).

Fostering the senior residents' willingness to share their life with others. The interviewees showed a strong inclination to share something interesting with the volunteers despite not sending postcards back to them. One of the interviewees suggested: "*It would be nice if we could take a camera and share our perspective, such as the children playing football outside*". Additionally, they expressed gratitude towards the sharers and emphasized the importance of acknowledging the efforts of the volunteers who have done so much for them. One interviewee mentioned, "*The photos are beautiful, and it's great that they share their views. We should thank the volunteers who have done so much for us*". By acknowledging and appreciating the efforts of the volunteers, senior residents could become more motivated to engage with them and share their experiences.

4.4.5. Suggestions for Improvements and Usability

In terms of suggestions for improvements, the first issue is to enhance the immersion of the Interactive Gallery by including other sensory channels. As one participant noted, "*I can hardly feel real nature, no sound, no smell, no wind*".—P3, M. Another participant suggested that sound could be added to the installation to enhance the experience: "*I believe the installation aims to bring nature closer to those who cannot physically access it. However, I think adding sound could enhance the immersive experience*". (P4, M). Secondly, the subsequent iterations of the Interactive Gallery should take into consideration the individual needs of its users. As one participant stated, "*Everyone has different views. It is not easy to make it good for all people*". (P3, F). The third suggestion is to ensure the sustainability of the Interactive Gallery. One interviewee expressed concerns about its long-term usage, saying that it may not be attractive for repeat visits. "*At first, we found the installation nice, but if people have seen it once, they may not feel the need to visit again*." (P7, M). Fourth, it was suggested that additional functionality could be added to it beyond displaying scenery pictures. For example, one participant proposed: "*In addition to displaying scenery pictures, the screen could also show the latest news to provide more diverse content*". (P7, M). Regarding usability, while the printing function was stable, it was noted that it was time-consuming, taking nearly two minutes. This should be improved to provide a more efficient and faster user experience.

Overall, these suggestions can improve the user experience and the sustainability of the Interactive Gallery, while also considering the individual needs and preferences of its users.

5. Discussion

5.1. Senior Residents' Social Interaction System, Behaviour Characteristics, and Technological Mastery Diversity

Understanding the social interaction system and behavior characteristics of senior residents is essential for designing effective interventions to improve their social well-being. Future research can explore additional factors that influence social interaction, such as the role of technology in facilitating connections between senior residents and their social circles.

5.1.1. Social Interaction System and Behavior Characteristics of Senior Residents

The social interaction of senior residents can be classified into two types based on their social circle: **internal social interaction** and **external social interaction**. **Internal social interaction** refers to connections with fellow residents and caregivers within the nursing home, while **external social interaction** involves connections with family members, friends, and people from the local community. Senior residents' social interaction can also be categorized by the activities they engage in, which can be formal or informal.

Formal social activities involve structured events, such as concerts, bingo, and billiards, while **informal social activities** are more casual, such as chatting, exchanging greetings, and social encounters. Understanding the social behavior patterns of senior residents in these different systems is important for developing strategies to improve their social well-being (Table 4).

Table 4. The senior residents' social interaction system.

The senior residents' social interaction system	***Formal social activity*** (concert, bingo, billiards, etc.)	Most did not actively participate in group activities, and the activities were not effective in promoting meaningful social interactions among them
	Informal social activity (chat, greetings, etc.)	They preferred to stay in their rooms instead of spending time in the public spaces of the nursing home
	Internal Social Interaction (with fellow residents and caregivers)	Caregivers were solely responsible for their physical well-being
		They experienced difficulties in establishing meaningful relationships with fellow residents
	External social interaction (with family members, friends, and people from local community)	Their children visited them periodically, ranging from once a week to once a month
		Connections with old friends had declined due to mobility issues
		They rarely had opportunities to communicate with individuals from the local community

5.1.2. Behavioral Characteristics of Senior Residents and their Impact on Social Interaction

The social interaction of senior residents is affected not only by their social system but also by their behavioral characteristics. Our observation and interviews revealed that the senior residents tend to maintain a stable daily routine and are relatively resistant to change. Their usage of the Interactive Gallery, a social media technology designed to promote social interaction, heavily depended on their daily routines. We also found that the behavior of some senior residents was influenced by the behavior of their peers. Some senior residents used the Interactive Gallery because they saw others doing so, and their behavior encouraged others to interact with it. This phenomenon can be viewed through the lens of social proof theory, which suggests that individuals determine what is suitable, appropriate, or correct behavior based on the extent to which it is demonstrated by others [18].

To fully leverage this behavioral characteristic, we propose that a small group of relatively active senior residents could be initially motivated to participate in social activities. Their behavior could then influence their fellow residents and further motivate them to participate. Thus, understanding the behavioral characteristics of senior residents can help us design interventions that are more effective in promoting social interaction.

5.2. Facilitating Social Interaction among Senior Residents within Nursing Home

5.2.1. Balancing Publicity and Individuality in a Senior Community Installation

The Interactive Gallery installation in the senior community setting demonstrated a unique combination of public and individual attributes. In terms of publicity, it was placed in a communal area and used by multiple residents, with the primary goal of fostering communication and social interaction among the senior residents. Observations revealed that the Interactive Gallery had a positive impact on the eleven senior participants' social behavior: the duration of their chatting activities and the time spent at the installation site both showed a remarkable increase.

Despite its public nature, the Interactive Gallery also had individualistic features that provided a sense of ownership and personalization for each older adult. Specifically, each resident was able to choose what they wanted to print on their postcards, which could be seen as a process of "privatization". The personalized postcards allowed the senior residents to express their individual preferences and connect with the installation on a more personal level. Moreover, the postcards became a conversational piece that they could share with their family and friends during visits.

This combination of publicity and individuality in the Interactive Gallery allowed it to enhance the social connections among the senior residents while also meeting their individual preferences. The personalized postcards provided a sense of ownership and increased engagement with the installation, further reinforcing its impact on social behavior within the community.

5.2.2. Design Should Be Integrated into Their Daily Routines and Promote Their Existing Habits

Designing interfaces for older adults to support their social interaction requires careful consideration of their life habits, routines, and preferences. To promote natural and non-intrusive social behaviors, the design should be integrated into their daily routines and promote their existing habits. For instance, the Interactive Gallery design concept was inspired by the habit of older adults to watch the outside world through a window. Therefore, the Interactive Gallery's watching function aligns with their current habits, making it more accessible to them. Additionally, older adults' daily routines are relatively stable, and therefore, the Interactive Gallery should be placed within their routine, especially where most social behaviors occur.

Rather than imposing socialization activities on older adults, promoting their social behaviors should be natural and non-intrusive. In the case of the Interactive Gallery, their memories are evoked by the scenery photos, which trigger conversations among them, making social behavior natural and non-intrusive. Integrating social communication into the interface can further promote social interaction among older adults, by allowing them to communicate with each other seamlessly. Thus, the interfaces should be tailored to the needs and preferences of older adults, taking into account their life habits and routines, to promote natural and non-intrusive social behaviors.

5.3. Facilitating Social Interaction between Senior Residents and People from Local Communities

5.3.1. Encouraging and Guiding Senior Residents to Connect with People Outside of the Nursing Home

According to the socioemotional selectivity theory, individuals' social goals tend to shift towards the strengthening of existing emotional relationships in late life, rather than in the pursuit of new social partners [15]. However, our study revealed that senior residents have the potential and motivation to connect with people outside of their family members. They appreciated the efforts of the volunteers and expressed a willingness to share their lives with others. Our project served as a catalyst for their communication desires, making them aware of the necessity of social communication beyond the nursing home, and sparking initiatives for both sides.

While they possessed the desire to share their lives with others, they lacked the appropriate tools and confidence to initiate communication. To address this, our project aimed to provide them with tangible interfaces that integrate social communication and can be easily incorporated into their daily routines. By designing tools that are intuitive and non-intrusive, we hope to encourage and guide senior residents in connecting with people outside of the nursing home. In future iterations, it would be beneficial to facilitate communication between residents and scenery-collectors to enable suggestions for photographic subjects. This would not only enhance the overall excitement and engagement with the installation but also foster a greater sense of community and interaction.

Therefore, encouraging and guiding senior residents to connect with people outside of the nursing home requires a comprehensive approach that takes into account seniors' needs, preferences, and unique challenges. By designing intuitive and non-intrusive communication tools and offering guidance and support, we can foster social connections that enhance seniors' wellbeing and reduce feelings of isolation.

5.3.2. Separating Tangibility from Communication

The topic of separating tangibility from communication is of critical importance in understanding the effectiveness of traditional communication methods, especially for marginalized populations such as seniors. While tangible objects such as postcards can create a sense of ownership and engagement, they may not always be the most efficient or effective means of communication. The field study discussed in this content highlights the challenges that seniors face when using traditional means of communication, including high costs, difficulty in writing, and a strong desire to keep the postcards as personal mementos.

To address these challenges, it is necessary to explore new and innovative communication methods that can facilitate quick and easy interaction. The adoption of direct audio recording and speech recognition technology can lower the use costs for senior residents and enable them to communicate more effectively with volunteers and other outside people. However, it is important to consider the unique needs and preferences of different populations when developing these communication methods. Moreover, to fully appreciate the effectiveness of different communication methods, it is crucial to consider the theoretical foundations of communication. Communication theories, such as the communication accommodation theory and the social penetration theory, provide a framework for understanding the processes and effects of communication. For instance, the communication accommodation theory [40] posits that individuals adjust their communication style to match that of their interlocutor, which can be particularly relevant for intergenerational communication. Meanwhile, the social penetration theory suggests that the depth and intimacy of relationships increase as individuals disclose personal information to each other, highlighting the importance of trust and open communication in fostering social connections [41].

Therefore, separating tangibility from communication requires a comprehensive understanding of communication theories and the unique needs of different populations. By embracing new technologies and taking into account the diverse preferences and contexts of different individuals, we can create more effective and inclusive communication methods that strengthen our social connections and reduce feelings of isolation.

5.3.3. Senior Residents Act as Content Producers, and the Outside People Act as Memory Trigger Providers

The interviews conducted in our study revealed that the senior residents' memories were triggered by familiar scenery photos, indicating the prevalence of nostalgia among them. This is in line with the place attachment theory, which suggests that places hold emotional significance for individuals beyond their geographical boundaries [42]. Given the strong emotional bonds between senior residents and the places they have visited,

the Interactive Gallery system leverages scenery photos as memory triggers to promote social interaction.

Our study demonstrates that senior residents have the potential to become content producers, as they possess treasured albums, souvenirs, and stories that they are eager to share with others. While the concept of senior residents as content producers is not novel [8], our study investigates how their contributions can help build new connections with outside people. Through the Interactive Gallery system, the volunteers share scenery photos with senior residents, which trigger their memories and encourage them to share their own stories. In this way, outside people can not only receive content, but also act as memory trigger providers. This collaborative process promotes mutual understanding and boosts the senior residents' self-esteem.

Our study highlights the importance of leveraging senior residents as active participants in the content creation process, and the potential benefits of using memory triggers to facilitate social interaction. Future research could explore how other forms of media, such as audio and video, could be used to encourage content creation and promote social interaction among senior residents. The study also points to the potential of using other forms of media to encourage content creation and social interaction among senior residents. For example, audio and video recordings could be used to capture the senior residents' stories and experiences in a more immersive way. This would allow them to share their memories and experiences with others in a more engaging and interactive manner.

Overall, the study highlights the importance of recognizing the value of senior residents as content producers and leveraging their contributions to facilitate social interaction. By providing opportunities for senior residents to share their memories and experiences with others, we can promote mutual understanding and strengthen the connections between generations.

6. Conclusions, Limitation, and Future Work

This paper explored the potential of facilitating social interaction between nursing home residents and citizens from local communities and social interaction among senior residents within nursing homes and between nursing home residents and citizens from local communities.

The findings suggest that the Interactive Gallery positively impacted social interaction among the senior residents within the nursing home (**internal social interaction**) but did not achieve the anticipated results for **external social interaction**. Nonetheless, it did stimulate the senior residents' desire to share their lives with people outside the nursing home. This study also identifies the social interaction system and characteristics of senior residents and proposes strategies to facilitate social interaction among senior residents within the nursing home and between senior residents and local communities.

Regarding limitations, our study has certain limitations that should be taken into account. Our sample size was limited to eleven senior participants who were selected based on specific criteria. It is important to note that our findings cannot be generalized to the entire population of senior residents who frequent public areas. Therefore, we emphasize the need to interpret our findings accurately within the context of this limited sample.

Despite the small sample size, we conducted a relatively long-term field study over a period of one month and collected valuable data that provide significant insights into our research question. We acknowledge that the small sample size is a clear limitation of our study; however, we believe that our findings still contribute to the current understanding of the topic and provide a foundation for future research in this area.

In terms of future work, this study suggests investigating the potential of senior residents as content producers and exploring other forms of memory triggers, such as albums and mementoes. For the Interactive Gallery itself, the study suggests incorporating real-time video and sound to improve the dynamic effects, and considering other sensory channels, such as smell and wind, to make the experience more authentic and immersive.

It is beneficial for residents to verbally express the content they desire to include on the postcard instead of relying solely on written communication.

Overall, this study contributes to the understanding of social interaction among senior residents and provides insights into the design of technology to facilitate social interaction in nursing homes. Future research can build on these findings to develop more effective interventions to address the social isolation and loneliness experienced by many older adults in nursing homes.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Participants' time budget of baseline observation and intervention observation.

					Baseline Observation						
Participant	1	2	3	4	5	6	7	8	9	10	11
						Location					
Canteen (Area B)	99.25	98.86	79.64	86.53	99.98	98.62	98.75	100	100	99.49	99.06
Meeting area (Area C)	0.02	0.12	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.13	0.00
Outside/Passing by	0.73	1.02	20.36	13.47	0.00	1.38	1.24	0.00	0.00	0.38	0.94
Passive activities	64.57	66.33	34.19	75.65	47.00	61.38	50.09	36.27	75.92	41.75	79.90
Nothing	2.79	12.76	2.10	1.41	3.31	0.69	27.88	5.49	34.31	1.39	1.88
Read	0.00	4.08	0.00	0.00	0.00	25.52	0.00	6.06	0.00	0.00	1.41
Eat and drink	6.68	37.76	0.55	1.21	30.97	35.17	22.21	24.72	41.61	25.35	3.76
Watch billiards	55.10	11.73	31.54	73.03	12.72	0.00	0.00	0.00	0.00	15.01	72.85
Social activities	33.82	32.14	43.28	3.11	51.98	37.24	48.12	62.31	23.09	57.51	17.38
Chat	3.50	30.10	3.73	2.59	46.83	36.55	48.01	61.88	22.36	38.97	1.28
Billiards	28.43	0.00	39.00	0.00	0.00	0.00	0.00	0.00	0.00	18.41	13.62
Order	1.89	2.04	0.55	0.52	5.15	0.69	0.11	0.43	0.73	0.13	1.88
Other	1.61	1.53	22.53	21.24	1.02	1.38	1.79	1.42	0.99	0.74	3.32

Table A1. *Cont.*

	Intervention Observation										
Participant	1	2	3	4	5	6	7	8	9	10	11
	Location										
Canteen (Area B)	99.08	98.36	81.55	88.61	99.83	98.90	98.40	99.95	99.04	98.30	97.66
Meeting area (Area C)	0.16	1.31	0.03	0.02	0.13	0.05	0.09	0.04	0.73	0.14	0.92
Outside/passing by	0.76	0.33	18.42	11.37	0.02	1.05	1.51	0.01	0.23	1.56	1.42
Passive activities	61.76	51.73	35.86	81.78	32.82	53.76	44.96	32.21	67.58	36.06	73.52
Nothing	0.76	5.81	4.60	2.41	4.52	2.32	28.57	4.27	24.23	0.00	2.18
Read	0.00	5.69	0.00	0.00	0.00	16.32	0.02	5.51	0.86	0.12	1.33
Eat and drink	6.05	32.07	0.48	1.08	15.72	35.12	14.22	21.91	42.49	22.21	2.73
Watch billiards	54.95	8.16	30.78	78.29	12.58	0.00	2.15	0.52	0.00	13.73	67.28
Social activities	37.05	35.04	44.94	2.73	47.17	39.13	52.10	64.76	24.51	58.58	19.1
Chat	3.62	33.50	4.35	2.32	46.91	38.37	51.89	64.58	23.28	37.81	1.32
Billiards	33.35	0.00	39.73	0.00	0.00	0.00	0.00	0.00	0.00	20.54	16.69
Order	0.08	1.54	0.86	0.41	1.26	0.76	0.21	0.18	1.23	0.23	1.09
Interact with installation	0.13	0.31	0.08	0.04	0.00	0.20	0.00	0.34	0.13	0.31	0.06
Watch installation	0.13	0.28	0.08	0.04	0.00	0.16	0.00	0.31	0.13	0.07 0.23	0.06
Print postcards	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.01	0.00
Share postcards	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00
Other	1.06	12.92	19.12	15.45	19.01	7.09	2.94	2.69	7.78	5.05	7.32

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