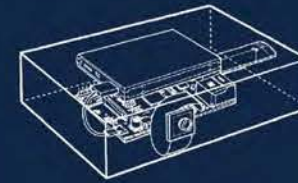
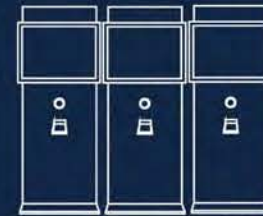


# Design for Story Sharing: Connect Seniors with their Children

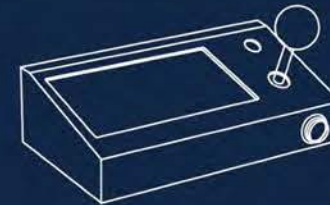
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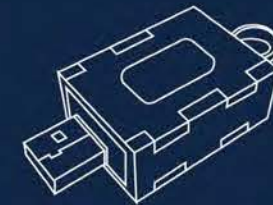
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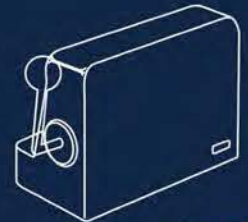
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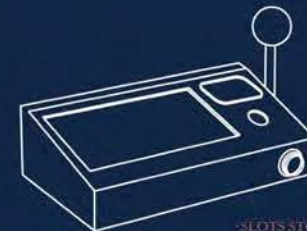
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-SLOTS STORY



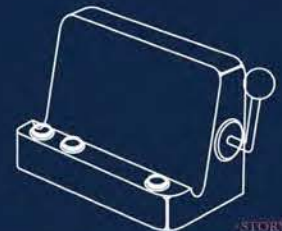
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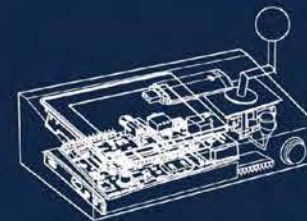
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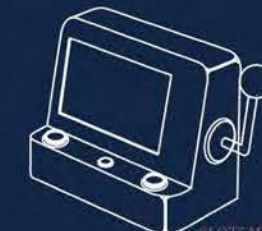
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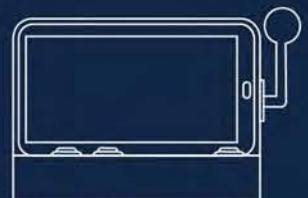
-STORY ME



-SLOTS STORY



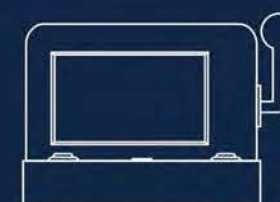
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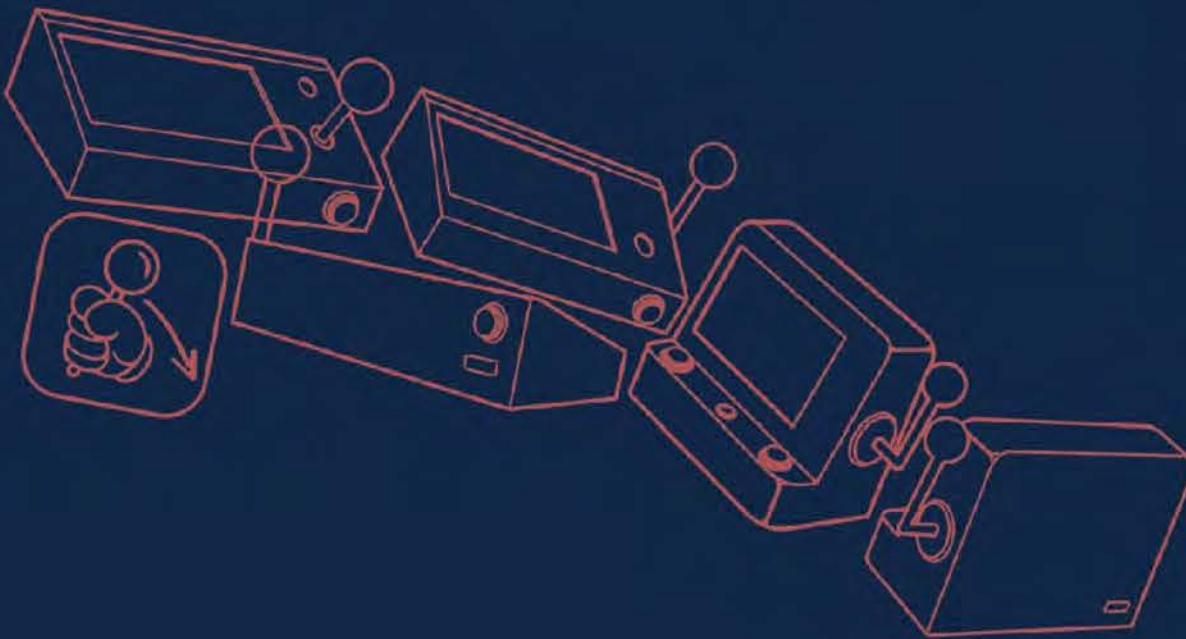
-SLOTS MEMENTO



-STORY ME

Design for Story Sharing: Connect Seniors with their Children

Cun Li



**Design for Story Sharing:**

**Connect Seniors with their Children**

Cun Li | 李存

# **Design for Story Sharing: Connect Seniors with their Children**

## **PROEFSCHRIFT**

ter verkrijging van de graad van doctor aan de Technische Universiteit  
Eindhoven, op gezag van de rector magnificus prof.dr.ir. F.P.T. Baaijens,  
voor een commissie aangewezen door het College voor Promoties, in het  
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Het onderzoek of ontwerp dat in dit proefschrift wordt beschreven is uitgevoerd in overeenstemming met de TU/e Gedragscode Wetenschapsbeoefening.

## Summary

### Essays on the Design for Story Sharing- Connect Seniors with Their Children

The world is graying. The worldwide population over age 65 is expected to more than double from 357 million in 1990 to 761 million in 2025. Within the context of the ageing society, social isolation is widespread among older adults. Among all their social relationships, the older adults rank connections with family members second only to health, as the most important area of their lives. Given that one of the most precious characteristics of older adults is their memory of events, people, and places, storytelling could act as an effective way to keep them stay in touch with their children. However, while younger seniors are embracing online social technologies, their parents, many of whom are still living, are neglected in this trend; these non-tech-savvy elders are targeted in this research. Based on the situation described above, the research presented in this thesis attempts to answer the research question:

*How can interactive technology facilitate intergenerational storytelling, specifically for non-tech-savvy older adults?*

To answer this question, four sub-questions are formulated:

- (1) What are the characteristics of older adults' storytelling?*
- (2) In which ways could interactive technology facilitate older adults to tell stories?*
- (3) In which ways could interactive technology involve older adults' children for intergenerational storytelling?*
- (4) Does such intergenerational storytelling with interactive technology promote connections between older adults and their children?*

The research described in this thesis follows a Research-through-Design approach. It includes one research context exploration and three Research-through-Design iterations. It started from an explorative project View-brick, which was a joint effort with fellow researchers Xu Lin and Kai Kang (Lin et al. 2016; Kang et al. 2018). Its findings helped to narrow down the research area and to specify research questions. To answer the research questions prototypes were iteratively developed. In the 1st and 2nd iterations, these prototypes were deployed in field studies, which focused on life stories and memento stories, respectively, while

the 3rd iteration aimed to also fully involve the young generation. Each iteration roughly consisted of a contextual inquiry, a research prototype, a field study, and reflections (see Figure 1).



Figure 1 Overview of the iterations

The dissertation is organized into an introductory chapter, five chapters describing the research activities, and a final chapter in which the research is discussed.

Chapter 2 reports on the implementation of View-brick, a team project conducted together with fellow researchers Xu Lin and Kai Kang. The three of us developed and deployed the View-brick system, from different perspectives. For me, the View-brick was for exploration, aiming to understand the situation of older adults' social interaction, to narrow down my research focus, and define my Ph.D. research question. The results of this study indicated that older adults could be deemed as story content producers, with their children as their listeners.

Chapter 3 presents a systematic literature review that explores the state-of-the-art in the field of 'older adults' intergenerational storytelling and technology accessibility.

Chapter 4 focuses on the life stories of older adults and reports on the development and deployment of the Slots-Story prototype. In a field study, interviews

were conducted before and after the deployment. Stories collected through the prototype deployment were analyzed on three dimensions: thematic, structural, and interactional. As some story themes were concerning family mementos (photos, souvenirs, letters, et cetera.), I turned my attention to these in the next iteration.

Chapter 5 focuses specifically on the older adults' memento stories. The prototype built in this iteration is called Slots-Memento, which is a follow-up of Slots-Story. In a field study, semi-structured interviews were conducted with older adults and their children, before and after the deployment. Mementos were categorized and analyzed. Stories were transcribed, then again analyzed thematically, structurally, and interactionally. Finally, I found the importance of optimizing the process of the young providing feedback to older adults after listening to the stories.

In chapter 6, to fully involve the older adults' children, a smartphone application was designed for the young, together with a re-designed prototype, creating a complete system. Chapter 6 reports on the deployment and evaluation of this final system design.

Lastly, in chapter 7, I present the conclusions of and reflections on this research. The reflections are findings derived from the research, but irrelevant to the research question, including implications for Research-through-Design and designing prototypes for older adults.

The contributions of this thesis are as follows. I see the intergenerational story sharing as a cooperative process that both the storytellers and listeners should actively be involved in. I particularly investigated and answered the question of how the young generation could participate. They are not only the audiences of a storyteller (older adult), but also the memory trigger providers acting as "filter" and "selector". I analyzed the collected stories deeply and comprehensively, from three dimensions: thematic, structural and interactional. The thematic analysis helped us to understand their preferences for story topics. The structural analysis helped us to understand their narrative patterns. The interactional analysis concluded the differences between the independent and face-to-face uses. Moreover, a framework for intergenerational storytelling was constructed, which details the intergenerational memento storytelling into four processes: triggering, telling, sharing, and curating.



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# Chapter 1

## INTRODUCTION



Chapter 1 is devoted to describing three aspects: (1) Research background (Section 1.1). Within the context of the ageing society, social isolation is widespread among older adults. Among all their social relationships, the older adults rank connections with family members second only to health, as the most important area of their lives. Storytelling has the potential to bridge the two generations, i.e., older adults and their children. Finally, I outline the research challenges and opportunities. (2) Research questions and method (Section 1.2). I describe the research question and sub-questions and the applied research method- Research-through-Design. (3) Thesis outline (Section 1.3). In this section, I illustrate the structure of this dissertation.

## 1.1 Research background

### 1.1.1 The ageing society and social isolation

The world is graying. Among the most significant achievements and challenges that society is facing today, is that human beings are living to unprecedented ages (Binstock et al. 2011). The worldwide population over age 65 is expected to be more than doubled from 357 million in 1990 to 761 million in 2025 (N. Hooyman and Kiyak 2002). There are two major causes for global aging: life expectancy increases and fertility rates decline (N. R. Hooyman and Kiyak 2008). The EU will face a more severe situation: the old-age dependency ratio (people aged 65 and above relative to those aged 15 to 64) in the EU is projected to increase by 21.6 percentage points, from 29.6% in 2016 to 51.2% in 2070 (Economic and Financial Affairs 2018). Under the situation of entering the aging society, an increasing number of older people spend their lives in nursing institutions; up to 50% of those over the age of 85 are likely to be placed in a nursing home at some point in their lives (Reichman et al. 1998). Living in a nursing home brings benefits to the older adults, including better physical and mental health, life satisfaction, self-esteem, and even reduced mortality (Yeung, Zhang, and Kim 2018)no research has examined its cumulative effects according to other-oriented and self-oriented volunteering on multiple health outcomes in the general adult public. This study examined other-oriented and self-oriented volunteering in cumulative contribution to health outcomes (mental and physical health, life satisfaction, social well-being and depression.

While there are benefits to living in an institutional setting, many new residents report a profound sense of loss (Mynatt et al. 2001). Since care homes are relatively closed environments, and older adults are separated from the mainstream social circles on account of being unfamiliar with technology, they have limited involvement in social connections. Growing old makes people more vulnerable to factors such as diminished social networks, bereavement, and health problems (Pedell et al. 2010). Social isolation is widespread among the elderly, particularly for the residents in the nursing institution (Tremethick 2001). Even senior residents in a nursing home with high specifications still spent most of their time inactive, immobile, and alone (Ice 2002). Social isolation is defined as “a state in which the person lacks a sense of belonging socially, lacks engagement with others, has a minimal number of social contacts, and they are deficient in fulfilling



and quality relationships (Nicholson Jr 2009)”.

Older adults also experience changes mentally: some studies have shown that self-esteem generally declines from the age of 50 to 80. The first reason is that older adults struggle with severe physical disabilities. The second reason is, the great adjustment of the older adults is to redefine their self-concept, that is, their perception of the image of the self. When people age, they need to adapt to new roles, because previous roles are often lost. As a result, older people are more likely to suffer from negative emotions, such as loss of self-esteem (N. R. Hooyman and Kiyak 2008).

Older adults experience that social interaction has an important influence on their quality of life (Bowling 1995). Social interaction is a critical factor affecting the quality of life of older adults. The quality and quantity of individuals’ social relationships have been linked not only to mental health but also to both morbidity and mortality (Holt-Lunstad, Smith, and Layton 2010). People lacking social contacts are more susceptible to diseases, infarction, stroke, and the onset of Alzheimer’s disease (Tomaka 2006).

### 1.1.2 Older adults’ communication with family members

Across the world, family members are the most important providers of support, especially psychological support, for older adults (Binstock et al. 2011). Among all the social relationships of older adults, family links provide important social support for them. The older adults consistently rank their connections with family members second only to health as the most important area of their lives (Victor et al. 2000). However, older adults have limited communication with their family members. For example, in the study named *Social isolation and telecommunication in the nursing home: A pilot study*, V. Ball-Seiter et al. found that nearly half of the nursing home residents were dissatisfied with the current level of communication with their family members (Meyer, Marx, and Ball-Seiter 2011). Reasons for this included different interests, stereotypes of aging, geographical distance, and the fast pace of contemporary life (Ryan et al. 2004).

### 1.1.3 Storytelling as a means of bridging the generations

Given that one of the most precious characteristics of older adults is their memory of events, people, and places (Dryjanska 2015), storytelling could act as an effective way to keep them stay in touch with their children. Since one feature

of older adults is their memory of events, persons, and locations, they have the potential to be story content producers, and story sharing could be a method to make connections with others (Dryjanska 2015).

Storytelling itself has social attributes: stories transmit cultural and individual traditions, values, and moral codes (Kemper 1984). Stories told by older adults create meaning beyond the individual and provide a sense of self through historical time and in relation to family members, and thus may facilitate positive identity (Fivush 2011). It has been well recognized that telling life stories can also have a ‘recuperative role’ (Frank 2000)(Rosenthal 2003) for individuals, relationships, and societies and therefore becomes a moral act. Life stories allow us to bring together many layers of understandings about a person, about their culture, and about how they have created change in their lives (Etherington 2009).

### 1.1.4 Interactive technology and older adults

Interactive technology is a broad concept, which refers to all forms of digital technology. It digitally facilitates interaction between people or allows for user content creation or manipulation, supporting users’ task performance in a collaborative manner (IGI Global 2020). Interactive technology targeted at older adults, such as safety and smart-living technologies, health and remote care, and wellness and fitness technologies, supports older adults to live healthy and active lives. In the meanwhile, older adults are still facing various challenges of learning to use such interactive technologies, which is not confined to physical and cognitive factors (Turner, Turner, and Van De Walle 2007). The challenges also include, e.g., attitude (Ellis and Kurniawan 2000), anxiety (Wilfong 2006), usefulness and usability (Olphert, Damodaran, and May 2005), and learning abilities in later life (Blit-Cohen and Litwin 2004).

### 1.1.5 Research challenges and opportunities

People hope they will be remembered. However, when death occurs, their family members are typically only left with bundles of images, materials, objects, and wishes of the deceased (Whittaker, Bergman, and Clough 2010). Recently, new practices on sharing personal content have emerged with the rapid growth of online sharing services. However, story sharing is still problematic for older adults, especially those living in a nursing home. First, despite that sitting together to communicate face-to-face is the most common and enjoyable way to share stories

(Lindley and Monk 2008), a growing number of older adults move to the nursing home and live separately from their children. Video calling (such as Skype and iChat) helps to a certain extent, but older adults and their children’s daily schedules are often non-synchronous (Tee, Brush, and Inkpen 2009). Video calls need to be pre-scheduled, which is less familiar to old adults (Ames et al. 2010). Second, instant messaging applications (e.g., WhatsApp and Messenger) help to share stories to some degree. However, they are more about the “now” moments and less about the past (Marcus 2015), and they are multipurpose and are designed for smartphone users. Digital storytelling and online oral history platforms such as *StoryCorps.org* or *LegacyStories.org*, have been gaining popularity as technology-mediated ways to record family memories.

However, our target group consists of aged, non-tech-savvy people. While younger seniors are embracing online social technologies, their parents, many of whom are still living, are neglected in this trend (Bell et al. 2013). Internet and social media use drop off significantly for people age 75 and older (Zickuhr, Madden, and others 2012)— Only 34% of people in the G.I. Generation (born in 1936 or earlier) uses the Internet (Madden et al. 2010). Even for the Netherlands, a country with high levels of general Internet diffusion, only around 30% of over-75-year-old have a tablet or smartphones (Janene 2016) (van Deursen and Helsper 2015). Older adults are still disconnected from the mainstream social circles due to a lack of technology and devices that resonate with them (Waycott et al. 2013).

## 1.2 Research question and method

### 1.2.1 Research question

Based on the situation described above, the research presented in this thesis attempts to answer the research question:

*How can interactive technology facilitate intergenerational storytelling, specifically for non-tech-savvy older adults?*

To answer this question, four sub-questions are formulated:

- (1) *What are the characteristics of older adults’ storytelling?*
- (2) *In which ways could interactive technology facilitate older adults to tell stories?*
- (3) *In which ways could interactive technology involve older adults’ children for intergenerational storytelling?*
- (4) *Does such intergenerational storytelling with interactive technology promote connections between older adults and their children?*

### 1.2.2 Research method: Research-through-Design

The research described in the thesis follows a Research-through-Design approach, which is described in the literature as an approach for scientific inquiry, taking advantage of the unique insights gained through design practice (Frayling 1993). One of its features lies in that the knowledge and insights are generated through the implementation of research prototypes. Therefore, Research-through-Design highlights the research prototype, which supports the researcher to develop a rich and grounded understanding of the problems and opportunities in the context of the social interaction of older adults in an exploratory and open manner. Several research prototypes were designed and implemented in different phases, and they were iterated in an incremental manner.

My research includes one research context exploration and three Research-through-Design iterations. It started from an explorative project *Vien- brick*, which was a joint effort with **Xu Lin** and **Kai Kang** (Lin et al. 2016) (Kang et al. 2018). Its findings helped me to reflect on and narrow down my research area and identify my research questions. To answer the research questions, I started developing the first prototype. In the 1<sup>st</sup> and 2<sup>nd</sup> iterations, prototypes were deployed in field studies, which focused on life stories and memento stories, respectively, while the 3<sup>rd</sup> iteration aimed to fully involve the young generation. Each iteration roughly consisted of a contextual inquiry, a research prototype, a field study, and reflections (Figure 1-1).

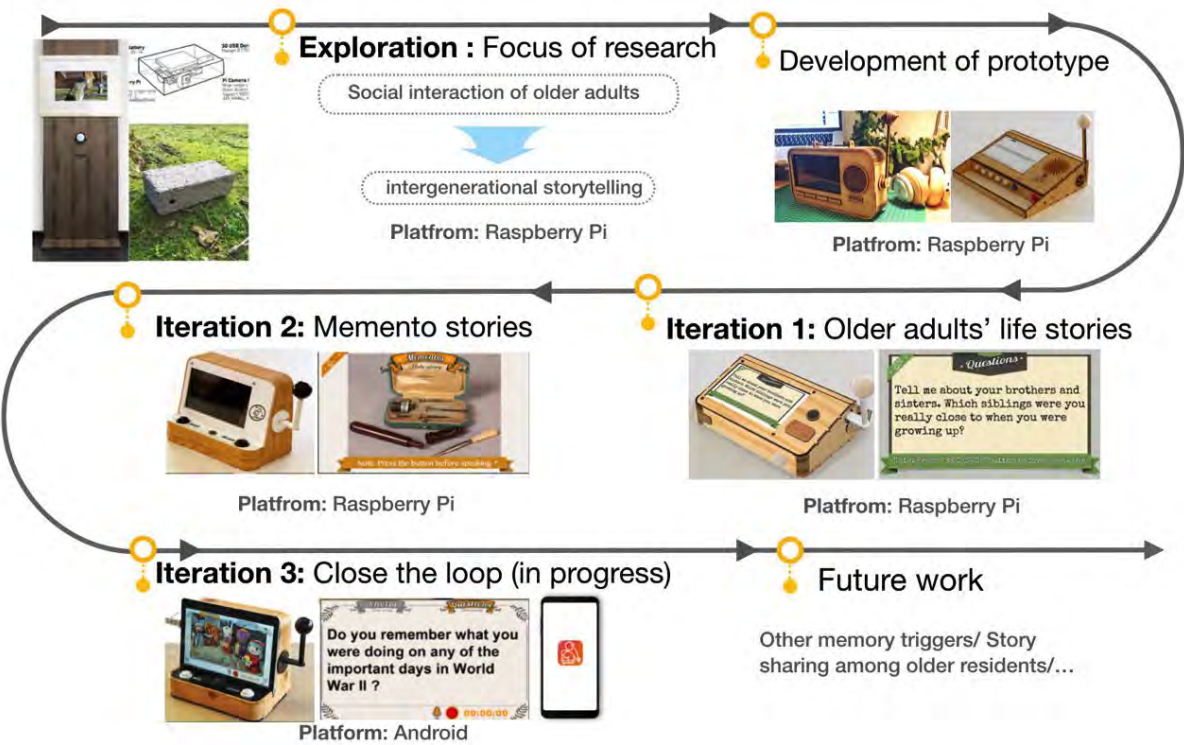


Figure 1-1 Overview of the iterations

My overall research question was broken into several sub-questions and addressed in different iterations (Table 1-1). In consecutive iterations, various prototypes were designed and deployed. The incremental iterations reflect not only the evolution of the design but also the phased answering of the research questions. In my research, I see intergenerational story sharing as a cooperation process that actively involves both the storytellers and listeners. I investigate particularly how the young generation could be involved as active participants.

Table 1-1 Research questions addressed in different iterations

Research questions	Design iterations	Chapters
Define the research question	Exploration: Focus my research	Chapter 2
Sub-research question 1 & 2 & 3	Iteration 1: Older adults' life stories	Chapter 4
Sub-research question 1 & 2 & 3	Iteration 2: Older adults' memento stories	Chapter 5
Sub-research question 3 & 4	Iteration 3: Fully involve the young	Chapter 6

### 1.3 Thesis outline

The remainder of this dissertation is organized into five chapters. Chapter 2 describes an exploration to identify the research focus – older adults’ intergenerational storytelling. Chapter 3 provides the literature review of the related field. Chapter 4, 5, 6 present the three Research-through-Design iterations, and Chapter 7 contains the discussions.

**Chapter 2** reports on the deployment of *Vien-brick*, a team project conducted together with Xu Lin and Kai Kang. The three of us developed and deployed the system, from different perspectives. For me, the *Vien-brick* was for exploration, aiming to understand the situation of older adults’ social interaction, to narrow down my research focus, and define my Ph.D. research question. The results of this study indicated that older adults could be deemed as story content producers, with their children as their listeners.

**Chapter 3** presents the theoretical knowledge, research methods, and the related applications. It concludes with a theoretical framework of the thesis.

**Chapter 4** focuses on the life stories of older adults, and reports on the development and deployment of *Slots-Story*. In a field study, interviews were conducted before and after the deployment. Stories collected through the prototypes were analyzed in three dimensions: thematic, structural, and interactional analysis. As some story themes were concerning family mementos (photos, souvenirs, letters, et cetera.), I turned my attention to them in the next iteration.

**Chapter 5** focuses on memento stories of older adults. The prototype built is *Slots-Memento*, which is an iteration of *Slots-Story*. In a field study, semi-structured interviews were conducted with older adults and their children, before and after the deployment. Mementos were categorized and analyzed. Stories were transcribed, then analyzed with the methods of thematic, structural, and interactional analysis. Finally, I found the importance of optimizing the process of the young providing feedback to older adults after listening to the stories.

In **chapter 6**, to fully involve the older adults’ children, a smartphone application was designed for the young, together with the re-designed prototype, creating a complete system. Chapter 6 reports on the deployment and evaluation of the system.

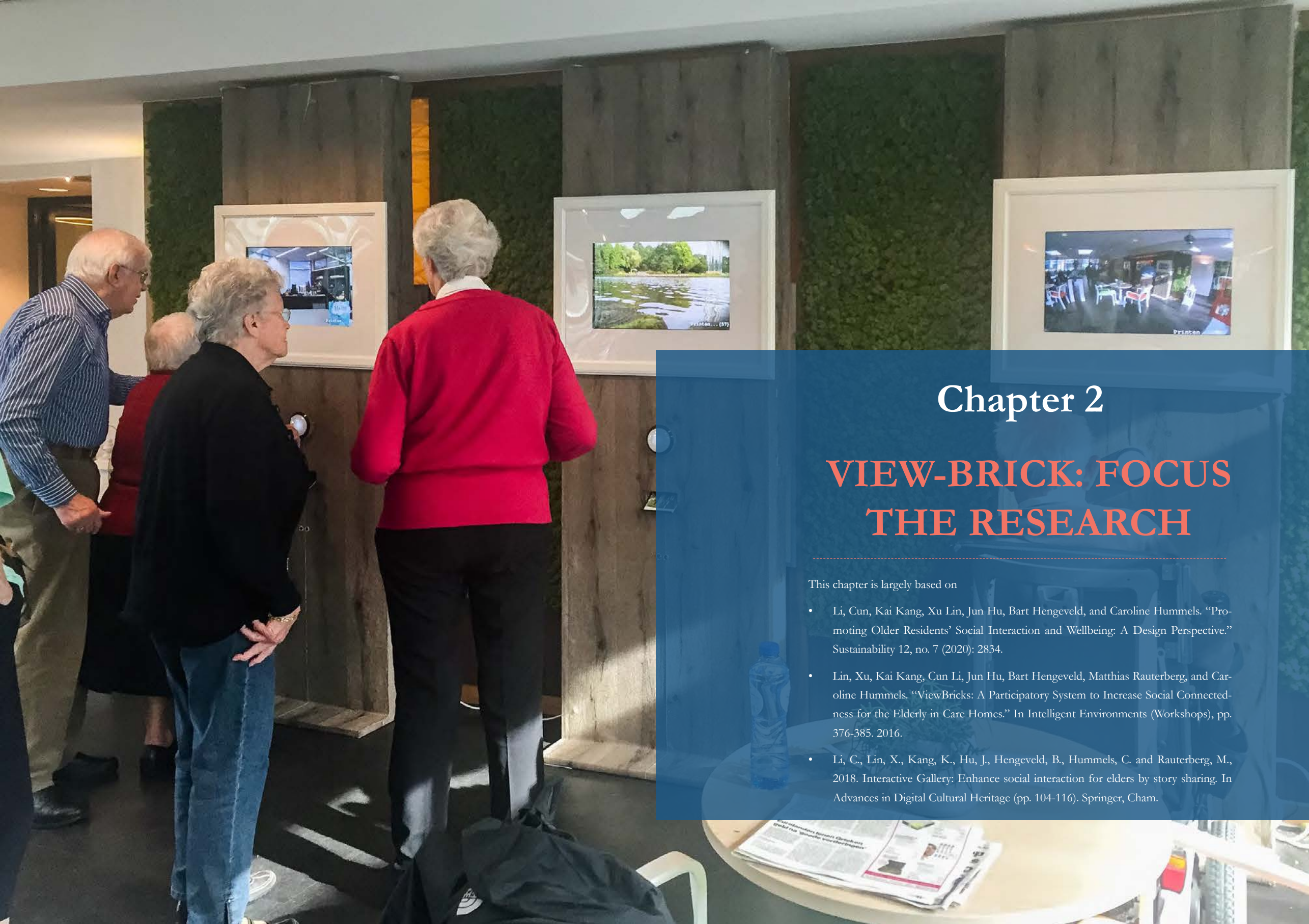
Finally, in **chapter 7**, I present the conclusions and reflections. The reflections



are findings derived from the research, but irrelevant to the research question, including implications for Research-through-Design and designing prototypes for older adults.

## 1.4 Contribution

The contributions of this thesis are as follows. I see the intergenerational story sharing as a cooperation process that both the storytellers and listeners should actively be involved in. I particularly investigated and answered the question of how the young generation could participate. They are not only the audiences of a storyteller (older adult), but also the memory trigger (trigger questions and mementos)provider, acting as “filter” and “selector”. I analyzed the stories deeply and comprehensively, which was conducted from three dimensions: thematic, structural and interactional analysis. The thematic analysis helped us to understand their preferences for story topics. The structural analysis helped us to understand their narrative patterns. The interactional analysis concluded the differences between the independent and face-to-face uses. Moreover, a framework of intergenerational storytelling was constructed, which details the intergenerational memento storytelling into four processes: triggering, telling, sharing, and curating.



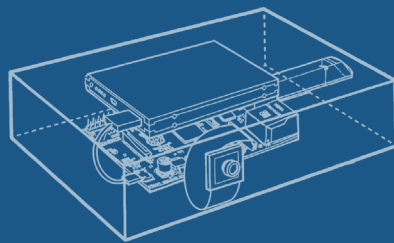
## Chapter 2

# VIEW-BRICK: FOCUS THE RESEARCH

This chapter is largely based on

- Li, Cun, Kai Kang, Xu Lin, Jun Hu, Bart Hengeveld, and Caroline Hummels. "Promoting Older Residents' Social Interaction and Wellbeing: A Design Perspective." *Sustainability* 12, no. 7 (2020): 2834.
- Lin, Xu, Kai Kang, Cun Li, Jun Hu, Bart Hengeveld, Matthias Rauterberg, and Caroline Hummels. "ViewBricks: A Participatory System to Increase Social Connectedness for the Elderly in Care Homes." In *Intelligent Environments (Workshops)*, pp. 376-385. 2016.
- Li, C., Lin, X., Kang, K., Hu, J., Hengeveld, B., Hummels, C. and Rauterberg, M., 2018. Interactive Gallery: Enhance social interaction for elders by story sharing. In *Advances in Digital Cultural Heritage* (pp. 104-116). Springer, Cham.

In this chapter, I describe the starting point of my research – an explorative project called *View-brick* that allowed me to explore the context and find my research focus. In particular, this chapter starts with a review on the literature review of older adults' social interaction (Section 2.1), followed by a contextual inquiry, aiming at an understanding of older adults' social behavior patterns (Section 2.2). Based on the findings, we<sup>1</sup> developed the *View-brick* system (Section 2.3) and implemented it (Section 2.4). Section 2.5 reports the findings, and in Section 2.6, I illustrate how my research focus was identified.



<sup>1</sup>The *View-brick* project was a team effort of three people: Xu Lin, Kai Kang, and Cun Li. Therefore, in this chapter, when I use the word “we”, “our” and “us”, it is a group-level activity. When I use the word “I”, “me”, and “my”, it refers to my individual contribution.

## 2.1 Literature review of older adults' social isolation

In order to get a better understanding of older adults' current social isolation, I looked into related literature from three aspects: theoretical framing (Section 2.1.1), anthropological studies (Section 2.1.2), and applications (Section 2.1.3).

### 2.1.1 Theoretical framing

Theoretically speaking, social isolation, specifically in regards to older adults, is defined as a loss in social and community ties (Berkman 1983). Nicholson Jr (2009) identified five broad causes of social isolation: the absence of quality relationships, physical barriers, psychological barriers, socio-economic factors, and environmental factors. Research has revealed that the quality and quantity of individuals' social relationships are related to both psychological health and mortality (Holt-Lunstad, Smith, and Layton 2010) (Hensel, Parkeroliver, and Demiris 2007). Loneliness, which is tied to social isolation, has various definitions in the literature, including lack or perceived lack of satisfactory social relations; the gap between relationships between people and the relationships they want (Pinquart and Sorensen 2001); and the amount of time spent alone due to lack of social networks (Oliver, Demiris, and Hensel 2006).

### 2.1.2 Anthropological studies

Directions of related anthropological studies are extensive. Gillian Harper Ice examined how nursing home residents spend their day, and the conclusion was that older residents spent most of their time in their own rooms, sitting, and alone (Ice 2002, 25). Other researchers have further studied in specific areas: Carstensen, Fung, and Charles (2003) pointed out that older adults' social and emotional goals were directed towards strengthening existing emotionally fulfilling relationships rather than pursuing novel social partners. H. Davis et al. (2012)'s study focused on the grandparent-grandchild relationship and explicitly on the intergenerational play. They identified the pertinent features of the intergenerational play. Alexis Hope et al. further 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 (Hope, Schwaba, and Piper 2014). Additionally, Vargheese et al. (2016) developed a model of persua-



sion to be employed by a virtual agent for encouraging social interaction and lowering the risk of social isolation among older adults.

### 2.1.3 Applications in HCI

In recent years, many researchers have explored how to apply technologies to alleviate the social isolation of older adults. Literature shows roughly two directions: (1) strengthening the connections between the older adults and their existing social circles (mainly family members); (2) expanding the older adults' social circles.

- For strengthening the connections, some designs try to combine the older adult's everyday objects with a display to enhance communication with family members. For example, Tsujita and Abowd (2010) designed *SocialMedicineBox*, a communication system for older adults using a medicine box. Theng, Chua, and Pham (2012) developed co-located games for two generations to promote intergenerational relationships. There is an electronic family newspaper, acting as a mediator in sharing information among older adults and their families (Santana et al. 2005). Computer-mediated games, such as adopting the game console *Wii*, could play a role in supporting inter-generational interaction between the older adults and the youths (Theng, Chua, and Pham 2012). Photographs are also seen as compelling media that facilitate communication: by adding audio narrations to traditional paper photographs, a paper-digital photo album could provide a focal point for communication between older adults and family members (West, Quigley, and Kay 2007). An electronic family newspaper helps older adults and their families living abroad share information, personal reminiscences, and cultural stories, and occasionally interact with each other (Santana et al. 2005).
- For expanding the social circles, a system called *StoryCube* was developed to help residents of nursing homes to make connections through sharing stories and express their identity (Linnemeier et al. 2012). Waycott et al. (2013) investigated the role of digital content created by older adults, to forge new relationships among strangers. Their findings demonstrate that creating and sharing content provides opportunities for them to build new social connections within a small peer community.

We see in the literature that many interactive installations in the nursing home focus on dementia residents. For example, to illustrate whether and how nursing home residents with dementia respond to interactive art installations, an interactive wall was developed for decreasing the number of wandering behaviours of people suffering from dementia (Robben et al. 2012). A robot cat was designed as a substitute artificial companion to provide interventions to older adults with dementia (Libin and Cohen-Mansfield 2004). Interactive robots were developed to facilitate the social interaction of older adults. For example, the sociable robot Paro was placed in a nursing home to encourage social interaction among older residents (Kidd, Taggart, and Turkle 2006).

### 2.1.4 Summary

Many studies and applications focus more on strengthening older adults' existing social relationships, and little attention has been paid to involving people outside the nursing home. We aim to develop a technology probe to explore two aspects of older adults' social interaction: how to build connections between older adults and citizens from local communities, and how to facilitate social interaction among the senior residents within the nursing home?

## 2.2 Contextual inquiry

To understand older adults' social behavior patterns in situ, we conducted a contextual inquiry by interviewing both older adults (Section 2.2.2) and their caregivers (Section 2.2.3). In Section 2.2.4, I present the findings.

For this contextual inquiry, we use a semi-structured interview method to obtain information about the context of use. Target people are interviewed in their own environments, and therefore, the analysis data is more realistic than laboratory data (Beyer and Holtzblatt 1997). In our case, to understand the socialization patterns of older adults, identify design opportunities, and further define requirements, interviews were conducted with the older adults and caregivers in a local nursing home. Older adults in nursing homes serve as the target user group that could provide firsthand experiences of their social lives. The caregivers have the most contact with the older adults, and could provide us with information from their more "outside" perspective.

2.2.1 Research site

The target nursing home was *Vitalis-Berckelhof*, Eindhoven, the Netherlands. It was located near a primary school and a supermarket, both within walking distance. The nursing home has a capacity of 270~280-beds, providing multiple levels of care services: independent living (around 150~160 residents were healthy and did not need care service), and assisted living (around 120 residents). For the residents needing care services, 40 of them ate in the restaurant, and 80 of them cooked by themselves. The average age of the senior residents was around 85. There were approximately 20 residents who were at the early stage of dementia, who were not in the focus of our research.

One reason for choosing this nursing home as a research site was its openness - it welcomed students, researchers, and volunteers to communicate and interact with the senior residents (Figure 2-1).



Figure 2-1 Inside Vitalis Berckelhof

2.2.2 Interview with older adults

A semi-structured interview is a qualitative method of inquiry that combines a pre-determined set of open questions to prompt further discussion (Louise Barriball and While 1994). The open-ended nature of the interview made it possible to reveal tacit knowledge, which was about their own living habits that the older adults themselves were not consciously aware of (Beyer and Holtzblatt 1997).

The older adults were from Vitalis-Berckelhof, Eindhoven. Some of them were recruited according to the recommendations of the caregivers. Some older adults were from the public space of the nursing home, who were interviewed directly after our introduction. A total of eleven semi-structured interviews were conducted with older adults (65 years or older). Demographic information of the participants is shown in Table 2-1. Each interview lasted for around 30 minutes. Our main objective in this phase was to obtain information on the following aspects: their familiarization with technology, their way of obtaining information, and their connections with fellow residents and the outside environment.

Table 2-1 Demographic information of the participants (F = Female, M = Male)

Participant	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Age, gender	82, M	90, F	85, M	85, M	75, M	72, F	84, F	95, M	87, F	71, M	86, F

Interview coding process

Each interview was audio-recorded. All names and data reported in this paper have been anonymized. The interviews were originally in Dutch, and they were translated into English by translation agency and student assistants. We made small edits in part of the quotes for clarity. Grounded theory techniques (Corbin, Strauss, and others 2008) were adopted to analyze the data, to allow themes to emerge in a bottom-up manner.

I provide an example coding process in Table 2-2. In the Initial coding, we remain open to find whatever theoretical possibilities we could discern from the raw data. While in the Focused coding, we chose a set of central codes from the dataset, which finally result in the identification of themes.

Table 2-2 An example of the coding process

Raw data	Initial coding	Focused coding	Theme
<i>Q: How many children do you have?</i> <i>A: I have three. The oldest one is already retired. She is also a nurse. The oldest son is unemployed, he used to be ING Bank service engineer, eh, Pathetic, but he is not idle. He has a part-time job. My youngest son, he came yesterday.</i> <i>Q: Where do they live?</i> <i>A: All of them are in the Netherlands but outside of Eindhoven. Only the youngest one is in this city, the one with the red cap. He came here yesterday because I called him. He can always come. He is fifty, but I regard him still as a small child.</i> <i>Q: How often do you see your children?</i> <i>A: I have no quarrel with my children. So, um, I see them regularly. Usually, at someone's birthday, we are gathered together. On my birthday or Mother's Day or so, they all come here. But other times, they don't come at the same time. They come regularly, but not often. Because they work, eh, and they also have their families, eh. One grandchild lives far away. He is studying in Spain.</i> <i>Q: Do you also call them regularly?</i> <i>A: Yes, if it is needed. Because they work, I call them not so often. Because I'm going to disturb them, eh, if they sit in the office.</i>	She has three children with different jobs  Two children live outside of her city, except the youngest son, and he comes often  Their children visit her regularly, and she has family reunions at festivals. One grandchild studies abroad  She calls children if necessary, but she does not want to bother them.	  She has regular contact with children (vising and call)  She does not want to disturb children	Older adults' connections with their children

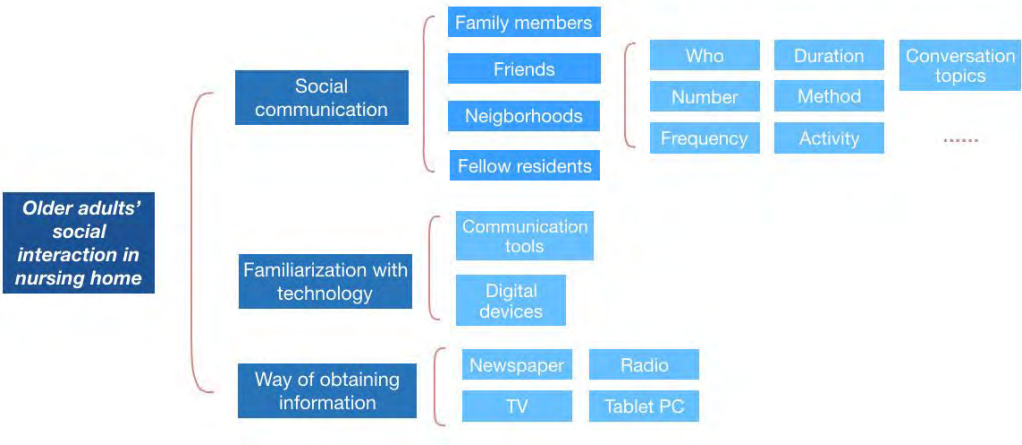


Figure 2-2 Concept-indicator model “Older adults’ social interaction in nursing home”



To better reveal the coding process, a concept indicator model was made to visualize the clustering of the codes (Figure 2-2).

The interviews indicated that although every older adult knew their fellow residents, the relationships between them were superficial, and there were no close bonds. For instance, when talking about whether they had someone to talk to within 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.”*—P2, F. One of the reasons was that they did not know each other’s backgrounds and hobbies, and therefore have no mutual topics to start a conversation. For example, when asked why they 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.”*—P4, M. 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.”*—P7, F. Lack of mobility caused by physical decline also leads senior 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.”*—P5, M.

Information gathered from older adults is summarized as follows: Older adults in the nursing home have alienated relationships with their fellow residents. Although most of the older adults’ 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 among older adults 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 were not enough to establish and maintain sufficient social connections. Most older adults 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 older adults. In short, the nursing home is a relatively closed living environment.

2.2.3 Interview with the caregivers

Four semi-structured interviews were conducted with caregivers, and each in-

terview was audio-recorded. We obtained the following aspects of information: major roles and responsibilities of the caregivers, collective activities in the nursing home, abilities of reading and writing of the older adults, daily routines of the older adults, and their connections with their fellow residents and the outside environment.

The interviews indicated that the daily routines of older adults remained the same. As one caregiver said: *“Basically, every day they move from the sleeping area to the eating area.”* Most older adults preferred to do nothing in their rooms rather than attend collective activities. One of the reasons, explained by one caregiver, was that they encountered difficulty in connecting with their fellow residents. Consistent with section 2.2.2, older adults would like to share life with caregivers, as said by one caregiver: *“After family gathering, they share lives with me. Although in most cases, the stories are the same.”* Finally, older adults often felt depressed because they could not do some things they could before. Table 2-3 shows the daily routine of a typical senior resident.

Table 2-3 Daily routine of a typical resident under care service

8:00	Wake up and take a shower
8:30	Have breakfast
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 lunch, most return to their apartments, while some stay in the canteen
17:00	Dinner
22:00	Bed time

2.2.4 Summary of contextual inquiry

The findings from the contextual inquiry are summarized in Figure 2-3. The findings are grouped into several categories. Depending on the people that the older adults socialized with, their social interaction could be classified into two types: **Internal Social Interaction** – connections with fellow residents and caregivers, and **External Social Interaction** – connecting with family members, friends, and people from the local community. Depending on the activities, their social interaction could be classified as two types: **Formal Social Activity** – such as a concert, bingo, and billiards; and **Informal Social Activity** – such as chat, greetings, and social encounter. Other findings include older adults’ routines remained the same, and most of them could not operate digital devices.

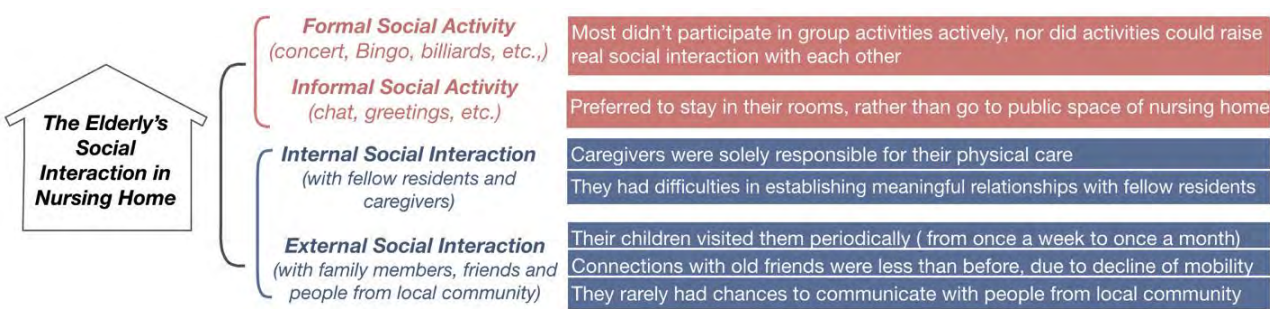


Figure 2-3 Findings of old residents' social interaction in the nursing home



Figure 2-4 Watching outside of the nursing home through the window

2.3 The View-brick system

The contextual inquiry provided a basic understanding of the socialization patterns of older adults in the nursing home. In particular, we were interested in, e.g., the frequency of the social interactions, the experienced quality of the social interactions, and potential improvements or additions. In this section, the *View-brick* system is introduced. It consists of two parts: Scenery-collectors for view sharing (Section 2.3.1) and a gallery-like installation used by older adults (Section 2.3.2). Section 2.3.3 presents the usage scenario of *View-brick* system.

Our design concept was on account of current senior residents' habit – they like sitting and watching outside of the nursing home through the window (Figure 2-4). Our idea was straightforward. Since the senior residents were isolated in the nursing home and had little contact with the outside world, we tried to bring the “outside” into the nursing home. We also drew inspirations from the literature that metaphor is an effective way to lower thresholds of technology access. People prefer using technologies that are recognizable in their everyday lives, and a new product that is designed based on familiar metaphors could reduce barriers of use (Irizarry, Downing, and West 2002). Accordingly, we adopted the metaphors of gallery and postcard-sending, through a very simple operation, hoping the older adults could use our design without or with little learning.

Particularly, the *View-brick* system consists of a set of Scenery-collectors and a gallery-like interactive installation. The former is distributed to volunteers from local communities to share real-time scenery photos with the senior residents. The latter is in the public space of the nursing home, and the senior residents could not only watch the scenery photos from the sharers but also print the scenery photos into postcards by merely pressing the button on the installation. They could write back to the sharers via postcards or share postcards with others. Moreover, the installation could provide topics for the residents to communicate with each other more.

2.3.1 Scenery-collectors for view sharing

Scenery-collectors are a group of specially designed camera kits (Figure 2-5). The appearance of the scenery-collector is a brick-like cuboid, which is robust and easy to be positioned. The shell is made of transparent acrylic covered with cement, which is waterproof and unobtrusive in an outdoor environment. Scenery-collectors are distributed to the citizens from local communities. Citizens could put them wherever they want to share sceneries with older adults in nursing homes. The scenery-collectors could automatically take pictures of sceneries and upload these to the online server at certain intervals. Subsequently, the gallery-like installation in the nursing home would download the photo sequence from the online server for display.



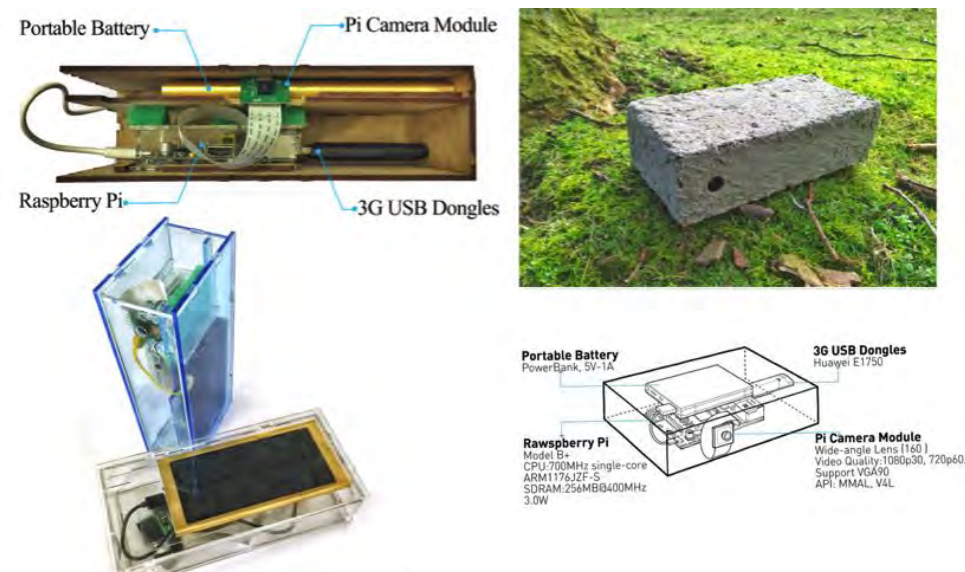


Figure 2-5 Scenery-collectors

### 2.3.2 Gallery-like installation used by older adults

The gallery-like installation was placed in the nursing home and used by the older adults (Figure 2-6). The vintage style aimed to be in line with the aesthetic preference of older adults. The installation consists of three units, with each unit equipped with one high-definition monitor decorated with a frame and a large round button below. The gallery-like installation displays the scenery photos with the location names transferred from the scenery-collectors. We encouraged the older adults to print photos in the form of postcards, which could be done just by pressing the button on the installation. If the scenery photo reminds older adults of past memories and experiences, we also encouraged the older adults to write them down on the back of the postcards. Then, the postcards can be either exchanged with other residents in nursing homes or sent to the citizens who shared the view. The interaction process of printing postcards is shown in Figure 2-7. On the first day of its deployment, we introduced the aim of our study, and the detailed working process of *View-brick* to the senior residents.



Figure 2-6 Gallery-like interactive installation

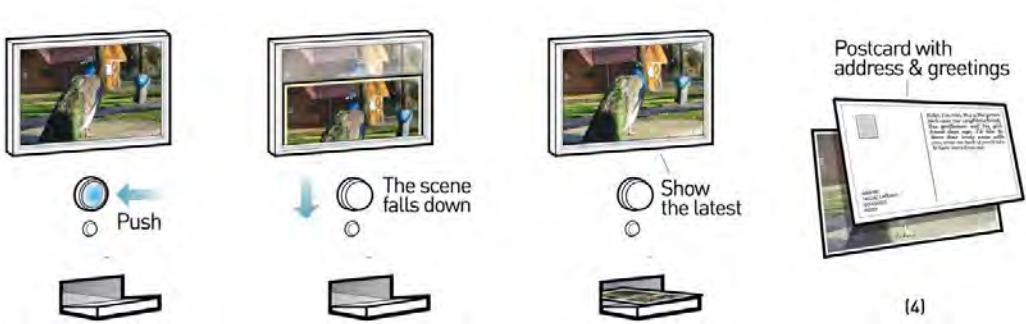


Figure 2-7 Interaction process of printing postcards by the gallery-like installation

### 2.3.3 Use scenario

Figure 2-8 shows the use scenario of the *View-brick* system.



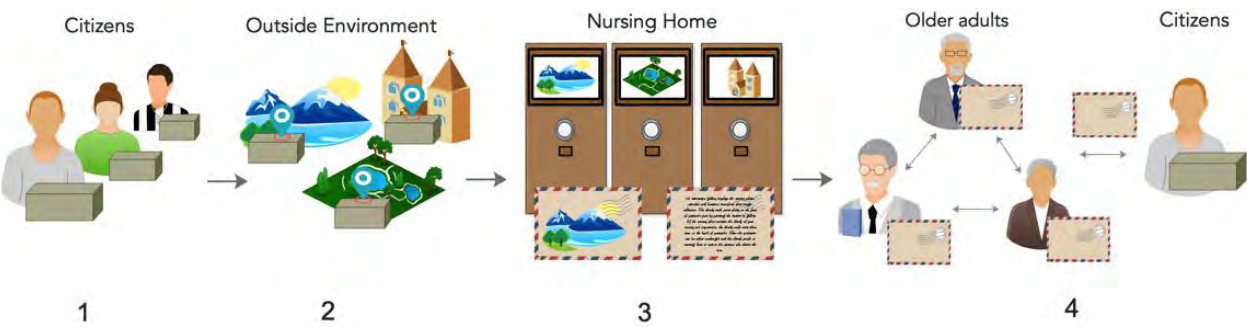


Figure 2-8 Storyboard of *View-brick* system

- Scenery-collectors are distributed to citizens from local communities.
- Citizens could put the scenery-collectors wherever they want to share sceneries with the older adults in nursing homes. Scenery-collectors automatically take pictures of the views at certain intervals and transmit them to the gallery-like installation in the nursing home.
- The gallery-like installation displays the scenery photos and their addresses transferred from the scenery-collectors. Older adults could print photos in the form of postcards by pressing the button at the installation. If the scenery photo reminds older adults of memories and experiences related to the photos, older adults could write them down on the back of the postcards.
- The postcards could be either exchanged with the older adults in the nursing home or sent to the citizens who share the view.

## 2.4 Field Study

This section reports the field study of *View-brick*. It describes the method and procedure (Section 2.4.1), including research context and deployment. It then reports the interview study (Section 2.4.2) and the results (Section 2.4.3).

### 2.4.1 Method and procedure

The Gallery-like installation is an installation placed in the public space of the nursing home, and older adults could watch and interact with it (Figure 2-9, Figure 2-10). The deployment lasted for two weeks, during which the installation was placed in Vitalis-Berckelhof, and several Scenery-collectors were distributed to volunteers. After the deployment, post-study interviews were conducted, aiming at the older adults' reflection on their use of *View-brick*.



Figure 2-9 The making of the installation



Figure 2-10 Field study

### *Research context: research site and residents*

The ground floor of the nursing home had a public space, including a meeting area, a library, and a restaurant/café. They were open to everyone, even outside visitors. Senior residents usually stayed in the restaurant/café (Area B), and meeting space (Area C), and these areas were the most occupied places. Therefore,



we chose the restaurant (Area B) and meeting space (Area C) as our research site (Figure 2-11).

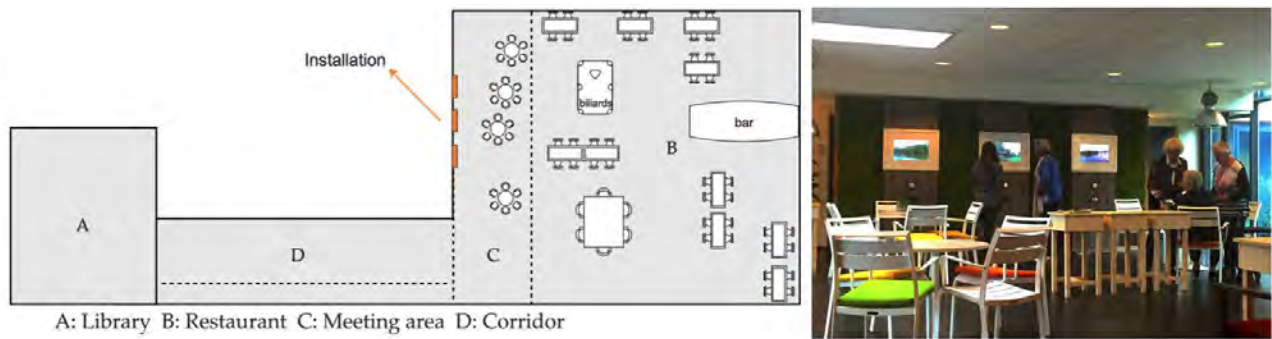


Figure 2-11 Deployment of *View-brick*

Experiment set-up

As most of the older adults walked along the corridor in area C to the dining hall for meals or public activities every day, our installation containing three units were placed here, close to the corridor wall, as is shown in Figure 2-12. The residents could interact with it without the intervention of the researchers.



Figure 2-12 Deployment

Scenery-collectors were easy to operate, and therefore, our recruitment criteria for volunteers were simple: the volunteers were interested in scenery sharing for

the older adults. We recruited three volunteers coming from our university and from local communities. We first introduced our project to them in detail and then distributed scenery-collectors to them. The volunteers were advised to put the scenery-collectors in natural landscapes where few people treaded, as taking photographs outdoors might violate the privacy of pedestrians. The locations they chose in the first round included: a landmark in the city center, a lake in the northern city, a river running through a local university, a zoo in the northern part of the city, a building in south city, and the city stadium. Each volunteer was asked to share a few words with the older adults, such as a brief introduction of the scenery and their contact information (name and address).

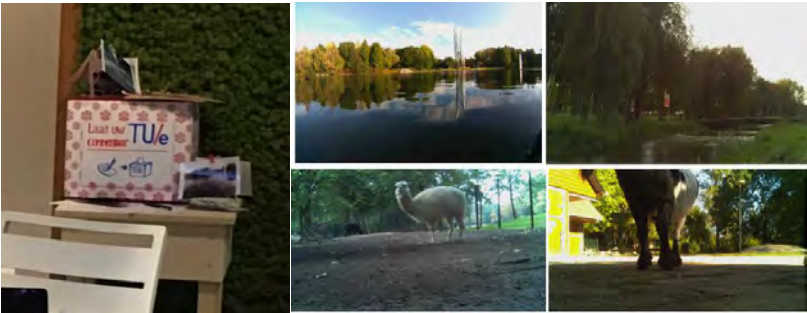


Figure 2-13 Mailbox and postcards printed by *View-brick*

2.4.2 Interview study

The interviews aimed at asking the older adults to reflect on their interaction with *View-brick*. After having used the installation for several weeks, we conducted interviews with 13 residents that used *View-brick*. Demographic information of the participants is shown in Table 2-4. Before the interviews, we firstly explained the purpose of the interviews to the older adults and got their consent by filling out a consent form. Thereupon, we introduced the installation to them in detail by showing them an explanatory video. Every interview lasted an average of 30 min.

The interviews were semi-structured and were based on the following six aspects:

- 1. **Overall:** Overall impression and evaluation of the installation.
- 2. **Interaction:** Frequency of watching, frequency of printing postcards, and whether they recognized that the photos were from their local city and were real-time.

- 3. **Content:** Feelings after seeing the scenery photos, and preference for photos.
- 4. **Sharing:** Whether they talked about the installation with others, whether they shared postcards with others, and whether they liked to share something else with the volunteers.
- 5. **Usability:** The problems they encountered when using the installation.
- 6. **Comments:** Any comments for improvements.

Table 2-4 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

2.4.3 Interview results

Overall impression

With regards to the overall impression of the installation, almost all the interviewees gave positive comments, and found it fun and interesting: *“I could see the places that I could not walk to. It is great.”* They were fond of the scenery pictures, and the first reason was they were not able to go outside of the nursing home independently, due to the age-related physical decline. One said: *“These are two things that deeply influence my life, bad mobility, and bad eyesight. But life goes on.”* —P7, M. Another interviewee said: *“I used to go to the city centre often, but now it is difficult for me. Because I am in the early stage of Parkinson’s, and my daughter dares not let me go alone, as she is afraid that I don’t know the way back.”* —P2, F. The second reason was that the scenery photos recalled their memories. For example, one interviewee who used to be a photographer showed great interest: *“I think they are all pretty. I still love pictures and have a small camera, but I can’t take photos outdoors anymore. I like the views of the lake: the birds and ducks.”* —P5, F. Third, they wanted to know the changes outside: *“It just like go back to see places. I travelled a lot when I was young. The world is developing so fast, and it must be different now, and I really like to see the changes.”*

Watching and interacting with View-brick

**Frequency of watching the installation.** The frequency of watching the installation varied among the interviewees. Seven interviewees watched and used the

installation approximately every other day. Three interviewees watched it almost every day. Three watched the installation occasionally. The interviews indicated that the frequency of use depended on a large extent to their daily routines. Those who used it every day were the people that went downstairs very often. For example, one older adult explained her daily routine: *“Every day I go downstairs to have coffee, and check if there is something new there, if not I go back to my own room.”* —P8, M. For those who did not watch it very often, it was either because they did not go to the public space very often, or the installation became gradually less attractive, as one said: *“I find the scenery images stay the same in most cases. I feel it is unattractive afterward.”* —P2, F.

**Recognize they were real-time local scenery photos.** Except for two interviewees who thought they were online pictures, the rest recognized that the scenery photos were from the local city. This was because most of the interviewees were natives, and they were familiar with the local sceneries. As one said: *“I believe the first picture was the northern city lake. I used to go there often, but that’s a long time ago when we were with the children.”* —P11, F. Two interviewees could not recognize the scenery photos, as they originally came from other cities: *“I am not local, I spent only a little time here, I am not familiar with this city.”* —P9, F. More specifically, photos of the northern city lake were recognized by five people; the photo of the university site was recognized by two people; the photo of the zoo was recognized by four people. However, some scenery photos were difficult to recognize, as significant changes took place in theses sceneries over the years. As one said about the photo of the zoo: *“When I lived there, there was nothing but only sand. Then there was a playground for the children, and then they put a zoo there. There are donkeys and chickens and giraffes now.”* —P5, F. Therefore, the scenery titles attached in the photos were essential clues for them to recognize. One interviewee said: *“I used to be there often, but it was a long time ago. It changed so much that I couldn’t tell until I noticed the address.”* —P12, F. When asked whether they realized the photos were real-time, only two interviewees knew they were live pictures. The reason, the rest of the interviewees explained that they did not recognize the photos were real-time, because the changes were so subtle. *“The present pictures always look the same.”* Therefore, changing the frequency of the photos needs to be increased.

**Interacting with the installation.** Except for two interviewees, the rest of the residents pressed the button to print postcards. Some of them attended the introduction day and understood how to operate it. Most interviewees who were not



familiar with the installation, they pressed the button as others did: *“At first I didn’t know what the button was used for, I pressed just because others pressed.”* —P10, F. For the two interviewees who never pressed the button, one explained that the installation was too novel and unfamiliar for her: *“I have never seen such kind of installation. I don’t know how to operate it.”* —P12, F. The other one felt nervous and anxious when using it: *“Actually, I dare not to press the button. So I asked others, my son went to print postcards for me.”* —P4, M. Lastly, three interviewees pressed the button not very often, because they found the printing process time-consuming.

Preference of content

Figure 2-14 shows their preferences. Firstly, most interviewees preferred hometown sceneries, especially where they were born or spent their childhood. The reason was that those places were full of their memories, but now difficult to reach. This reflected their nostalgic feelings. As one interviewee said: *“Something like a mill will be interesting. It reminds me of the past that I ran the mill by doll carriage when I was twelve.”* —P11, F. Another interviewee said: *“When I saw those pictures again, it was indeed a little reminiscent of the past. Although I don’t remember the details because I am 88 already. Now I can’t drive any longer and can’t get there. It takes me back to the time when I went to the park with the kids.”* —P10, F. Another interviewee: *“In my hometown, my house was positioned behind the garden, in front of the cornfields. I do miss the outside there.”* —P9, F. One interviewee was from Indonesia, and kept an album of hometown photos: *“When I miss my hometown, I will open the albums. If I want to see scenery photos, I would like to see Indonesia. Every day I think of my hometown, especially where I was born. I hope I can see my hometown if possible, but I am so old.”* —P12, F. Another interviewee said: *“I am interested in photos of my hometown, and I have three picture books of my hometown. Sometimes I share them with others.”*

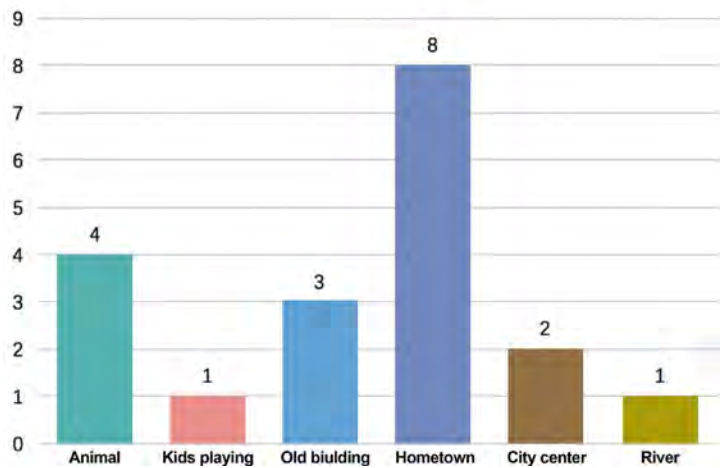


Figure 2-14 Their preferences for scenery photos

Secondly, they preferred dynamic rather than static pictures. Scenery photos containing animals were more alive. As one interviewee said: *“I think the picture of the zoo is better, because it changes often. While the others are relatively static. You can even put the camera on a bike.”* —P4, M. Moreover, the animal photos reminded them of their pets. There were also some interviewees who preferred photos from a kindergarten, which could remind them of their childhood: *“I like it when seeing children playing. It seems like I’m returning to childhood.”* —P6, F.

Sharing

Use of postcards. All of the older adults liked the postcards. However, when asked if they shared the postcards with others, to our surprise, they shared the postcards with their family members face-to-face, except two interviewees sent the postcards to the volunteers. For the two residents who sent the postcards, they were curious about the sharer: *“I want to know more about the people who share the scenery.”* —P4, M. They both wrote memories related to the scenery photos. For those who did not send postcards, first, they thought their memories were personal, and therefore attached importance to privacy. One of the interviewees was concerned that the volunteers might not be interested in her memories. Next, sending a postcard was time-consuming and tedious, compared to other communication methods like the telephone. As one of the residents said: *“I used to write cards, so did most people, especially around Christmas. However, gradually, cards are abolished,*

*and we now use phones instead. You do not really have a reason to send a letter.*”—P4, M. Finally, most of them had difficulties when writing, as one said: *“We grow older and have difficulties to write, I have sight loss, and my hands tremble.”*—P7, M. This could also explain why they preferred to write nothing on the postcards, but share them face-to-face.

### *Usability and comments for improvements*

With regard to the usability aspects, most interviewees felt the printing was stable, but was time-consuming, which took nearly two minutes. Regarding comments for improvements, first, some interviewees suggested to add other sensory channels to enrich the immersion: *“I can hardly feel real nature, no sound, no smell, no wind.”*—P3, M. Another said: *“I think the installation’s intention is for people who don’t get out to be in contact with nature. I believe there should also be sound, but I’m not quite sure.”*—P4, M. Second, the next iterations should consider individual needs. As one said: *“I think it is good, but you need to take into account the individual’s needs. Everyone has different views, and it is not easy to make it good for all people.”*—P3, F. The third was a suggestion related to sustainability. One interviewee thought it was hard to keep the installation sustainable: *“At first, we feel it is nice, but for permanent use, no. If people have seen it once, they will say I’ve already seen it. I do not think that’s sustainable.”*—P7, M. Fourth, they were suggesting to add additional functionality. As one interviewee said: *“Besides scenery pictures, the screen could also display the latest news.”*—P7, M.

## 2.5 Discussion

In this section, I first present the lessons learned on designing tangible interfaces for older adults’ social interaction from the field study. I then discuss how it leads my research to intergenerational storytelling.

### 2.5.1 Designing tangible interfaces for older adults’ social interaction

The design should conform to the older adults’ life habits by integrating it into their daily routines, while the promotion of social behaviours should be natural and non-intrusive.

First, the design concept of the *View-brick* stems from the current older adults’ habit – they like sitting and watching outside of the nursing home through the window. Therefore, the watching behaviour of *View-brick* conforms and build on

their current habits. Second, as discussed, senior residents’ daily routines are stable and do not change much. Therefore, the location of the installation should be within the senior residents’ daily routine, especially where most social behaviours happen.

Further, instead of “forcing” the senior residents to socialize, the promotion of their social interaction behaviours should be natural and non-intrusive. In our pre-study interview, the formal collective activities aims at organizing them to socialize seemingly were not effective for some of them. When they interacted with the *View-brick*, their memories were evoked by the scenery photos, triggering conversations among them. Integrating social communication into the interaction with installation can make social behaviour natural and non-intrusive.

### *Improving the dynamic effects, and adding multisensory channels for a more immersive experience*

The current design displays sequential real-time scenery photos. This is a low-cost and stable technical solution. However, the changes in the photo sequence were so subtle that the senior residents felt that the scenery photos stayed static, and most of them did not realize they were real-time images. Hence, it became gradually less attractive. In the next iterations, real-time video and sound could be included to improve the dynamic effects. Further, other sensory channels, such as smell and wind, could also be considered to make the experience more authentic and immersive.

### 2.5.2 Facilitating social interaction between older adults and their children

#### *Older adults’ memories were evoked by the familiar scenery photos*

The interviews in the field study indicated that the familiar scenery photos evoked the older adults’ memories, reflecting the prevalence of nostalgia among them. Explained from the place attachment theory, a place is not merely a geographical area, but also imbued with meaning or resonance to an individual or a collective (Tuan 1990). Therefore, there exist emotional bonds between people and the places they visited. These bonds are especially common among older adults. In the system of the *View-brick*, the scenery photos act as memory triggers. In my following iterations, such memory triggers will be highlighted.

*Older adults act as content producers*

One unexpected result from the field study was that most older adults preferred to share postcards with their children. It was because they considered memory as something personal, and therefore attached importance to privacy. During our contextual inquiry, the older adults also valued their connections with family. This can be explained by the socio-emotional selectivity theory, which asserts that *if the end of life is near, it shifts one's social and emotional goals towards strengthening existing emotionally fulfilling relationships rather than pursuing novel social partners* (Carstensen, Fung, and Charles 2003). These findings helped me to shift my focus to older adults connecting with their children by sharing their memories.

The contextual inquiry also indicated that older adults have treasured albums, souvenirs, et cetera., containing various underlying stories. It implies that older adults have the potential to become story content producers. The idea of deeming older adults as content producers is not new (Waycott et al. 2013). However, in my next study, I will investigate how the content created by older adults can be utilized to build new connections with their children.

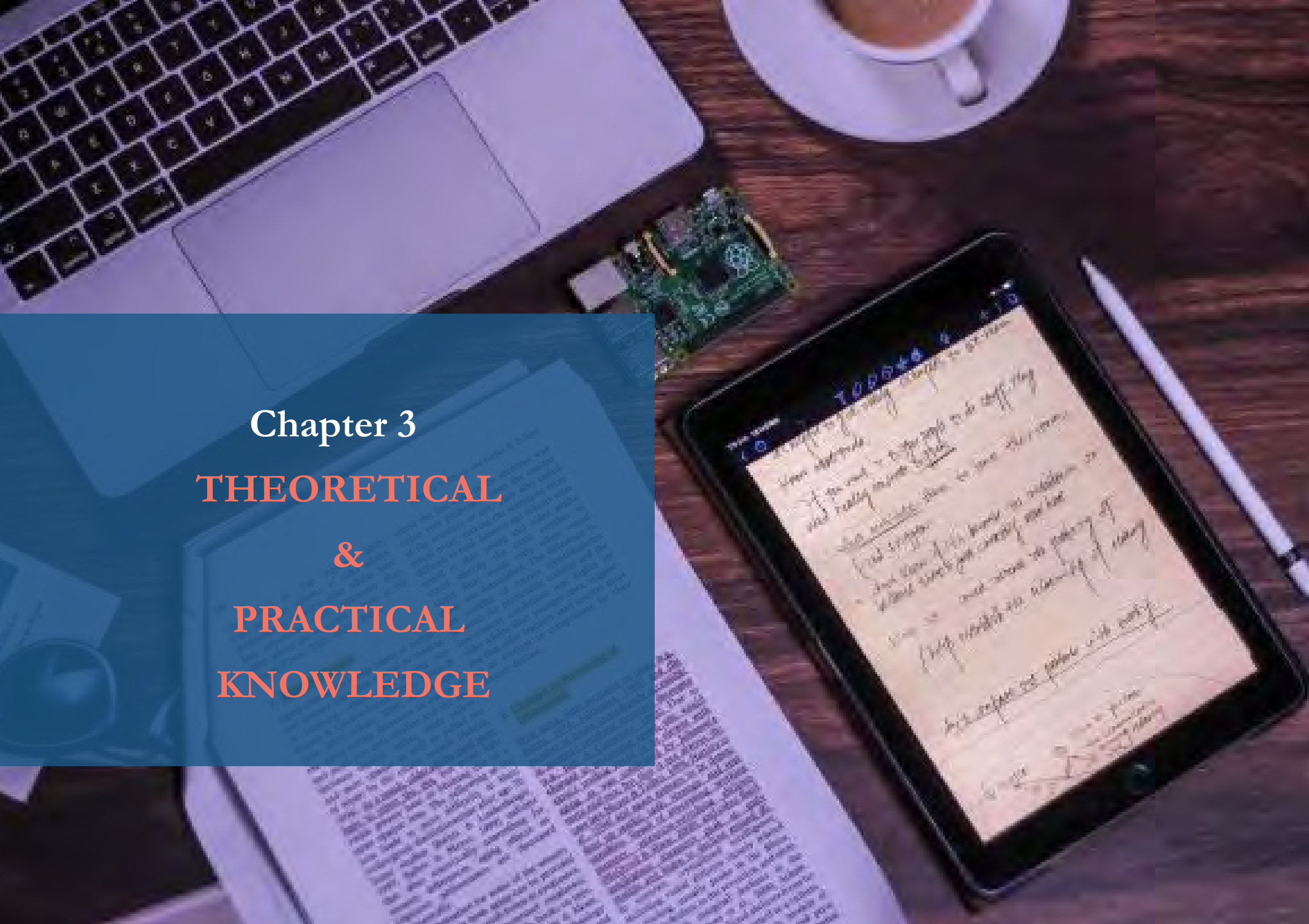
*Older adults' children act as memory trigger providers*

The older adults' children can not only be content receivers but also be memory trigger providers. Sharing memories or stories should not be a solitary but collaborative process, which contributes to mutual understanding, and boosts the older adults' self-esteem. This concept is the strategy throughout the remainder of this thesis.

## 2.6 Concluding remarks

In this chapter, I reported on the exploration with *View-brick*, which helped me to refine my research focus. It was observed that memories of older adults were evoked by the scenery photos. The interview study indicated that the older adults preferred to share postcards with their children, rather than the volunteers or fellow residents. Therefore, the study suggested that the older adults could be deemed as story content producers for their children, where also memory triggers can be used to create and share stories. Based on the above, I started focusing my research on older adults' intergenerational storytelling, and further defined the research questions.





# Chapter 3

## THEORETICAL & PRACTICAL KNOWLEDGE

As presented in chapter 2, the exploration with View-brick led my research focus to older adults' intergenerational storytelling. This chapter is intended to explore the state-of-art in this field. In Section 3.1, I describe the theoretical knowledge, including older adults' storytelling, older adults' memento, memory trigger, and older adults and technology. In Section 3.2, I describe the research method, including the overall research method: Research-Through-Design, and the story analysis methods. In Section 3.3, I describe the related applications. Finally, in Section 3.4, I present the theoretical framework of the thesis.

## 3.1 Theoretical knowledge

### 3.1.1 Older adults' storytelling

#### *Definition and scope of the "life story"*

Storytelling plays a fundamental role in human communication. It is so common that we seem to be unaware of it. From a hermeneutic point of view, human life is a process of story and narrative interpretation (Widdershoven 1993). As Robert Atkinson (1998) put it: "*Storytelling can serve an essential function in our lives. We often think in story form, speak in story form, and bring meaning to our lives through story*" (Atkinson 1998). The definition of life story, according to Charlotte Linde (1993), is almost synonymous with personal narrative; it consists of all the stories and associated discourse units, such as explanations and chronicles, and the connections between them, told by an individual during the course of their lifetime (Linde 1993). There is considerable variation in the definitions across different disciplines (Table 3-1). Robert Atkinson (1998) sets forth a comprehensive definition of life story: "*Life story is the story a person chooses to tell about the life he/she has lived and what is remembered of it. A life story is the essence of what has happened to a person. It can cover the time from birth to the present or before and beyond*" (Atkinson 1998).

Table 3-1 Definitions of life story across different disciplines

Sociolinguistics	Brief, topically specific stories organized around characters, setting, and plot (Labov 1982)
Anthropology & Social history	An entire life history woven from threads of interviews, observations, and documents (Myerhoff 1980)
Psychology & Sociology	Encompassing long sections of talk- extended accounts of lives in the context that develop over the course of single or multiple interviews (Riessman 2005)

#### *Multiple functions of older adults' storytelling*

Storytelling has social attributes: transmitting cultural and individual traditions, values, and moral codes. Not only that, storytelling by older adults serves multiple functions: From a physiological perspective, reminiscing and sharing life stories improve self-esteem, mood, well-being and enhance feelings of control and mastery over life as one ages. Research has associated reminiscence with improving psychological well-being, reducing feelings of loneliness and depression, and

helping older adults find meaning in their life (Driessnack 2017). Stories help organize and integrate the neural networks of the brain (Stein and Young 1992). Besides, as well-told stories contain emotions, thoughts, conflicts and resolutions, they are critical to brain development and learning (Cozolino 2013). From a broader perspective, stories told by older adults are treasured intangible sources of cultural heritage. When individuals regard that they approach to the end of their lives, they tend to document segments of their personal history, issues of generativity, and knowledge transmission to younger generations (Unruh 1983).

3.1.2 Older adults’ memento

*Definition and scope of the “memento”*

A Memento is defined as “an object given or deliberately kept as a reminder of a person, place, or event” (Petrelli, Whittaker, and Brockmeier 2008). Objects can be sources of the self, relational intimacy, and social integration (Cetina 1997). Mementos, such as keepsakes, postcards, souvenirs, trinkets, and other similar items as physical objects symbolize and evoke memories, associations, and stories. Photos are also mementos, allowing memories to be shared across time, place, and people (Norman 2004). Nowadays, mementos (especially photos) are increasingly becoming digital, replacing traditional physical forms such as paper documents and letters (Nunes, Greenberg, and Neustaedter 2008).

*Multiple functions of the memento*

Mementos themselves play an essential role as triggers for personal memory. Recalling memories around mementos is a process of reminiscence, which improves psychological well-being and helps older adults find meaning in their life (Driessnack 2017). From a social perspective, stories told by older adults create meaning beyond the individual and provide a sense of self through historical time and in relation to family members, and thus may facilitate positive identity (Fivush 2011). From a broader perspective, mementos and related stories are an essential part of identity preservation. Preserving legacy, sharing narratives of events and experiences are the key motivations for families to take photos and display them at home (Kim and Zimmerman 2006).

3.1.3 Memory trigger

A memory trigger, or memory clue, is loosely defined as “a circumstance or piece of information which aids the memory in retrieving details not recalled spontaneously.” Research has reported that memory trigger is essential to reminiscence and storytelling, and it is one of the keys to success in terms of facilitating and supporting remembering (van den Hoven and Eggen 2014). Humans have memory triggers that set off very strong recollections of past experiences. Memory triggers 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 triggers are classified as: things, places, people, and experiences, which is concluded as Table 3-2.

Table 3-2 Memory triggers 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	Friends	Work
Food	Work		Travel
Events: <i>Sports, Parties</i>			

3.1.4 Older adults and technology

*Tech-savvy and non-tech-savvy older adults*

Nowadays, social media play roles in people’s social interaction, but most of the older adults living in the nursing home do not benefit from it, because they are mostly non-tech-savvy. There is a trend that more older adults could better use technology and the Internet, though. However, these older adults’ parents, many of whom are still living, are neglected in this trend (Bell et al. 2013). As mentioned, the use of the Internet and social media drops significantly for people age 75 and older (Zickuhr, Madden, and others 2012) — Only 34% of people in the *G.I. Generation* (born in 1936 or earlier) use the Internet, and 21% have home broadband (Madden et al. 2010). Even for the Netherlands, a country with high levels of general Internet diffusion, only around 30% of over-75-year-old had a tablet or smartphones, according to the data from (Janene 2016)(van Deursen and Helsper 2015). Since people above the age of 75 years old are diverse regarding



cognitive ability, they comprise a group that is considerably more diverse than people of the general (younger) population, and their level of technological mastery varies (Gregor, Newell, and Zajicek 2002).

According to their technology accessibility, older adults could be divided into two groups. The first group is tech-savvy. This group consists of young-old adults who are more educated. This group has relatively substantial technology assets and sees the benefits of online platforms positively. The second group is non-tech-savvy. They are normally 75 years older, and have less mastery of technology with disease ability (N. R. Hooyman and Kiyak 2008). My target group is the older adults in the nursing home. According to my investigation, most of them are non-tech-savvy users (Li et al. 2018).

#### *Reasons that non-tech-savvy older adults do not use ICT technology*

According to the literature, reasons the non-tech-savvy older adults do not use ICT technology could be summarized as the following aspects.

- **Anxious about using modern technology.** Despite their willingness to learn how to use a computer, most older people still regard modern technology as something not belonging to their own world, feeling uncomfortable and anxious about it (Leonardi et al. 2010).
- **Age-related physical decline.** Due to the limitations resulting from the psychological and physiological process of ageing, older adults face many problems when interacting with devices (Valles et al. 1996). In addition to attitudinal variables, cognitive abilities are important to technology adoption for older adults (Czaja et al. 2006).
- **User-friendliness of technology.** Currently, most interfaces are designed to support younger users. To support senior users, we need to consider more age-related differences.

## 3.2 Research method

As mentioned in Section 1.2.2, the overall research described in the thesis follows a Research-through-Design approach. Additionally, the concept of research prototype and tangible interface are also related.

### 3.2.1 Research-Through-Design

Research-through-Design (R-t-D) is described in the literature as an approach for scientific inquiry, taking advantage of the unique insights gained through design practice (Frayling 1993). R-t-D is conceptualizing research done by means of the skillful practice of design activity, revealing research insights (J. Zimmerman, Stolterman, and Forlizzi 2010). Although the term of R-t-D is not a new concept, it is until recent years that it has been widely discussed and used in the HCI field, and became an increasingly recognized approach in design. Despite there have been many research activities in R-t-D, the field does not(yet) entail practical guidelines and cases for researchers to hold on to (Reeker, van Langen, and Brazier 2016).

As mentioned in Section 1.2.2, my overall research question was broken into several sub-questions and addressed in different iterations. In consecutive iterations, various prototypes were designed and deployed.

#### *Research prototype*

One feature of R-t-D lies in that the knowledge and insights are generated through the implementation of research prototypes. Therefore, R-t-D highlights the research prototype, which supports the researcher to develop a rich and grounded understanding of the problems and opportunities in the context of the social interaction of older adults in an exploratory and open manner. Prototypes serve multiple functions within the research process: Prototypes make abstract theory concrete as they could involve people in the research process, and they are 'like products' in the sense that someone can interact with them and experience them (Soegaard and Dam 2012). Prototypes are also seen as embodying designers' judgments about valid ways to address the possibilities. In my research, various research prototypes were designed and implemented in different phases, and they were iterated in an incremental manner.

#### *Tangible interface and non-tech-savvy older adults*

My target group is the older adults in the nursing home. According to literature and my investigation, most of them are non-tech-savvy users. Since TUI (Tangible user interface) has been proved to have great potential to improve older adults' technology acceptance (Spreicer 2011), many applications for non-tech-savvy older adults adopt a tangible interface. It has been well acknowledged that

tangible interfaces are more accessible and suitable for the needs of older people, as they could provide a natural style of interaction. Older adults suffer from a decline in motor control and accuracy, while physical contact with an interface gives senior users confidence in their abilities (Häikiö et al. 2007). Current touch-based interfaces are mainly visually guided without physical feedback. This lack of tangible feedback often leads to errors and frustrations that are accentuated in older adults. In my research, all of my prototypes adopted a tangible interface, and I expect that a tangible interface can help to bridge the technological gap for older users.

3.2.2 Story analysis method

One of the features of my research is the comprehensive and deep analysis of the stories told by the older adults. In this research, the story analysis was conducted from three dimensions: thematic analysis, structural analysis, and interactional analysis. The definition and functions of these three analysis dimensions are as follows (Table 3-3).

Table 3-3 Definition and function of the story analysis

Analysis Method	Definition	Function
Thematic analysis	Thematic analysis is a method for identifying, analyzing, and reporting themes within data, and it minimally organizes the data set in (rich) detail (Braun and Clarke 2006).	Have a better understanding of older adults' preferences for story topics.
Structural analysis	The structural analysis supports understanding the self-told life narrative, which reveals a common formal structure across a wide variety of contents (Bruner 1988).	Have a better understanding of the narrative patterns of older adults' storytelling.
Interactional analysis	Storytelling itself has properties of social interaction, and it performs social actions, and audiences are involved directly or indirectly (Schiffrin 1996).	Adopt the story to bridge two generations.

Based on the findings from the thematic analysis, we can understand the narrative patterns of older adults' stories. Based on the findings from structural analysis, we can understand older adults' preferences for story topics. Therefore, these two dimension analysis contribute to answering the first research question in this thesis (RQ1): *What are the characteristics of older adults' storytelling?* Based on the findings from structural analysis, we can understand the dialogic process between tellers (older adults) and listeners (the young). It contributes to answering the third research question in this thesis (RQ3): *In which ways could interactive technology involve*

*older adults' children for intergenerational storytelling?*

3.3 Related applications

My research includes older adults' life stories and memento stories, which is a multidisciplinary area, and I focus on the related applications in the HCI area.

3.3.1 Practices of older adults' storytelling

My study links the intergenerational communicating and older adults' story sharing. We have presented the review study of current communication tools in Section 1.1.5, Chapter 1. Therefore, the following aspects are concluded in this section: current applications supporting intergenerational communication, and current applications supporting story sharing for older adults.

*Current applications supporting intergenerational communication*

Regarding family communication, several interactive products and systems have been implemented to support communication in families. There are applications supporting co-present sharing. For example, "Cueb" is a set of interactive digital photo cubes with which parents and teenagers can explore individual and shared experiences and are triggered to exchange stories (Golsteijn and van den Hoven 2013). For the family members over a distance, Judge et al. (2011) explore how families would make use of a video system that permitted sharing everyday life over extended periods between multiple locations. There are studies focusing on enhancing communication within remote family members through sharing photos (Biemans et al. 2009); (Mynatt et al. 2001), and there are also tangible applications aiming to strengthen family connectivity through ambient awareness (Chung, Lee, and Selker 2006). Another study explores how older adults' favorite objects (for example, kettle and tea box) could be augmented to help them to connect with their children living remotely (Brereton et al. 2015).




*Current applications supporting story sharing for older adults*

Regarding storytelling, Jasmine Jones et al. (2018) interviewed 21 people in "teller (older adults)" or "listener (young adults)" generations in their respective families, and they identified strategies and challenges that family members face when conveying life experiences, life lessons, and historical information through family

stories (Jones and Ackerman 2018). Some research and applications focus on the dementia group. For example, “Traumreise” explores how tangible objects integrating multisensory digital media could stimulate people with dementia to tell stories (Mertl et al. 2019).

Particularly for intergenerational storytelling, related applications are mostly mobile applications used by the listeners—the young. For example, Welsh et al. (2018), Druin, Bederson, and Quinn (2009), Marcus (2015), and Bentley, Basapur, and Chowdhury (2011a) developed applications, which could be seen in Table 34 for details. These applications typically could be used only when both the older adults and their children meet face to face. For applications that are specifically designing for non-tech-savvy users, there is a tangible device allowing sharing photos and artefacts between grandparents and remote grandchildren below the age of ten (Wallbaum et al. 2018)

Table 3-4 Applications related to intergenerational storytelling

Application	Description
	A mobile application supporting conversation between young people and older adults with dementia (Welsh et al. 2018)
	Smartphone application and website for creating multimedia stories (Druin, Bederson, and Quinn 2009)
	Software (including smartphone application and website) for managing family stories (Marcus 2015)
	Software for saving videos at user-specified real-world locations, shared with friends and family (Bentley, Basapur, and Chowdhury 2011)
	A mobile application for reading and editing books, or even creating new stories on an iPhone (Bonsignore 2010)

3.3.2 Practices of memento

Studies on physical mementos

There are some ethnographic studies on physical mementos, such as (Petrelli, Whittaker, and Brockmeier 2008) and (D. Kirk and Sellen 2008), which are both conducted family tours and interviews in the participants’ homes. As mentioned, memento is a broad concept. In other studies, different types of mementos are investigated. Richard Banks et al. ’s study focuses on heirlooms; they investigated the role technology plays as part of the process of inheritance (Banks, Kirk, and Sellen 2012). More studies focus on photos: Chalfen et al. (1987) acknowledge the central role of film and photography in family representation. Then draw attention to how familial and domestic conventions are reproduced through its tools and practices. Swan and Taylor’s related field study points out that photo displays play into the shaping of a moral character to the home (Swan and Taylor 2008). As mementos are increasingly becoming digital, some fieldwork looks at characterizing and comparing physical and digital mementos in the home (Petrelli and Whittaker 2010). Golsteijn, van den Hoven, et al. (2012) further investigated how we perceive physical and digital objects, including their advantages and disadvantages.

Applications supporting memento sharing

Regarding applications related to mementos, some applications aim at building links between physical mementos and related digital content such as audio, which are mostly based on barcodes and RFID technology. For example, “MEMENTO”, an interface that can support the creation of scrapbooks (West, Quigley, and Kay 2007), is a tagging service that provides means to link stories to objects via QR codes and RFID tags (Barthel et al. 2013). However, recent applications focus more on digital mementos, which could be summarized into the following three directions:




- Capturing personal mementos, so-called lifelogging, aims to benefit from the advantages of digitally storing memory cues by aiming for ‘total recall’ (Sellen and Whittaker 2010). The captured data types vary from pictures (Sellen et al. 2007), sound (Petrelli et al. 2010), to videos (Singhal et al. 2018). The forms of applications also vary from static tangible devices to wearable devices (Jiang et al. 2017).



- Organizing and archiving personal mementos. Given that the temptation of people to capture as much as possible, has resulted in vast personal collections scattered over disparate sources (Thudt et al. 2016). Applications that mostly employ interactive devices, such as interactive multi-touch tabletops (D. S. Kirk et al. 2010) and projectors (Jansen, van den Hoven, and Frohlich 2014), are both aiming at better organizing and retrieving personal digital content.
- Displaying and sharing personal mementos, which is the most relevant direction to my study, and will be highlighted next.

The third research direction is based on the fact that people display photos in their homes to share narratives and stimulate social interactions (Kim and Zimmerman 2006). Most related applications are used within the context of family, aiming at facilitating conversations among family members. Since these applications focus on digital content, one of the key design strategies is to enable digital content more accessible through integrating the interactivity of physical objects with digital content. Some of them can be seen in Table 3-5.

Table 3-5 Applications related to displaying and sharing personal mementos

Application		Description
"Photoswitch"		"Photoswitch" is a digital photo display device with purposefully simple functions to provoke discussion within family members (Durrant et al. 2009)
"Cherish System"		"Cherish System" is a smart digital photo frame aiding family members social interaction, and its goal is to create an opportunity for enriching the social interaction and co-experience among family members and visitors to the home through mediating digital images displayed electronically (Kim and Zimmerman 2006)
"Photobelix"		An interactive table supporting browsing, sorting, and sharing digital images (Hilliges, Baur, and Butz 2007)

3.4 Theoretical framework

Given the above theoretical knowledge and related applications, I present the theoretical framework of the thesis (Figure 3-1). The framework demonstrates the related theoretical notions, and organize the notions in a logic of Research-through-Design. To make it clear, I organize it into three parts: Research Prototype, Field Study, and Data Analysis.

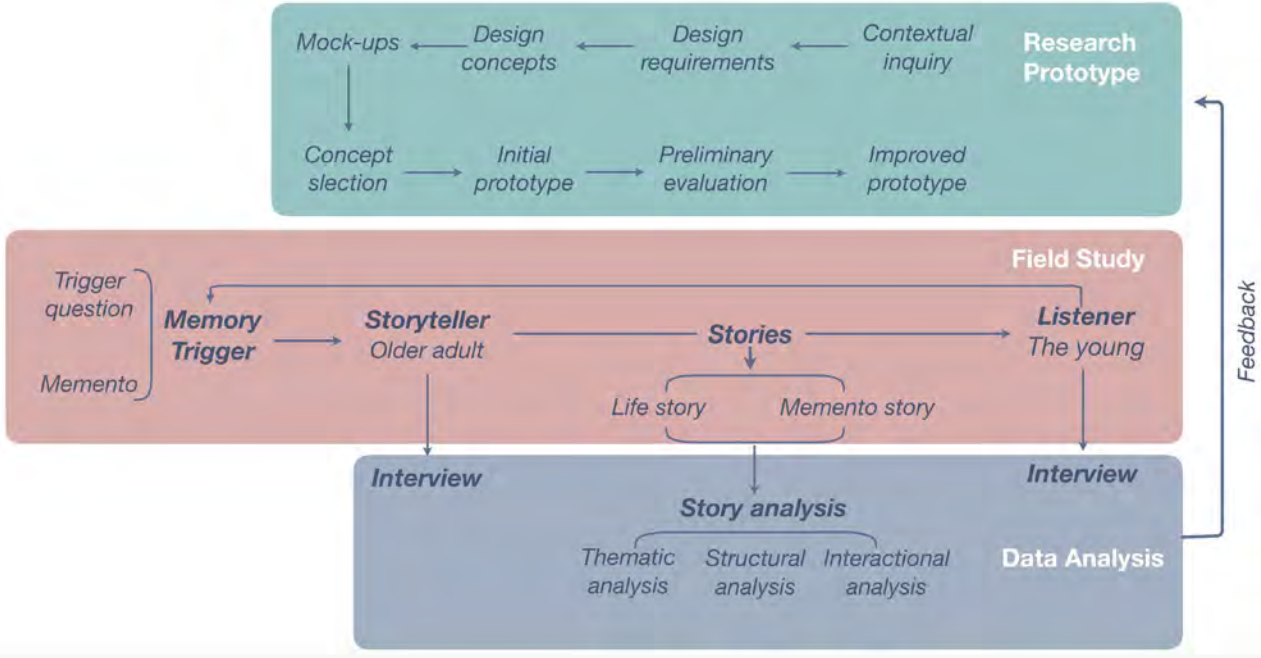



Figure 3-1 Theoretical framework



## Chapter 4

# SLOTS-STORY: OLDER ADULTS' LIFE STORIES

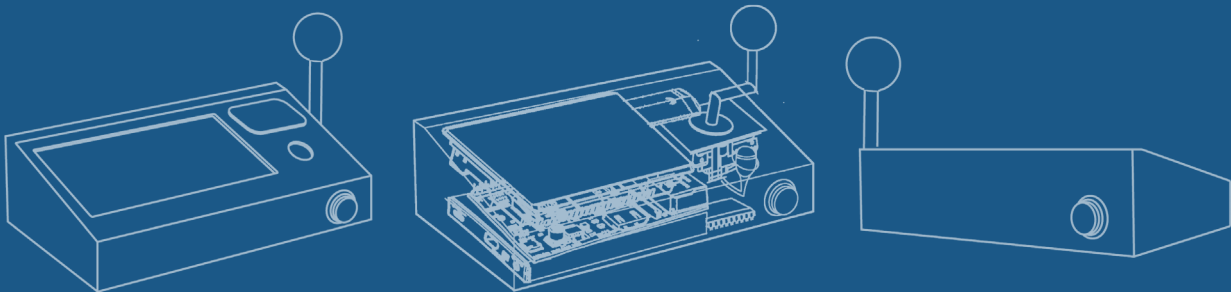
This chapter is largely based on

- Li C, Hu J, Hengeveld B, Hummels C. Facilitating Intergenerational Storytelling for Older Adults in Nursing Home, a Case Study. *Journal of Ambient Intelligence and Smart Environments* (Li, Hu, and Hengeveld 2020)
- Li C, Hu J, Hengeveld B, Hummels C. *Slots-Story*: facilitate inter-generational life story sharing and preservation of older adults. *Proceedings of the 10th Nordic Conference on Human-Computer Interaction* (Li et al. 2018)

The results of Chapter 2 indicated that older adults could be deemed as story content producers, and their children as their listeners. Hence, I turned my attention to intergenerational storytelling. In this chapter, I will focus on older adults' life stories. This is because, first, the "life story" is one person's memory of events, people, and places (Dryjanska 2015), which is one of the most precious qualities of older adults. Second, a life story is one person's own experience, which could resonate with one's children, and increase the intergenerational bonding.

Therefore, I focus on the following research questions: (1) *What are the characteristics of older adults' life storytelling?* (2) *In which ways could interactive technology facilitate older adults to tell life stories?* (3) *In which ways could interactive technology involve older adults' children?* These questions are sub-research questions (1), (2), and (3) in Chapter 1.

In particular, this chapter starts with a contextual inquiry, aiming at understanding the status quo of intergenerational storytelling of older adults and defining design requirements (Section 4.1), based on which I explored potential concepts. Some of these concepts were developed into mock-ups. Older adults were consulted to evaluate these concepts. *Slots-Story*, one of the concepts employing the metaphor of slots-machine, was chosen and further detailed (Section 4.2). *Slots-Story* is a tangible device that integrates trigger questions and audio recording. Trigger questions were taken from The Life Story Interview (Atkinson 1998), which covered the majority aspects of a person's life journey. The children of the older adults choose what they were interested in and add customized questions (Section 4.3). Section 4.4 is about the experiment: eight pairs of participants (each pair consisted of an old adult and his/her children) participated and used the research prototypes, and interviews were conducted. Section 4.5 presents the analysis of the stories they shared. The stories were analyzed from three dimensions: thematic, structural, and interactional analysis. Section 4.6 discusses the insights with regard to the research questions. Finally, section 4.7 concludes the findings.



## 4.1 Contextual inquiry

To understand the intergenerational storytelling of older adults and define design requirements, I conducted seven semi-structured interviews with the older residents (age from 71 and 90) in Vitalis-Berckelhof, Eindhoven, the Netherlands (Table 4-1). In section 4.1.1, I describe the findings from these interviews about their current life storytelling. Based on these findings, the design requirements of the prototype are formulated.

Table 4-1 Demographic information of the participants (F = Female, M = Male)

Participant	P1	P2	P3	P4	P5	P6	P7
Age, gender	78, M	84, F	87, F	82, M	71, M	86, F	90, F

Each interview was audio-recorded with the interviewees' approval. All names and data reported have been anonymized. In particular, I wanted to know their current communication habits with family members and story sharing situation. The following topics were discussed:

- Familiarity with technology.
- Communication habits with family members (*who, number, frequency, duration of contacting with family; the way of keeping in touch (face-to-face, phone, skype, et cetera); activities and conversation topics when getting together, and familiarity with technology*).
- Their current story sharing situation (*whether like to share stories and why; situations and reasons for sharing life stories; topics, duration, and frequency of story sharing; triggers of life story sharing; problems encountering during story sharing*).

### 4.1.1 Findings of contextual inquiry: their current storytelling

In this section, I present the findings with regard to the above topics. The interviews were originally in Dutch, and they were translated into English by translation agency and student assistants. Grounded theory techniques (Corbin, Strauss, and others 2008) were adopted to analyze the data, to allow themes to emerge in a bottom-up manner. The coding process includes Initial coding and Focused coding, which is the same as in Chapter 2, Section 2.2.2. To better reveal the coding process, a concept indicator model was made to visualize the clustering of the codes (Figure 4-1).



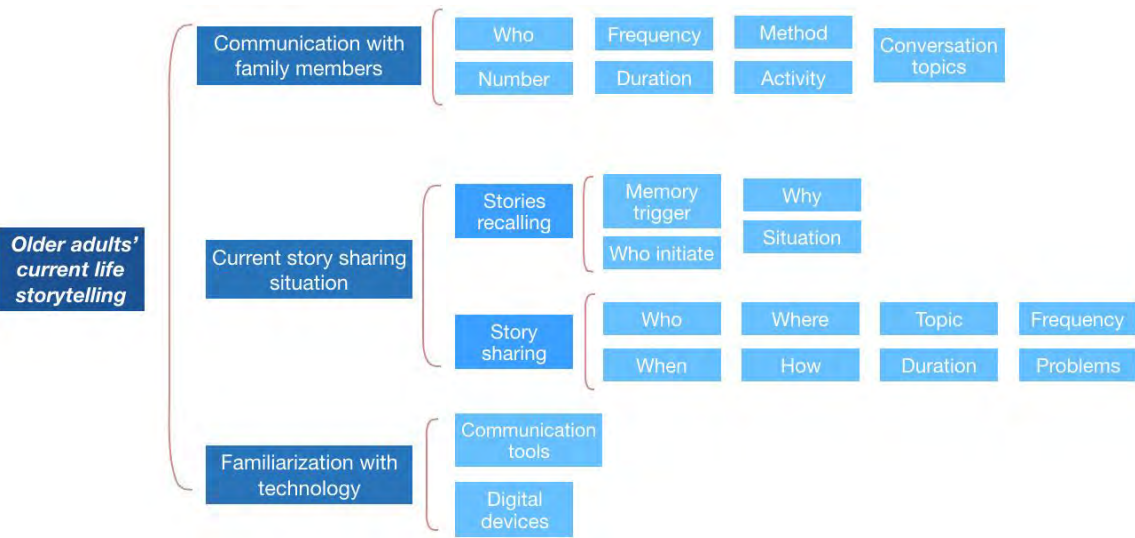


Figure 4-1 Concept-indicator model “Older adults’ current life storytelling”

Communication with family members

Older adults had regular contact with their children, who visited them regularly. The connection with their sisters, brothers, and friends of the same age was less, as they were also aged, and some of them even passed away: “I have one sister and one brother, but less contact with them because they are dying. I am old and can’t take a train or drive to visit them.” —P6, F. Except for one interviewee, they all had more than one child, who visited them regularly (from once a week to once a month), and the duration of each visit lasted 3-5 hours. Older adults enjoyed the family union: “When they visit me, sometimes we have dinner together. It is the cosiest moment, and I like that.” —P3, F. Despite regular visits, they wanted more. However, their children’s busy work hindered the connection: “I hope they could visit me more, but they are too busy.” —P2, F. They also connected by telephone, but they called their children only in special and urgent circumstances (festivals, diseases, et cetera.): “I don’t call my children very often because I don’t want to disturb them. They have to work after all.” —P5, M. Regarding activities and conversation topics, they usually had dinner together, did groceries, and drove out when getting together with family. They preferred to stay in their own apartments rather than the public space of the nursing home. Conversation topics were various from daily life, sports, weather to politics, but mainly were related to family, which were private and personal. Children were nearly the only people that older adults could really tell personal things to: “I would

like to share personal things with my children and close friends. These are very private. I don’t want to share with others, nor do I think they are interested in.” —P4, M.

Their current story sharing situation

First, nostalgia was prevalent among the older adults. Older adults are often emotional and depressed, and would like to recall the past: “I do not know. I am often easily emotional. For example, when I see one little girl ride bicycles, she is very friendly and nice. She reminds me of when I was a girl.” —P2, F. They could not do some things they could before, making them easily frustrated: “When I encounter a problem, I first try to solve it myself. But now I need care services, and that’s why I moved here.” —P6, F. People tended to be nostalgic naturally when they grew old, as one said: “Past things come to my mind somehow. I often look back to my life and feel life is short. Maybe you can’t understand unless you really grow old.” —P1, M. Another said: “I don’t understand the society of today. I miss the past. Recalling the past is like watching a movie.” —P3, F.

Second, older adults would like to share life stories, but their children did not realize the importance of listening and preserving older adults’ stories. Older adults would like to reflect on their past, but they were not explicitly asked, nor did they have many chances to tell. They hoped their children would ask them more: “There is no doubt that I’d like to tell my past things to my children if they ask me, but I won’t force them to listen.” —P5, M. “I rarely initiated the storytelling. It was only when they asked, would I tell my past.” —P2, F.

Third, situations and reasons for older adults’ story sharing are as follows. The older adults did not share life stories specifically and deliberately in their daily lives, and their life story sharing was fragmented. Since it happened informally, casually, and unnoticeable, it was hard to preserve these stories. Situations and reasons could be summarized as follows. (1) Chat topics were related to their past, acting as memory triggers to tell past: “Someone said his past things, or the talking topics just reminded me about my past, then I would like to tell my stories.” —P2, F. (2) Someone asked the older adults about their past, specifically: “Children are curious about how it all went before, because life now is very different, and they sometimes asked me about that.” —P7, F. (3) Older adults sometimes needed to talk with someone, as an outlet for their painful memories. (4) When the family got together to view family albums, photos acted as memory cues. Other situations included meeting friends had not seen for a long time, using a tape recorder to record stories for grandchildren, and talking about life experiences when explaining the bible. All the above situations

happened occasionally.

Fourth, children were whom older adults would like to tell stories to, and the older adults hoped they could be remembered. Although the interviewees lived together with fellow residents in the nursing home, their connections were mostly superficial. Second, although some lived with a spouse, they felt no necessity to share life stories with each other: *“My wife and I know each other too much, and I don’t think it is necessary to tell my past to her again.”* —P5, M. Overall, they preferred to share with their children: *“I hope my children could understand my life by telling my stories to them.”* —P4, M. The reason, perhaps, was because they wanted to be remembered. For example, one senior participant had made a brief biographical note, in case their children wanted to know him when he passed away. Another had filmed a video to document his life: *“I recorded a DVD to tell my life. So, when I pass away, my children don’t have to do anything, and they just need to play it back, that’s all.”* —P3, M.

Fifth, problems were encountered when sharing life stories. As some felt their lives were ordinary, their first concern was that their stories were unappealing to others. One said: *“I suppose those successful or rich people would like to tell their life stories. The celebrities publish their biography to express their thoughts, convey experience, and record history. For us, ordinary people, there is nothing worth telling.”* —P6, F. Storytelling topics were sometimes lacking. *“We rarely talk specifically about the past, because we usually talk about what happens now.”* —P3, F. The visits of children were not long enough to tell stories: *“Visiting time is short, so we don’t have too much time to talk about the past, specifically.”* —P1, M. Some interviewees were emotional, and they wept when recalling and telling stories, and they felt it was embarrassing.

Familiarity with technology

Older adults in nursing homes acquire information still mainly by traditional tools: newspapers, magazines, TV, et cetera. Only the youngest senior participant (P7, M, age=71) had an iPad and used it to browse news, watch videos, and play simple games. The others in the nursing home did not use computers or smartphones.

Design requirements

The following is a short summary of the findings. Older adults did not share life stories specifically and deliberately in their daily lives. Life story sharing was fragmented and happened informally, which made the stories hard to preserve. They had regular contact with their children. Older adults would like to share their life

stories, but they were rarely explicitly asked. Their intergenerational conversation topics were mainly about family, which was private and personal. Memory triggers were necessary to facilitate life storytelling. Currently, their life memories were recalled by conversation topics, family mementos, et cetera. The visit time of the young to the older adults was limited, and it might be necessary to separate the process of storytelling and story listening. Table 4-2 presents the findings and corresponding design requirements.

Table 4-2 Findings and corresponding design requirements

Aspect	Findings	Design requirements
Basic background information	Most older adults had difficulty in writing	Adopting recording as a method of storytelling
	Most older adults in the nursing home are non-tech-savvy	Adopting a tangible interface with metaphor
		Cross-generational cooperation
Communication habits with family members	Their children’s each visiting time was limited	The prototype should be able to be used both separately and together by them
Their current story sharing situation	Lack of conversation topics	Integrating memory triggers into their lives

- **Adopting recording as a method of storytelling.** That is, use audio as the storage medium of stories. Given that older adults felt difficulty in writing as they age, the audio recording could lower the threshold of sharing. Compared to handwriting, audio could retain more information such as emotions, feelings, and ambient sounds. In this context, audio also shows advantages over video. Chalfen (1987)’s study points out that video is too real to allow room for thinking about the past with others.
- **Adopting tangible interfaces with metaphors.** As most senior interviewees could not operate digital devices, a tangible interface could be adopted to increase usability. Tangible interfaces can be better integrated into their living environments, using metaphors and intuitive operations to enhance familiarity and simplicity for them.
- **The prototype should be able to be used both separately and together by the seniors and their family.** Older adults live apart from their children, and the duration of each visit is limited. The older adults and their children’s lives are usually unsynchronized. Hence, the prototype should be able to be used both face-to-face and separately.

- **Integrating memory triggers into their lives.** The interviews indicated one major problem of life story sharing by the seniors was the apparent lack of topics. Memory triggers are one of the keys to success in terms of facilitating and supporting remembering (van den Hoven and Eggen 2014). A memory trigger is “a circumstance or piece of information which aids the memory in retrieving details not recalled spontaneously” (Stevenson 2010). Despite the numerous studies focusing on why and how memory triggers evoke people’s reminiscence, I investigate how to integrate them into older adults’ daily lives.

4.2 Design concepts, mock-ups, and concept selection

This section describes the development process of *Slots-Story*. In section 4.2.1, I first present a framework for designing for story sharing of older adults, serving to clarify design opportunities, and set a boundary for design concepts. Based on the framework, I came up with eight design concepts presented in Section 4.2.2. In Section 4.2.3, I report the concept selection, which included two rounds: Pugh Matrix and user consultation.

4.2.1 A framework for designing for older adults’ story sharing

To clarify design opportunities and set a boundary for design concepts, I propose a framework for designing for story sharing of older adults. The basis of the framework is as follows. First, as mentioned in Chapter 3, research has reported that memory trigger is essential to reminiscence and storytelling, and it is one of the keys to success in terms of facilitating and supporting remembering (van den Hoven and Eggen 2014). Therefore, the memory trigger is necessary for contributing to older adults’ recalling. Second, the process of story sharing is not a solitary but a collaboration process. It is a rewarding and engaging process in which responsive receivers are needed. Therefore, both the storyteller and the listener are needed. Together with the findings in Section 4.1.1, I propose a framework for designing for story sharing of older adults (Figure 4-2).

As shown in Figure 4-2, the framework is constructed based on the process of story sharing, which has the following elements:

- **Memory cue.** Memory cues are essential in triggering storytelling. Memory cues take various forms, such as trigger questions and mementos in this

work.

- **Storyteller.** In this work, older adults are the storyteller.
- **Story listener.** Story listeners can be within and outside the nursing home. They are, for example, fellow residents, citizens, or family members. In my work, I am interested in family members as story listeners (“Citizens” are grey and not included in Figure 4-2).
- **Story collecting.** There are two methods of collecting stories: interviews and story-collecting installations.
- **Story classification.** Depending on the medium, stories could be classified as audio, text, and video. I have suggested that audio is the ideal form in this context. Hence, text and video are not included in Figure 4-2. According to the story contents, stories could be classified as anecdotes/fantasy tales (not related to the older adults), stories of themselves/their friends (related to the older adults), and stories of souvenirs and photos of the older adults.

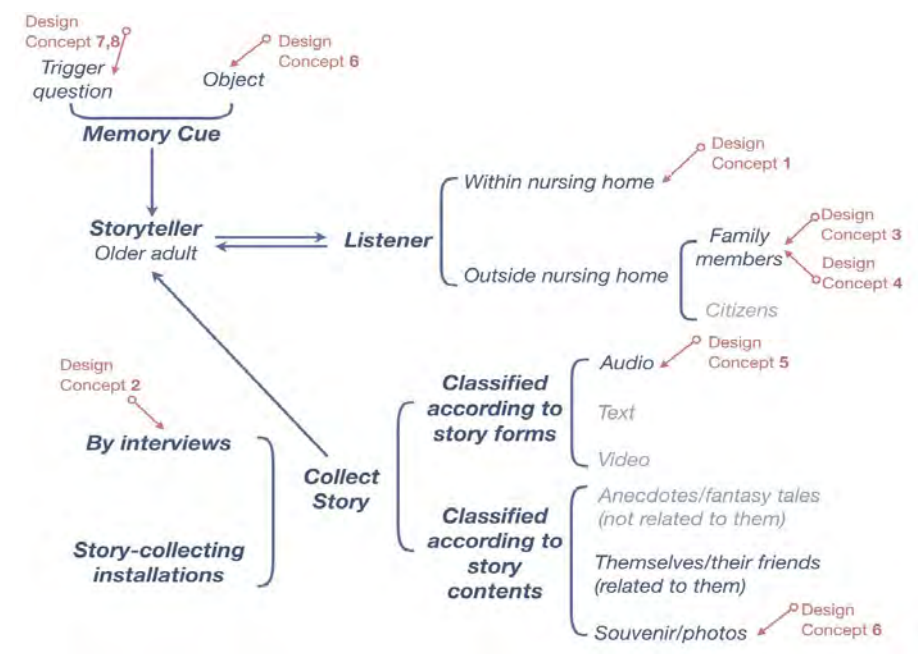


Figure 4-2 Framework of designing for story sharing of older adults



4.2.2 Design concepts

Based on the above framework, I came up with eight design concepts (Figure 4-3):

- Story-Booth. It is an installation in a nursing home. It utilizes the metaphor of a telephone. Older adults could pick up the receiver to tell their stories, which will be recorded.
- Story-Token. Every older adult has one token. The token contains pictures related to his/her stories. The older adult could share the stories related to the pictures by placing the token on the installation.
- Story-Generator. The installation is placed outside the nursing home and could generate stories collected from older adults in nursing homes. A QR code on the installation is linked to a website, and people could scan it to comment.
- Location-Story. This installation is based on the *View-brick*. The older adults in nursing homes tell stories related to scenic spots, while the young could listen to the stories by scanning the city map.
- Memento-Story. It is well known that personal belongings contain memories. Combined with NFC technology, objects are attached to stories told by the older adults, and the audio recordings of these stories could be played back.
- Story-Collector. The young use a tablet application to take photos of mementos, and the older adults could also directly tell the stories related to the mementos, which could be recorded.
- Radio-Story. The metaphor of radio is applied. A trigger question displays when an older adult turns the knob. The older adult could also tell stories related to the trigger question, which will be recorded.
- Slots-Story. Its function is similar to Radio-Story, but it adopts the metaphor of a slots-machine.

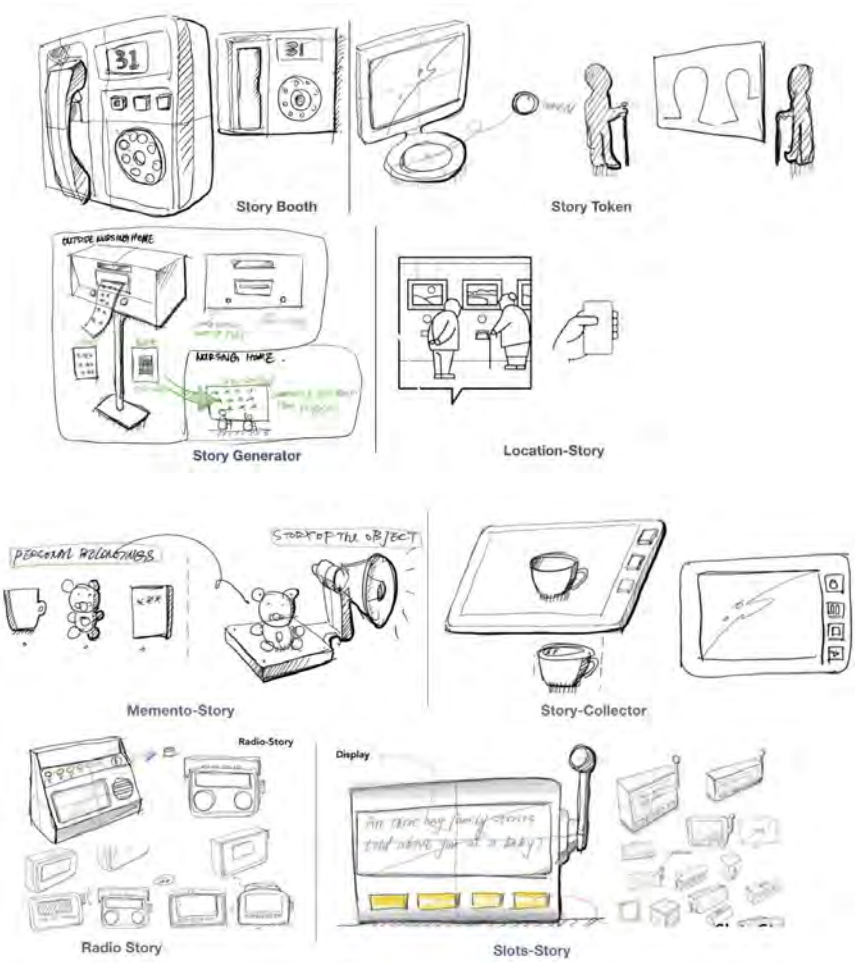


Figure 4-3 Sketches of the design concepts

4.2.3 Concept selection

Concept selection included two rounds. In the first round, I adopted the Pugh Matrix (Pugh 1981), where design concepts are compared against a set of criteria by means of a matrix. Despite that this method is widely accepted and used due to its simplicity and efficiency, it also has two deficiencies: (1) the difficulty in understanding the real needs of users; (2) it is difficult for the users to provide accurate feedback on the design concepts, due to a lack of physical products in the early stages of developing. Therefore, in the second round of concept selection, I developed the first round's chosen concepts into mock-ups, and consulted older adults.

*The first round of concept selection: Pugh Matrix*

To conduct the Pugh Matrix, I organized the design concepts into three groups with similar characteristics.

- **Group A: Memories associated with mementos.** This group of concepts mainly adopt RFID technology to attach stories to mementos, including Story-Token, Memento-Story, and Story-Collector.
- **Group B: Trigger the older adults to tell stories via different forms of memory triggers.** This group includes Story-Booth, Radio-Story, and Slots-Story.
- **Group C: Storytelling between older adults in the nursing home and outside citizens.** This group includes Story-Generator and Location-Story.

Next, I adopted Pugh Matrix to evaluating the above design concepts. The Pugh Matrix is a method for identifying the most promising design concepts among the alternatives. It consists of the following key steps:

- Choose the criteria by which the concepts will be evaluated;
- Formulate the decision matrix;
- Evaluate the ratings.

Regarding the criteria, I referenced universal design requirements from a usability test (Lund 2001, 12). Since I need to develop working prototypes, the criteria of

feasibility are also needed. All the criteria were equally important to my project, and therefore I set the weight as 1. Table 4-3 shows the Pugh Matrix comparing these three groups of concepts against usefulness, ease of use, ease of learning, novelty, and feasibility.

Table 4-3 Application of the application of Pugh Matrix in my study

			Group A			Group B			Group C	
Evaluation Criteria		Weight	Story-Token	Story-collector	Memento-Story	Story-Booth	Radio-Story	Slots-Story	Story-Generator	Location-Story
Usefulness	Bench-mark:	1	1	0	1	1	1	1	1	1
Ease of use		1	0	0	0	0	0	0	0	0
Ease of learning	Current story sharing	1	1	1	1	1	1	1	0	0
Novelty		1	-1	-1	-1	1	1	1	1	1
Feasibility		1	1	1	1	1	1	1	1	1
		Sum of positives	3	2	3	4	4	4	3	3
		Sum of negatives	-1	-1	-1	0	0	0	0	0
		Total weight score	2	1	2	4	4	4	3	3

Concept selection legend: Better= 1, Same= 0, Worse= -1

The results indicate that Group B is superior to Group A and C. I went through the second round of concept selection: with user consultation, to select the final concept within Group B.

*The second round of concept selection: user consultation*

To conduct user consultation and acquire user feedback, the chosen concepts from the first round were developed into mock-ups, including *Radio-story*, *Slots-Story*, and *Booth-story* (Figure 4-4). Five older adults from Vitalis-Berckelhof, Eindhoven, were recruited and consulted. Design ideas were first introduced to them in detail. To make them fully understand the design concepts, the mock-ups and related pictures of antique radio, telephone, and slots-machine were shown to them as well. I wanted to know their feelings regarding the concepts, familiarity with the objects, operations, preferences, and suggestions during the user consultation.

Regarding their familiarities with the objects, all the interviewees were familiar

with the above objects. When talking about the ease of operation, one interview-ee said: “I used to listen to radios, and I still have one in my room. But I feel difficult to operate precisely when I scroll through stations by turning a knob.” When asking about the preference for the ideas, most older adults reflected that the handle operation is more intuitive and enjoyable than others: “I prefer the slots-machine because the operation is interesting.” Therefore, the concept of *Slots-Story* was chosen and further detailed.



Figure 4-4 The development process of mock-ups

### 4.3 Research prototype: Slots-Story

This section elaborates on the *Slots-Story*. In Section 4.3.1, I report the initial prototype, and it was preliminarily evaluated, which is presented in Section 4.3.2. In section 4.3.3, I describe the improved prototype in detail, including its appearance, hardware, interaction, trigger questions of different themes, and use scenario.

#### 4.3.1 Initial prototype

*Slots-Story* is a slots-machine-like device, which could either be used face-to-face or independently by older adults and their family members (Figure 4-5). It utilizes the metaphor of slots-machine. I hope this tangible interface employing metaphor and intuitive interaction could enhance familiarity and simplicity for them. The device integrates the functions of a memory cue generator that displays trigger questions, and a story recorder that records the stories told by the older adults and related to the trigger questions.



Figure 4-5 Initial prototype

*Slots-Story* is expected to be placed on a table or on the lap (Figure 4-6). For viewing convenience, it is designed to be wedge-shaped, and a 7-inch display is arranged on the top side. The recording button is on the front side, which is easy to be pressed, and a lever is on the right side, which is easy to be operated. There is a handle on the backside, together with a compact dimension, making it easy to carry. The interface shown on display has two views: “Question” and “Recording”. The “Question view” displays one specific question, which will be



switched to Next/Previous question by pulling down/pushing up the lever. It will be switched to the “Recording view” when the REC/STOP button is pressed.



Figure 4-6 *Slots-Story* on table and lap

4.3.2 Preliminary evaluation

I conducted a preliminary evaluation with older adults, still in *Vitalis-Berckelhof*, Eindhoven. To get the feedback for improvement, I first introduced purpose, functions, and operation instructions of *Slots-Story* to them. The older adults then operated the prototype. I finally conducted short interviews with them. Detailed

interview topics are as follows.

- **Validity:** *Would you like to use it? Whom would you like to share with? Do you think it could facilitate sharing stories? Why?*
- **Appearance:** *What kind of appearance style would you prefer: A. Vintage B. High-tech C. Colorful D. Simple*
- **Interaction:** *Do you understand the concept of it? What is the most difficult part? Do you find it easy to use?*
- **Comments for improvements:** *Which parts would you change it? Comments and suggestions.*



Figure 4-7 Preliminary evaluation of *Slots-Story* with older adults

The following is a brief overview of the results:

- For validity, the interviewees thought it could facilitate life story sharing. They showed significant interest in it. They found it intuitive to use. The trigger questions were easy to answer and recall memories. The metaphor of slots-machine was easily understood.
- After browsing the initial trigger questions, the interviewees recalled and told their stories. Stories they were mostly interested in telling were from their childhood.
- For appearance, they thought that vintage style with the decorative effect would fit better in their homes.
- For the interaction design, a timer or indicator should be added to provide immediate feedback when the REC/STOP button was pressed. Moreover, they suggested that the sensitivity of operation should be reduced as the required precision was a challenge for their hands.
- For suggestions, the portability of the prototype was emphasized as they wanted to use it anytime and anywhere. A detailed instruction was necessary. Some interviewees suggested that family photos and souvenirs could also be used as memory triggers.

4.3.3 Improved prototype

The initial prototype was further improved based on the feedback from the preliminary evaluation. As mentioned, its operation draws inspiration from slots-machine: the user could pull down/up the handle to switch trigger questions, and press the front button to record stories (Figure 48). I aimed at providing an intuitive, familiar, and enjoyable experience for these non-tech-savvy users. Since their children visit them regularly, according to my contextual inquiry, *Slots-Story* could be used either face-to-face or separately. I initially attempted to make the recording transmission from the older adults to their children wirelessly. However, audio files recorded by Raspberry Pi which by default were 320 kbps, were too large to make the sending process stable. I then adopted a compromised solution: using a flash disk as a data storage to store the trigger questions and audios.

Appearance and interfaces



Figure 4-8 Appearance of *Slots-Story*

As is shown in Figure 4-8, for the ergonomic purpose, it keeps the wedge shape (L = 22cm, W = 11cm), making the display easy to see, and the lever and buttons easy to access. A 7-inch display and a microphone are arranged on the upside, and a button is on the front side. The lever is on the right side. The main body is made of porcelain white acrylic, and the bottom part is covered with wood-grained paper, making it look slightly old-fashioned, which is in line with the aesthetic taste of older adults.

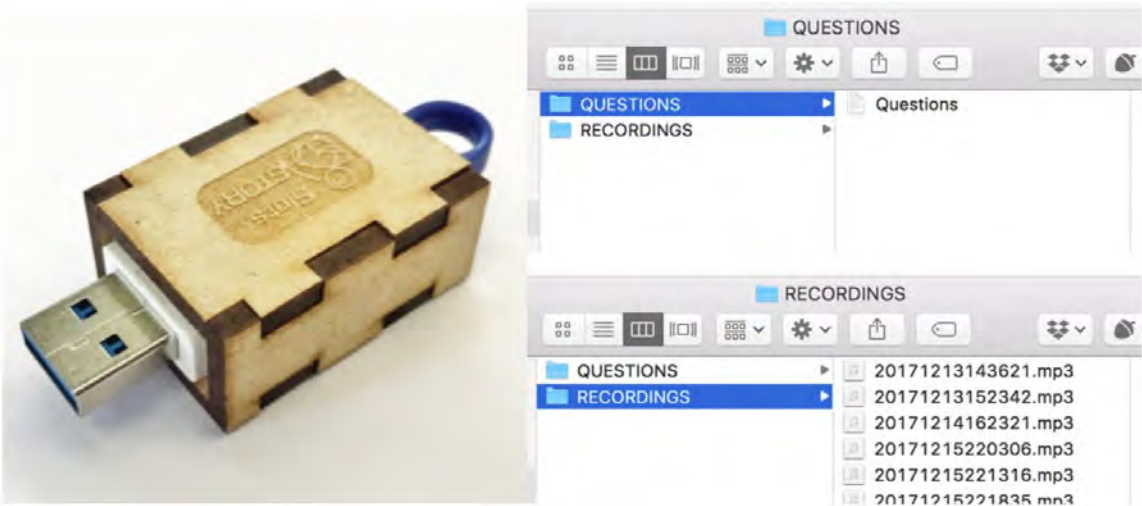


Figure 4-9 Flash disk and inside folders



There are two folders on the flash disk- “QUESTIONS” and “RECORDINGS”. The former contains trigger questions, and the latter contains the story audios told by the older adults (Figure 4-9).

The display has two views: the question view and the recording view (Figure 410). A vintage style is applied in the interface elements. Considering the eyesight of older adults, bold and large fonts are used for the text. There are use tips at the bottom: “Note: Press “REC/STOP button before/after recording.” The question view displays one specific question, which will be switched to Next/Previous question by pulling down/ up the lever, and it will be switched to the recording view if the REC/STOP button is pressed. In the recording view, a dynamic recording icon and timer widget are placed to provide real-time feedback.



Figure 4-10 Interfaces of *Slots-Story*

Hardware

As shown in Figure 411, the design consists of a Raspberry Pi, a 7-inch display, a joystick, a lever, a portable battery, a microphone, an audio adapter, and a button. Raspberry Pi 2 Model B is chosen as the hardware platform, and the Joystick USB Encoder board is used to connect Raspberry Pi and joystick. The lever is 3D printed, which could fit into the joystick component. Assembly of the microphone and the sound-card provides audio input, and the LCD Screen is for graphical output. A power bank powers the prototype.

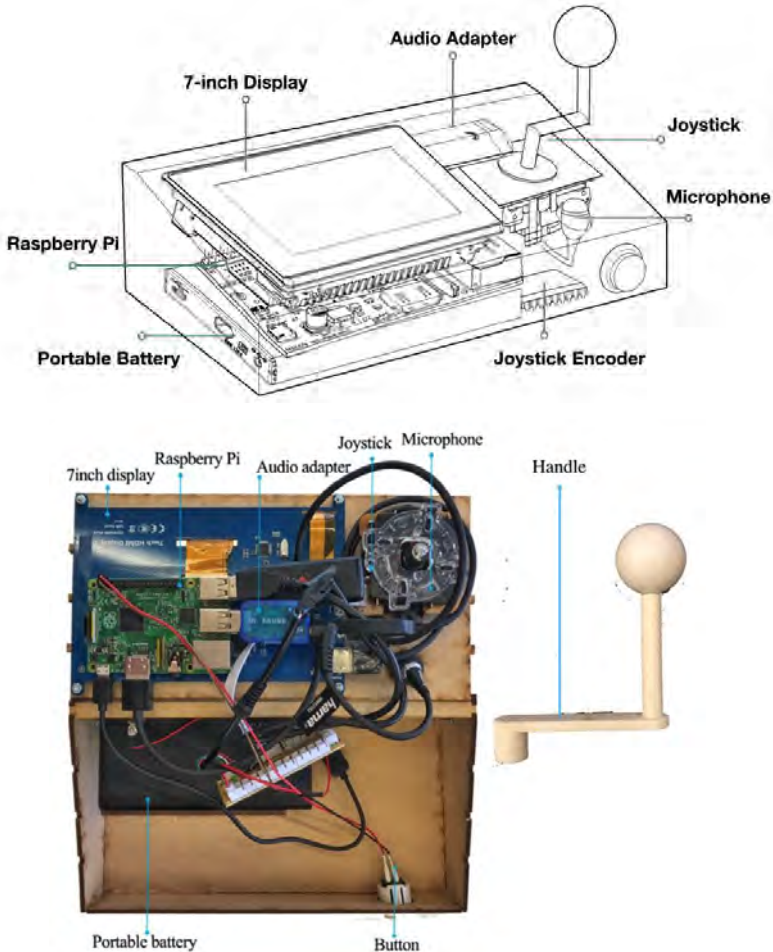


Figure 4-11 Internal structure and hardware of *Slots-Story*



Interaction

The interaction process of *Slots-Story* is shown in Figure 4-12.

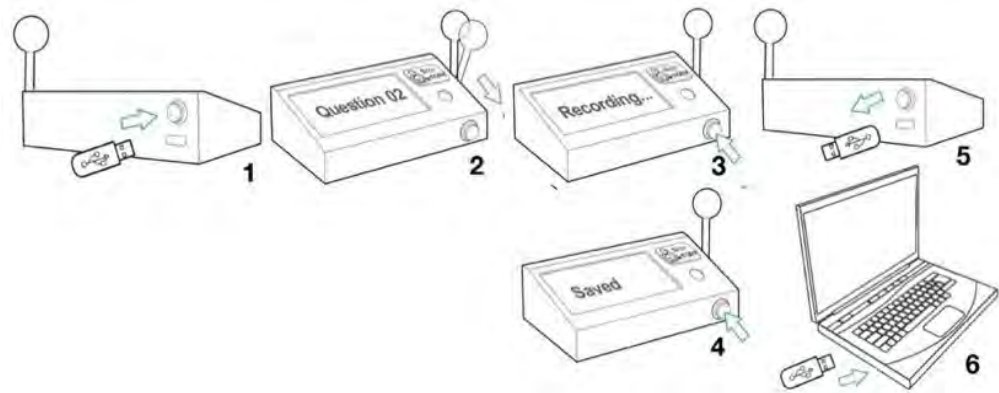


Figure 4-12 The interaction process of *Slots-Story*

- (1) The young or the older adults insert the flash disk into *Slots-Story*, and switch it on. *Slots-Story* displays one trigger question.
- (2) The older adult could pull down/push up the lever to switch trigger questions.
- (3) The older adult could press the recording button to start recording, and it will jump to the recording interface.
- (4) The older adult could then press the recording button again to save the recording.
- (5) Stories told by the older adult now are on the flash disk.
- (6) The young plugs the flash disk into a computer to listen and keep stories, and further modify trigger questions.
- (7) The *Slots-Story* could also be used face-to-face.

Trigger questions of different themes

The trigger questions were based on The Life Story Interview (Atkinson 1998), and cover most aspects of an entire life course, such as birth and family of origin, cultured setting, traditions, education. Compared with other types of memory cues (for example, photo, sound), questions are more explicit and straightforward, as such triggering targeted answers. Older adults' children could choose what they

were interested in and add customized questions. In order to avoid triggering negative memories of the older adults, I encouraged their children to choose positive and neutral trigger questions. Example trigger questions are:

- **Childhood:** *Were you ever told anything unusual about your birth? What is your earliest memory? What clubs, groups, or organizations did you join?.....*
- **Family:** *What was going on in your family, your community, and the world at the time of your birth? Which beliefs or ideals did your parents try to teach you?.....*
- **School and Work:** *What is your first memory of attending school? What was your first experience of leaving home like?.....*

Use scenario

To provide a step-by-step overview of how *Slots-Story* can be used, I present a use scenario: David grows old and lives alone. Someday his son Peter gives him a *Slots-Story*, and David soon masters functions of it after Peter's short instruction (Figure 4-13).



Figure 4-13 Use scenario

- Use *Slots-Story* separately (①~④ in Figure 413). David operates the lever to select questions that he is interested in. Peter gets the flash disk and plugs it into a computer to listen to the recordings. With great interest, Peter wants to know more details of the question-“What is your earliest memory?” Peter then calls David: “Hey, Dad, I listened to your story about your earliest memory, and I am very interested and want to know more about my grandmother at that time.” David then tells more details of that story, and his son feels knowing more about his father and grandmother.

- Use *Slots-Story* face-to-face ((5) in Figure 413). Every weekend Peter brings his children to David, which is the happiest moment for David. The grandchildren like David, because They could always hear lots of stories from David. With the trigger questions provided by *Slots-Story*, the whole family get together and listen to the stories from David.
- Listen to the recordings ((6)). Using the flash disk, Peter and his children can easily listen to the recordings.

4.4 Field study

This section reports on the field study of *Slots-Story*. In Section 4.4.1, I introduce the procedure, method, and participants. In Section 4.4.2, I describe the interview topics, and Section 4.4.3 presents the findings from the interview. The interview aims to ask the participants to reflect on their use of *Slots-Story* to share stories, and their children's feelings. The stories told by the older adults will be analyzed in Section 4.5.

4.4.1 Procedure, method, and participants

Three prototypes were made, and each of them was provided with a printed manual with instructions. I recruited eight pairs of participants (each pair consisted of an old adult and his/her children). The older adults were from Vitalis-Berckelhof, Eindhoven, and they were recruited according to the recommendations of the caregivers. They were four male and four female, with their age ranging between 73 and 86. None of them reported any significant physical impairments. All of them would like to share the stories with us on an anonymous basis, with their consent.

Table 4-4 Demographic information of the participants (SP = Senior Participant, YP = Young Participant, F = Female, M = Male)

Participants	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8
SP	73, F	79, M	86, F	79, M	75, M	74, F	82, F	80, M
YP	42, M	53, M	46, F	47, F	36, F	44, M	51, F	41, F

The procedure was as follows:

- **Preparation.** Purpose, functions, and procedures were introduced to them

face-to-face. They were then asked to sign the consent form.

- **Deployment.** Each participant with his/her family member used the prototype for around ten days. They could contact us whenever they had trouble using the prototype.
- **Interview.** Semi-structured interviews were conducted at the end of the deployment, and each interview was audio-recorded.

4.4.2 Interview

After using the prototype, the participants and their children were interviewed. The interviews aimed to ask the participants to reflect on their use of *Slots-Story* to share stories, and their children's feelings. Some of the older adults were interviewed together with their children, and some were separately. I explored the following topics with the older adults:

- Validity (*Do you think it could facilitate sharing stories, and why? Would you like to use it?*)
- Appearance (*What kind of appearance style would you prefer: A. Vintage B. High-tech C. Colorful/Lovely D. Simple*)
- Interaction (*Do you understand the concept of it? Do you find it easy to use? What is the most difficult part?*)
- Comments for improvements (*Which part do you like/dislike most of the prototype? why?*)
- Open questions (*Other comments*)

I interviewed their children with the following questions:

- Feeling (*What's your feeling after listening to the stories?*)
- Connection (*Did you contact your parents after listening to the stories?*)
- Content (*Preference of stories: A. Childhood B. Family C. School and Work D. Friend and Fun E. Historical Events G. Others Comments for improvements*)

4.4.3 Findings

Frequency of use

After analyzing the frequency of use of *Slots-Story*, I have two findings. First, most users used *Slots-Story* quite often in the first two days, after which there was sort of a settlement period (see Figure 4-14). It can be explained by the novelty effect. P4 and P6 were two exceptions, whose frequency of use was rather stable. Second, most participants showed peaks during their usage. According to the interview, these peaks happened during their children's visits. That is, as soon as the children were there, there was an incentive to tell stories. Either because their children reminded their parents to use the prototype, or they would like to use the prototype together. In Section 4.5, I will elaborate on the differences between using it face-to-face and individually.

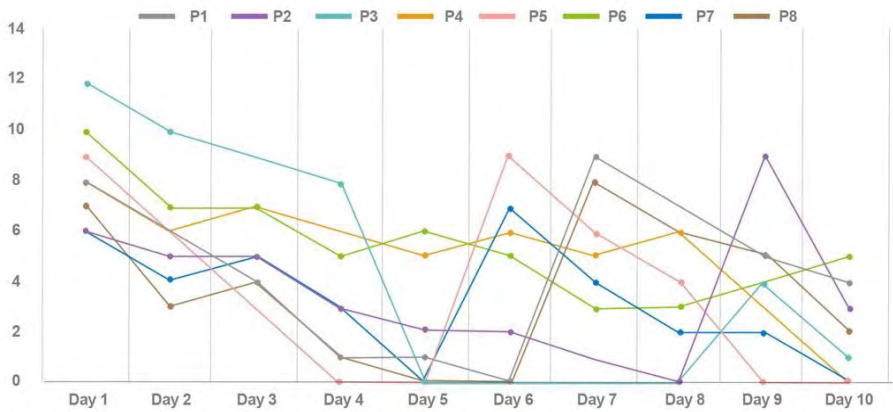


Figure 4-14 Older adults' frequency of use

Interview with older adults

For the interview, all names and data reported have been anonymized, and I restricted access to the data to our research team only. I also made small edits in part of the quotes for clarity. Grounded theory techniques (Corbin, Strauss, and others 2008) were adopted to analyze the data, to allow themes to emerge in a bottom-up manner. The coding process includes Initial coding and Focused coding, which is the same as in Chapter 2, Section 2.2.2. The following are the findings.

**The validity of *Slots-Story*: their feelings and opinions.** Most of the partic-

ipants thought it could facilitate life storytelling. One said: “No one has ever asked me so many questions like this machine. It encourages me to sit together with my children to tell stories.” —SP4, F. It helped them remember what they almost forgot, and reflect on their life again. It provided an easy way to record the memories: “The explicit questions make it easy to remember the long-forgotten things, and some questions are what you might not think of yourself. They are good prompts.” —SP8, M. They also enjoyed and benefited from recalling their memories: “I had a lot of fun when telling my own memories, experiences, and feelings.” —SP4, M. One reason was they could get insights from looking back to the past: “The recalling gave me insights into the past, mistakes I made, and reactions of people who are very close to me.” —SP6, F.

**Appearance of *Slots-Story*.** Although their preferences for the appearance styles varied, they all thought appearance should be unobtrusive when putting it at their home. Therefore, the decorative effects of the prototype should be highlighted: “I think I have enough house appliances in my home, and I don’t want another one.” —SP2, M. “Since you are making an intergenerational communication tool, you should make it have a sense of family.” —SP1, M. Most preferred vintage style, since it indicated the past, and brought a sense of mysteriousness.

**Interaction with *Slots-Story*.** Most interviewees showed great interest in its intuitive operation of the lever. They easily understood the metaphor of slots-machine. Trigger questions and the lever operation were the most interesting functions for them: “The slots-machine-like operation raises for me a sense of expecting and curiosity for the unknown.” —SP7, F. Also, they appreciated the accessibility of voice-based story preservation: direct storytelling by speaking was convenient compared to writing, especially for those who had difficulty in writing: “Without good eyesight, you cannot do much alone, even if you are mentally totally fit.” —SP3, F. One unexpected finding was that they appreciated the flash disk as a tangible carrier to preserve their memories.

**Comments for improvements.** The comments were mainly related to usability aspects. First, some participants complained that it always displayed the same question after startup. It should be able to memorize the question displayed the last time automatically. Second, one participant thought it could be more friendly by displaying “Thanks for your story” after telling stories. Third, by default, it should display the questions as a slideshow when not in use, so as to attract older adults’ attention, and encourage them to use it.



**Other comments.** As mentioned earlier, I tried to avoid questions that would trigger negative memories. However, some senior participants found *Slots-Story* a tool to vent their negative emotions and frustrations. They had some memories that they could not let go, while *Slots-Story* provided an outlet and unburdening for them: “I felt it is a total stranger that I could feel free to say anything to it.” —SP3, F. They suggested the trigger questions could be more comprehensive, including both positive, neutral, and negative topics. Although they knew their children were their story listeners, some of the older participants argued that they felt as if they were telling to strangers when they used the prototype. They felt at ease: “I feel like a broadcaster, and I’m telling strangers about my life journey.” —SP6, F. They were also willing to share their stories with strangers on an anonymous basis.

### *Interview with the older adults’ children*

Their feelings and opinions. The following six aspects are summarized.

(1) Not only did they hear new stories that they did not know before, but also they felt closer to their parents. Some said they learned entirely new things, and they were surprised that there were lots of things they did not know before: “In the audio, my mother talked about the origin of her nickname.” —YP6, M. “I didn’t know too much about my great grandfather because he had passed away before I was born. I heard a lot about him through my mother’s recordings.” —YP7, F. After they learned more about their parents’ life, the young showed reverence to them: “I thought she is great, and her achievements are admirable.” —YP3, F. It had a positive effect on intergenerational relationships, besides merely facilitating storytelling.

(2) They felt the prototype could develop intergenerational conversations when used face-to-face, as one said: “It helps to develop conversations, and I think the trigger questions have been thought of for me, in case I didn’t ask my father.” —YP4, F. Another said: “It can serve as a conduit for discussion, and one gets to know my grandparents differently.” —YP5, F.

(3) They realized the importance of preserving parents’ life stories in the long run. They felt the recordings were not only valuable memories worth cherishing, but also could be a consolation if older adults passed away: “If mom once will die, these recordings with many heartfelt memories can certainly give me a little consolation. They could be something to give me comfort when she is gone, and I will treasure it forever. They are valuable memory, and it will be an eternal memory for me.” —YP1, M. The recordings are also a treasure to pass on to the next generation, as the recordings were like

a biography, encapsulating the storyteller’s life: “Our parents are guardians of a very personal memory treasure, which needs to be preserved. I think that is the meaning of the prototype.” —YP8, F. Another said: “I can play the recording to the next generation and talk about how it was with her grandmother back then. It is a great idea for recording memories to be handed down the generations.” —YP2, M. “It’s something you leave to your children after death when they cannot ask for details anymore.” —YP6, M.

(4) They felt familiarity and emotion in the recordings: “The voice is so familiar, and she is telling her own story, the things she has been going through.” —YP7, F. “The recordings really brought heart-touching memories back to me.” —YP4, F. The background sounds in the recording also enabled the young to imagine the scene of older adults telling their stories: “I even hear the meow of her cat. I could imagine the scene when she told her stories.” —YP3, F. They appreciated that the prototype could preserve older adults’ voices: “I once made a short video consisting of photos, to honour my father, who has passed. I had photos and added background music to the video, but I don’t have my father’s real voices.” —YP2, M.

(5) Some found it an excellent way to ask questions that might be awkward, as listening to the recordings was different from talking face to face. The prototype provided a way for avoiding awkward situations, when it came to sensitive topics: “My dad is a serious man, and never tells me about his love experience. Using this tool makes him tell me indirectly.” —YP5, F.

(6) Finally, my project, together with the prototype, enabled the young to be aware of the importance of intergenerational storytelling and preservation. As one said: “The stories are right there, we just need to dig them out.” —YP8, F. More importantly, the project made them aware of the urgency to listen and preserve older adults’ stories, as they found there were some memories that older adults could not remember. The sooner they would tell their stories, the more they could remember: “When we were young, we might not be interested in stories of parents. But later, when we would like to ask them, they may already be passed away, and we will not be able to ask anything longer. I will keep all these memories well and will learn much more.” —YP3, F.

Some children frankly mentioned that not all the stories aroused their interests. They had different reactions to different themes. Some were appealing to them, while some seemed dull and uninteresting for them, so they choose to fast forward, or even skip these recordings. Also, the large number of recordings increases the pressure for organizing the files, and made it hard for subsequent retrieval.

Even so, their attitudes towards preserving were conservative, and they preferred to keep them all. The motivation was to preserve for the future, and for the next generation.

**The young generation's preferences for story topics.** Their preference for story topics varied. Some were interested in stories related to the war: *"I learned WWII from the book, but I want to know some real stories."* —YP2, M. Some were interested in their family members: *"I never saw my grandfather, because when I was born, he had passed away. I am interested in stories about him."* —YP5, F. Some were interested in the lifestyle of the past, as it was different from today, and some others were interested in the things before they could remember.

**Comments for improvements.** Some suggested that a smartphone application could be designed for them, together with the prototype, making it complete and easier to use.

Summary

For the older adults, most of them provided positive feedback, and they especially appreciated the voice-based story preservation. Two unexpected findings include that they recognized the flash disk as a tangible carrier to preserve their memories, and that some senior participants found *Slots-Story* a tool to vent their negative emotions. Older adults' comments for improvements mainly focused on the usability aspects. For their children, the opinions can be summarized as follows. Learning new things from older adults, developing intergenerational conversations when using face-to-face, feeling familiarity and emotion in the recordings, and being able to ask some awkward questions. Not all the stories aroused the interests of their children, and their preferences for story topics varied.

4.5 Analysis of stories

To understand the older adults' preferences for story topics; their storytelling patterns; the differences between the independent and face-to-face uses, in this section, stories collected with *Slots-Story* in the field study will be analyzed. The story analysis was conducted from three dimensions: thematic analysis, structural analysis, and interactional analysis. The focus and features of these three analysis dimensions are as follows:

- The thematic analysis emphasizes the content, reflecting on older adults'

preferences for story topics

- The structural analysis focuses on the way stories are told, and it helps to understand the narrative patterns of older adults' storytelling
- The interactional analysis emphasizes on the dialogic process between teller and listener, and it is necessary because I aim to adopt the story to bridge two generations.

Based on the findings from the thematic analysis, we can understand the narrative patterns of older adults' stories. Based on the findings from structural analysis, we can understand older adults' preferences for story topics. Therefore, these two dimension analysis contribute to answering the first research question in this thesis (RQ1): *What are the characteristics of older adults' storytelling?* Based on the findings from structural analysis, we can understand the dialogic process between tellers (older adults) and listeners (the young). It contributes to answering the third research question in this thesis (RQ3): *In which ways could interactive technology involve older adults' children for intergenerational storytelling?*

These findings generated from story analysis can provide design considerations when other researchers designing similar systems, especially with regard to the usability aspects. In the meanwhile, the analysis of stories can provide insights on choosing appropriate methods of analyzing stories, and provide an example of a detailed story analyzing process.

4.5.1 Thematic analysis

Thematic analysis is a method for identifying, analyzing, and reporting themes within data, and it minimally organizes the data set in (rich) detail (Braun and Clarke 2006). During the thematic analysis, by calculating the proportions of story themes, I could have a better understanding of older adults' preferences for story topics.

Method

Some responses to the trigger questions, such as: *"I don't remember"*, *"I don't want to talk about it"*, *"I don't know"* and *"Yes, I think I make friends easily"*, were first eliminated: A total of 344 valid stories were collected. Table 44 shows the number of stories told by each participant. The stories were translated from Dutch to English by native student assistants, then were transcribed, following Robert

Miller’s transcription guideline (R. L. Miller 1999). I first read through all the stories once to familiarize myself with the content. Following Alex Sanderson and Ann McKeough’s study (Sanderson and McKeough 2005), story audio is divided into sub-stories and marked by the type of theme they represent. To qualify as a sub-story, the described event had to be allotted a significant amount of elaboration in regard to the cause and process of the experience (Sanderson and McKeough 2005). After tabulation of the sub-story events, the themes of the stories were defined, and were labeled according to themes. I provide an example analysis process in Table 4-6.

Table 4-5 The number of stories told by each participant

Group	P1	P2	P3	P4	P5	P6	P7	P8
Number of stories	45	36	44	52	37	55	39	36

Table 4-6 Example of thematic analysis

Transcription	Theme	Label
<i>The first question is ‘were you ever told anything unusual about your birth.’ When I see this question, um.....Naturally, I am reminded of when I was little, and my mother told me: “My girl, you will be a lucky girl. “I said: “I certainly hope so, but why do you say so?” and she said: “It is because you were born in autumn, and we had a harvest that year. At that time, thousands of people died of famine. We didn’t know where our next meal came. But when you were born, we had an autumn harvest. So I believe you will be a lucky girl.”</i>	Her mother believed she was a lucky girl as when she was born in the autumn harvest	Birth

Overview of the story themes

The histogram in Figure 4-15 presents the frequency of story themes they talked about. In Figure 4-15, the y-axis specifies the number of stories. All the themes are generalized into the following themes, the percentage from high to low they were: **Childhood** (funny thing, historical event, impressive thing, lifestyle, dream, horrible thing), **Family** (family member, parents teaching, impressive thing, family story), **Perception** (feeling, insight, self-evaluation, world-view, belief, regret), **School** (proud thing, bad thing, impressive thing, club, funny thing, teacher, regret), **Work** (job, colleague, impressive thing, proud thing, promotion, danger), **Marriage**, **Friends**, **Hobby**, **Retirement**, **Birth**, **Skill instruction**, **Memento**, **Fairy tale**, and **Other**. The stories collected in the study could be roughly divided into description and perception. The former is mainly concerning the description

of an event, objects, or people. The latter is mainly concerning feeling, self-evaluation, life insight, et cetera.

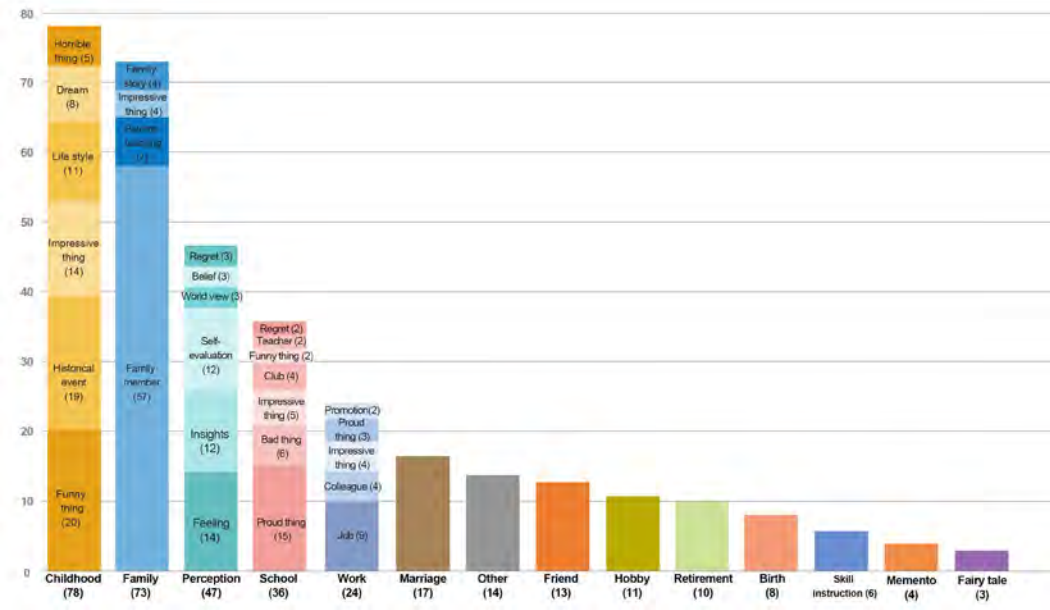


Figure 4-15 Story themes

For clarity, I present this section in the form of “proportion of the story theme”(quantitative data) + “reason behind it”(related interview data). 22.7% of the themes were about **Childhood**, among which “funny thing” and “historical event” were the most frequent sub-themes. This was in line with the interview: they would like to talk about happy and positive things, especially in their childhood. The reason could be explained by the quotes from the senior interviewees: “Recalling the past makes me feel go back to the past.” “Telling happy things itself is a happy thing, and it also brings happiness to others.” The next most talked sub-theme was “impressive thing”, which was some impressive stories related to childhood. Next was related to “lifestyle”, and the reason was that they often felt that great changes had happened; Life now was different from the old-time, and they missed the old days. Next sub-themes were “dream” and “horrible thing”.

21.2% were related to **Family**, among which the most frequent sub-theme was about “family member”, and followed by “parent’s teaching”, which were beliefs and ideals that parents taught them. Finally, they were “impressive thing” and “family story”. Both the quantitative data and our interview indicated that the



older adults focus more on the people they were familiar with, such as their parents, children, and friends. This was in line with Carstensen et al.'s study, pointing older adults' social and emotional goals towards strengthening existing emotionally fulfilling relationships rather than pursuing novel social partners (Carstensen, Fung, and Charles 2003).

13.7% were about **Perception**, which mainly includes feeling, self-evaluation, life insight, et cetera.

Next was **School** (10.5%), among which “proud thing” was the most, which was also in line with the interview: they would like to tell stories they were proud of. One reason seems to be that they could not do some things they could do before: “*I like to recall the past, when I was young and strong. I am old now.*”

It is followed by **Work** (7.0%), including the description of their jobs and their colleague. Others were some memorable events: “promotion”, “dangerous thing”, “proud thing”.

It is followed by **Marriage**, which is major life event.

The theme of **Other** varied and was hard to be classified into a certain theme. They were mainly about memorable stories, such as important life decision, mysterious thing, dangerous thing. One thing to note was the **Skill instruction**, which was interspersed in their narratives — for instance, making hand-made shoes, chess skills, and skills of writing articles. They were an intangible treasure worth preserving. Additionally, in the theme of **Memento**, referring to photographs, mementos, and artifacts, they were important clues to help older adults to recall. These memory cues need to be explored in the next iteration.

*The detailed story themes*

Table 46 describes the themes, including the number and percentage of the stories in each theme. To keep the table compact, I did not arrange the themes from high to low.

Table 4-7 Themes, the absolute number, and the same number in percentages of the total number

<b>Birth 8 (2.3%)</b> <ul style="list-style-type: none"><li>-Seriously ill</li><li>-Famine</li><li>-Born after a lantern show</li><li>-Origin of infant name(2)</li><li>-Mother said she would be a lucky girl</li><li>-Her mother was biking, and she was born later</li><li>-She was born after the war</li></ul>	<b>Memento 4(1.2%)</b> <ul style="list-style-type: none"><li>-Firearm, broadsword, painting of an eagle</li><li>-A blue skirt sister made for her</li><li>-Gifts she received during a special moment</li><li>-The gift was elected with care</li></ul>	<b>Hobby 11 (3.2%)</b> <ul style="list-style-type: none"><li>-Calligraphy, play the dulcimer, reading books, chess, and making kites</li><li>-Making dolls</li><li>-Did handwork</li><li>-Closing eyes to recall past</li><li>-Chess</li><li>-Liked to reminisce in leisure time reading books and singing</li><li>-Fishing</li><li>-Play outside and play sports</li><li>-Tinkering, build radios, and handwork</li><li>-Singing (2)</li></ul>	<b>Skill instruction 6 (1.74%)</b> <ul style="list-style-type: none"><li>-A short instruction of making shoes</li><li>-Chess skills</li><li>-Experiences in writing articles</li><li>-Basic introduction to fishing</li><li>-Then-popular song</li><li>-Traditional marriage customs</li></ul>
<b>Childhood 78 (22.7%)</b>			
<b>Horrible things (5)</b> <ul style="list-style-type: none"><li>-Saw dead bodies</li><li>-Mad dog</li><li>-Almost dead due to illness</li><li>-Fast in learning to talk</li><li>-Saw neighbor died in an ice skating</li><li>-Fell from a scooter and broke the leg</li></ul> <b>Dream (8)</b> <ul style="list-style-type: none"><li>-Teacher or doctor</li><li>-Worker</li><li>-Ate well and slept well</li><li>-Singer</li><li>-Train conductor</li><li>-Shunter</li><li>-Became a physical therapist</li><li>-Piano and calligraphy</li></ul> <b>Funny things (20)</b> <ul style="list-style-type: none"><li>-Could not find shoes</li><li>-Sister made shoes for her</li><li>-mother spanked her by mistake</li><li>-Stole meat to eat</li><li>-Sung at night</li><li>-Childhood games he played</li><li>-Went to open-market by bullock cart</li><li>-Felt free to play games</li></ul>	<b>Impressive things (14)</b> <ul style="list-style-type: none"><li>-Mother read stories for her</li><li>-Forced mother to pay the tuition fee</li><li>-The home was stolen without a trace</li><li>-His father building houses</li><li>-Mother often sang for her</li><li>-Grandparents took him to attend a meeting</li><li>-Mother was away home for a long time, and he missed her</li><li>-Neighbors said she was beautiful</li><li>-How his little house was furnished</li><li>-How she went to school</li><li>-Made a decision to repay her parents</li><li>-Had Piano lessons on holidays</li><li>-Brother sang songs, and she was proud of him</li><li>-Kites in the open market</li></ul> <b>Historical events (19)</b> <ul style="list-style-type: none"><li>-Experienced a political event (2)</li><li>-Her experience of the Beatles period</li><li>-Father hid from the Germany army in WWII</li><li>-Mother was ill in the war</li><li>-Something related to the war of him</li><li>-Her mother gathered lots of stuff from the Korea war</li><li>-Mother got sick after WWII</li><li>-The neighbor died in bombings</li><li>-Mother was distracted due to war</li><li>-Hid in a cave from invaders</li><li>-WWII, the invaders dropped bombs</li><li>-Neighbors were killed by invaders - Invader gave candy to me</li><li>-Invaders robbed her home</li><li>-The yard was bombed, and his father took him to hide.</li><li>-Some people were killed by the invaders</li><li>-Hid in a tunnel and could hear the explosion of shells.</li><li>-Radio handed into German</li></ul>		
<b>School 36 (10.5%)</b>			
<b>Proud (15)</b> <ul style="list-style-type: none"><li>-Was selected as leading singer</li><li>-Attended volleyball match</li><li>-Rank first in a race match</li><li>-Became student leader</li><li>-Became student representative</li><li>-Made public speech (2)</li><li>-Famous in school because singing well</li><li>-Teacher praised her for singing well</li><li>-Teacher often praised her for calligraphy</li><li>-First place in exams</li><li>-Work hard and did well in the study</li><li>-Was awarded an excellent student</li><li>-Won in skating match</li><li>-Good at reciting poems, writing articles</li></ul> <b>Bad (6)</b> <ul style="list-style-type: none"><li>-The first show was a failure</li><li>-Classmates bullied her</li><li>-Was forced to stay in her grade, felt ashamed</li></ul>	<b>Work 24 (7.0%)</b> <div><b>Job (9)</b><ul style="list-style-type: none"><li>-Normal textile worker</li><li>-The part-time job of making shoes</li><li>-The first job was a construction worker</li><li>-Parents did not agree with him to do business</li><li>-Work was interesting</li><li>-Farmer life</li><li>-Worked in a local church</li><li>-Working in an automobile factory</li><li>-Part-time job of growing peanuts</li></ul><b>Colleagues (4)</b><ul style="list-style-type: none"><li>-Introduction of colleagues (2)</li><li>-A colleague and they often complemented each other</li><li>-Colleagues were not fine</li></ul></div> <div><b>Promotion (2)</b><ul style="list-style-type: none"><li>-Excellent performance and became leader</li><li>-worked for the government</li></ul><b>Impressive (4)</b><ul style="list-style-type: none"><li>-Slept in the bottom of a ship for two nights</li><li>-Did not eat for three days due to seasickness</li><li>-Happy when earned money</li><li>-Fighting for justice when she worked</li></ul><b>Dangerous (2)</b><ul style="list-style-type: none"><li>-Almost died in a storm</li><li>-Dangerous things he encountered</li></ul><b>Proud (3)</b><ul style="list-style-type: none"><li>-Earned a reputation for high-efficiency</li><li>-Was awarded because of excellent performance</li><li>-His contribution to the village</li></ul></div>		
<b>Regret (2)</b> <ul style="list-style-type: none"><li>-Did not study hard (2)</li></ul> <b>Clubs (4)</b> <ul style="list-style-type: none"><li>-Sculpting and sports clubs</li><li>-Club of sculpting and a short period of football</li><li>-Volleyball team</li><li>-Chorus</li></ul> <b>Impressive things (5)</b> <ul style="list-style-type: none"><li>-Cooked for a soldier</li><li>-Mow grass of playground</li><li>-Wrote letters to a singer and received a reply</li><li>-The first word he learned from school</li><li>-Friends always went to school together with him</li></ul> <b>Funny (2)</b> <ul style="list-style-type: none"><li>-Hides a shoe of a classmate</li><li>-Played jokes with classmates</li></ul> <b>Teacher (2)</b> <ul style="list-style-type: none"><li>-A teacher who was nice to him</li><li>-Got along well with teachers</li></ul>			



<b>Other 14 (4.1%)</b> <ul style="list-style-type: none"><li>-A mysterious thing he encountered</li><li>-He and friends carried their grandchildren to walk across the railway</li><li>-Became a member of a political party</li><li>-Followed a soldier to go through a mine-filled zone</li><li>-Went to daughter's school for her</li><li>-A thief was beaten in his journey</li></ul>	<ul style="list-style-type: none"><li>-Saving a baby in a traffic accident</li><li>-First leaving home</li><li>-Went to my daughter's company when she was bullied</li><li>-Help and taught her neighbors a lot</li><li>-Sympathized with the beggar</li><li>-Helped a poor old man on the train</li><li>-Hope to have a biography and make others understand her</li><li>-Mother was happy because after two boys, came a girl</li></ul>	<b>Fairy tale 3 (0.87%)</b> <ul style="list-style-type: none"><li>-Story of Peter and Jesus</li><li>-A fairy tale of hometown mountain</li><li>-Story of stealing techniques of making bulb from Japan</li></ul>	
<b>Family 73 (21.2%)</b> <b>Family members (57)</b> <ul style="list-style-type: none"><li>-Family member introduction (3)</li><li>-Family member relationships were not well</li><li>-Sister dropped off school (2)</li><li>-Characteristic of parents (8)</li><li>-Mother punished sister</li><li>-Characteristic of grandparents (3)</li><li>-Characteristic of mother-in-law</li><li>-Hobby of brother</li><li>-Introduction of sister and brother</li><li>-Jobs of parents (4)</li><li>-Jobs of grandparents (3)</li><li>-Grandmother was suddenly missing</li><li>-Aunt (2)</li><li>-Sister-in-law</li><li>-Daughter-in-law</li><li>-Daughter (2)</li><li>-Uncle</li><li>-Birth of her daughter brought her much happiness</li><li>-Parents quarreled frequently</li><li>-Relationship with grandparents</li></ul>	<ul style="list-style-type: none"><li>-Father helped with her homework</li><li>-Mother always prepared a birthday party for her</li><li>-Illness of mother</li><li>-Stay with parents often as school not far from home</li><li>-Parents spend little time with him</li><li>-Father recovered from illness naturally</li><li>-Father became Christian</li><li>-Generation gap with grandparents</li><li>-Father took care of grandmother when she was ill</li><li>-Grandfather was finally paralyzed</li><li>-Older sister frightened to her</li><li>-Death of father</li><li>-Son was excellent and was proud of him</li><li>-Crucial choices of her son</li><li>-Son was weak and thin due to malnutrition</li><li>-Old sister did not treat her well</li><li>-They went to traveling when on the holidays</li></ul>	<b>Parents' teachings (7)</b> <ul style="list-style-type: none"><li>-Honesty, self-reliance</li><li>-To marry out to the countryside</li><li>-Honesty, righteous, and loyal man</li><li>-To be righteous and helpful</li><li>-Parents did not teach him too much</li><li>-Honesty and be fair to others</li><li>-Honesty and never give up</li></ul> <b>Impressive (4)</b> <ul style="list-style-type: none"><li>-Mother loved her and showed favoritism to her</li><li>-Mother often sang for her</li><li>-Mother often taught her past things and life points</li><li>-Mother read stories for her</li></ul> <b>Family story (4)</b> <ul style="list-style-type: none"><li>-Her mother met robbery</li><li>-Grandfather hid money in pork</li><li>-Great grandfather was locally famous</li><li>-grandfather bought cattle</li><li>-A rich man gave his great grandfather three presents when he retired</li></ul>	<b>Retirement 10 (2.9%)</b> <ul style="list-style-type: none"><li>-Did poultry farming after retired</li><li>-More people went to church and felt happy</li><li>-Did some odd work after retired</li><li>-Hope to make contributions to society</li><li>-Took care of children</li><li>-Often recalled the nice working time</li><li>-Felt hard to get involved in working people</li><li>-Felt free and do whatever he wants</li><li>-Had no sense of belonging</li><li>-Feel free but physical condition declined</li></ul>
<b>Perception 47 (13.7%)</b> <b>Insights (12)</b> <ul style="list-style-type: none"><li>-Did not make many life choices, and her life went on naturally</li><li>-Importance of friends</li><li>-Mother's instruction influenced her deeply</li><li>-Character determined destiny</li><li>-Family needs sacrifice</li><li>-Thanks to parents and she had a great childhood</li><li>-Confirmed belief after believed in God</li><li>-Felt God really loved her</li><li>-Her old sister that hurt her the most</li><li>-Children's education</li><li>-Experiences of choosing a husband</li><li>-Life crucial decisions were profession and marriage</li></ul> <b>Self-evaluation (12)</b> <ul style="list-style-type: none"><li>-Naughty when little</li><li>-She was emulative</li><li>-She was an emotional person</li><li>-Likes making friends, and reasons</li><li>-She was too pure and childish</li><li>-Always ready to help others</li><li>-His characteristic was fond of adventure</li><li>-People she met were good-tempered</li><li>-Unwilling to flatter others, I am upright</li><li>-His life contributed to the community was sharing knowledge</li><li>-Her life contributed to the community was the birth of her kids</li></ul>	<ul style="list-style-type: none"><li>-Saving a baby in a traffic accident was the greatest accomplishment</li><li>-Greatest accomplishment was educating his children</li></ul> <b>Feelings (14)</b> <ul style="list-style-type: none"><li>-Childhood was interesting and happy, they want to go back (6)</li><li>-Childhood really worth recalling</li><li>-Poultry farming was hard with increasing age</li><li>-Feels happy when recalling childhood</li><li>-Misses friends from school</li><li>-Her life was rough and difficult (2)</li><li>-Society changed, now is different from the old ages</li><li>-It is more free and open than before</li></ul> <b>World view (3)</b> <ul style="list-style-type: none"><li>-One should be righteous to others, and treasure everyone</li><li>-Everyone is different, and we could learn from each other</li><li>-His life motto</li></ul> <b>Belief (3)</b> <ul style="list-style-type: none"><li>-Experiences and stories after believing in God</li><li>-The metaphor of eagles to illustrate the love of God</li><li>-God love her although life was hard</li></ul> <b>Regret (3)</b> <ul style="list-style-type: none"><li>-Did not study hard (2)</li><li>-Mother died early</li></ul>	<b>Marriage 17 (4.9%)</b> <ul style="list-style-type: none"><li>-Characteristic of husband</li><li>-Job of husband</li><li>-Death of husband (2)</li><li>-How he met his wife</li><li>-Had no dream after getting married</li><li>-How she met her husband (3)</li><li>-Mother-in-law and husband treat her badly</li><li>-Quarreled frequently with husband</li><li>-Husband had a brain tumor</li><li>-Husband went to jail</li><li>-His first kiss</li><li>-Time after her husband passed away was painful</li><li>-Pray to God to decide whether to marry again</li><li>-Husband bought nothing for her in festivals</li></ul>	<b>Friends 13 (3.8%)</b> <ul style="list-style-type: none"><li>-Close friends (5)</li><li>-Close friends drifted apart</li><li>-Characteristic of close friends (2)</li><li>-Friends made in late life</li><li>-Friends made during holidays</li><li>-Loss of friends</li><li>-Made several good friends in school</li><li>-Friends alienated gradually</li></ul>

Story themes were not limited to the trigger questions

The results showed that story themes told by older adults were not limited to the trigger questions provided by the young, nor did they follow the trigger questions strictly and record dutifully corresponding stories. The reasons were twofold. Firstly, some participants got used to using the prototype to tell stories gradually, and when a story suddenly came to their mind, they would like to use the prototype to record. For example, one audio starts with “*I suddenly come up with an interesting thing, maybe it is not relevant .....*” Secondly, they had more and new insights into their lives after telling their life stories. When they tell stories, it is from a broader perspective, and they are able to place their childhood experiences in a larger context of senior experiences (Etherington 2009). A life review is an overview of somebody’s existence in retrospect. Older adults could relabel and re-evaluate their earlier life from a wider perspective.

Supplemental trigger questions

The above findings indicated that trigger questions provided by my prototype were not taken as the themes of stories, but acted as starting points for telling stories. Also, the process of recalling gave them an opportunity to review their lives, which was a critical review or a second glance on their lives. Therefore, supplemental trigger questions could be added, targeting for stories that older adults particularly want to tell, as well as new life insights and stories generated after answering the typical trigger questions. These supplemental trigger questions could be like, “*Do you have some stories you particularly would like to tell?*” “*Does the life review remind you of other interesting memories?*”

4.5.2 Structural analysis

The structure of stories is more stable than the content, while the content of stories is influenced by trigger questions (Kemper 1984). By structural analysis, I can have a better understanding of the narrative patterns of older adults’ storytelling. In particular, the structural analysis helped me to summarize three structural story types. The structural analysis in this section includes two aspects: the structural analysis of stories, and the structural relationship between the stories.

Method

Narratives are structured, having plots with both temporal and spatial features (Abbott 1997). The structural analysis supports understanding the self-told life narrative, which reveals a common formal structure across a wide variety of contents (Bruner 1988). I first analyzed the structure of the stories by applying *Labov's* model, and then I analyzed the structural relationship between the stories. According to *Labov's* model, narratives have formal properties, and each of them has a function. A “fully formed” narrative includes six common elements: **Abstract**, **Orientation**, **Complicating action**, **Resolution**, **Evaluation**, and **Coda** (Labov 1982).

I applied *Labov's* model to conduct a structural analysis for two reasons. The first reason is that *Labov's* model is applicable to “natural narrative” as its origins are situated in the everyday discourse practices of real speakers in real social contexts (Stoneley and Weinstein 2008). In my case, stories were life stories that related to the storyteller (older adults), and were told in an informal manner. In other words, they are “natural narratives” (Johnstone 2016). The second reason is that *Labov's* model is based entirely on the narrative by a single person, that is, the narrator, and it does not consider actual contributions by the audience (Johnstone 2016). In my case, most stories are personal narratives. After the *Labov's* model was applied in my transcriptions, three types emerged.

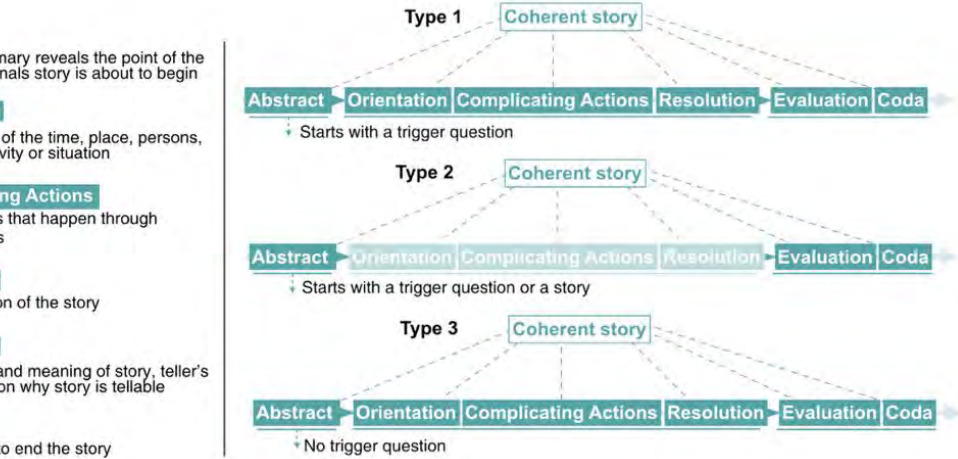


Figure 4-16 *Labov's* model of natural narrative structure (Labov 1982) (left), and the three structural types in my case (right)

Three structure types of stories in my study

**Type one: the trigger question serves as “Abstract”, and the story consists of all six elements** (Figure 4-16). This is the most common type in my study. It contains not only concrete plots but also comments and reflections. Specifically, the trigger question acts as “**Abstract**”, which is the introductory part, and a summary of the event to spark attention. The participants often read the question out loud, and in the meanwhile, they are thinking and recalling memories. For instance, most start with: “*As for my first experience of leaving home. Hmm...*” “*This question is about if there is something special about my birth, when I see this question, it naturally reminds me of when I was a teenager, my mother said: ‘You will be a lucky girl.....’*” Following are details of the story, including identification of the time, place, persons, and their activity and situation of the story, all the events that happen through the narratives, and the final action of the story, which are defined as “**Orientation**”, “**Complicating Actions**”, and “**Resolution**” in *Labov's* model. The final part is “**Evaluation**” and “**Coda**”, which are the comment for this story, or some new reflections. For instance, one story ends up with: “*Looking back now, it was the best decision I ever made.*”

**Type two: the story without “Orientation”, “Complicating Actions”, “Resolution”.** This type contains only subjective perception without a specific story plot. Therefore, it is more of an answer than a story. Trigger question also acts as “**Abstract**”, and this type is normally evoked by abstract trigger questions, such as “*How would you describe your world view?*” Another situation was emerging at the end of a story, for example, After telling a story of his childhood friend, the audio then turned to tell older adults’ understanding of “friend”, including his definition of a true friend, and his principles of making friends. In my case, they include word view, insight on life, feeling, self-evaluation, and regret, et cetera.

**Type three: the story is not starting with a trigger question.** This type appears in the following situations: First, stories that they specifically would like to tell, but are not covered by the trigger questions. Second, one story might remind older adults of another related story. For example, one story is about the club she used to join, and she talked chorus, and then a funny event that happened in that club, and then a friend she met there. Finally, she said: “*I find recalling the past is interesting, a train of recollections are awakened, even those nearly forgotten.*”



The structural relationship between the stories

The trigger questions were explicitly about given topics, but stories were non-directive. That is, the trigger questions act as jumping-off points that spark broader memories, and gradually the narrative becomes non-directive and unfocused. Concerning the contents, some were lengthy and discursive, which started from the trigger questions and gradually tangent, but in most cases, the content would return to the original point. The following snippet (Table 4-8) is one example that one story was interlarded with another story.

Table 4-8 Snippets of stories told by older adults

	Transcription	Theme
Story1	<i>In 1957, my friend and I took a train to another city. At 3 PM, the train stopped, then my friend and I got off the train to stroll around and buy something to eat. When we went back to the train, almost everybody got off the train, and someone's wallet was stolen by a thief.....</i>	On the train journey with a friend, passengers caught a thief, and they beat the thief seriously
Story2	<i>.....It was dusk, and the street lamps came on. The bulb of the lamp, it was originally made in Japan, and it was crystal clear. In an international exhibition.....</i>	Techniques of making bulb from Japan
Story1	<i>.....When lamp came on, lots of the passengers surrounded the thief, but suddenly went on.....</i>	On the train journey with a friend, passengers caught a thief, and they beat the thief seriously

Insights derived from structural analysis

**Type one** and **Type two** were the most typical structural types in my study. For **Type three** — the story not starting with a trigger question. It also implies that **Supplemental questions** should be added, since trigger questions could not cover every aspect of one's life. Therefore, another type of **Supplemental questions** could be like: “Do you have stories that the trigger questions aren't covering?” While by analyzing the structural relationship between the stories, I also found that older adults' storytelling was not always done in a linear fashion.

4.5.3 Interactional analysis

In my study, I aim to use storytelling to bridge two generations: older adults and their children. Therefore, I pay special attention to their social interaction. Interactional analysis in this section emphasizes on the dialogic process between teller and listener. Additionally, storytelling itself has properties of social interaction,

and it performs social actions, and the audience is involved directly or indirectly (Schiffrin 1996). I found social interaction behaviors occurring in two cases in the field study: (1) Older adults and their children used *Slots-Story* face-to-face. (2) Their children contacted older adults after listening to the stories.

Using Slot-story face-to-face

Stories told when using Slot-story face-to-face are “small stories”. The term “small stories” is used to describe a variety of non-prototypical kinds of narrative, including tellings of ongoing, future, hypothetical, or already-shared events (Georgakopoulou 2007). Table 48 is an example snippet of using the prototype face-to-face, which recordings collected included conversations between an older adult and her grandson. In this case, the stories served the conversations. Trigger questions were the starting point of the conversations. The conversations were easy to drift away from the trigger questions. Meanwhile, the young provided instant feedback, which acted as a new memory clue to trigger the storyteller telling new stories. Therefore, more topics were opened. Most of the stories were short, and the storytelling gradually turned more into a conversation. Stories are less performances of the storyteller and more aimed at creating shared expectations (Georgakopoulou 2007). In my case, I found the listeners influenced the storyteller in several ways: by evaluations, by changing trigger questions, and even by acting as co-tellers, where teller and listener created the stories collaboratively.

Table 4-9 Snippets of conversation transcription (C= Older adults' children, O=Older adults)

C	<i>This question is what was going on in your family, your community, and the world at the time of your birth?</i>
O	<i>There were my parents and grandfather. Umm.....When I was five, my grandfather took me to an open market, and he bought me lots of toys. My grandfather liked me very much.....</i>
C	<i>So what's your life like at that time?</i>
O	<i>We didn't own a house. We just rented.</i>
C	<i>Why? Was it because being in a war?</i>
O	<i>Yes, it was in WWII.</i>

Using Slots-Story separately

Unlike conversations that the listener could communicate with the storyteller instantly, the storytelling and story listening were asynchronous when the *Slots-Story* was used using separately. The young contacted their parents after listening to the recordings. Reasons are concluded as: the young wanted to know more detail

of some stories; the young expressed their viewpoints on older adults' stories; the young expressed emotions of love, appreciation, sympathy, et cetera to older adults. More intergenerational communication was observed during the field study.

*Insights on interactional analysis*

The interactional analysis revealed the differences in using the prototype face-to-face and separately by older adults and their children. When used face-to-face, the prototype acts as a “conversation topic generator”, and the storytelling serves for conversations- the audio recordings were mixed with the stories from multiple people, and these stories were not complete but fragmented. When used separately, older adults could take their time to reminisce and concentrate on telling the past with deeper insights.

4.6 Discussion

This section discusses the characteristics of older adults' life story sharing and the design strategies for promoting older adults' storytelling with their children. The former reveals the current situation and problems the older adults encountered when sharing stories. The latter proposes corresponding design considerations derived from the implementation and evaluation of *Slots-Story*.

4.6.1 Characteristics of older adults' life story sharing

Although their children visited them regularly (from once a week to once a month), the duration of every visit was limited. Compared with the young generation that tended to share the present, the older adults preferred more to recall and share the past. The older adults would like to tell stories to their children, because the older adults hoped they could be remembered, and they had the responsibility of passing on family stories. However, their children seemed to lack awareness of listening and preserving older adults' stories. They did not share life stories specifically and deliberately in their daily lives, and life story sharing was fragmented. In addition, older adults had the concern that their stories were unappealing to others. The gap between the generations regarding life story sharing offers an opportunity for *Slots-Story* to be bridged.

4.6.2 Design strategies for promoting older adults' storytelling with their children

**The process of story sharing.** Memory cues take various forms, and in my case, trigger questions are adopted. Storytellers are exporters of stories, and listeners are receivers of the stories. Stories can be told in various forms(text, drawing, audio, video), and in my case, audio is adopted. I see story sharing is not a solitary but a collaboration process- the listeners provide not only feedback on the stories but also the memory triggers. The listeners' role is highlighted in my study, and the story could even be viewed as a product of two minds instead of one (Figure 4-17).

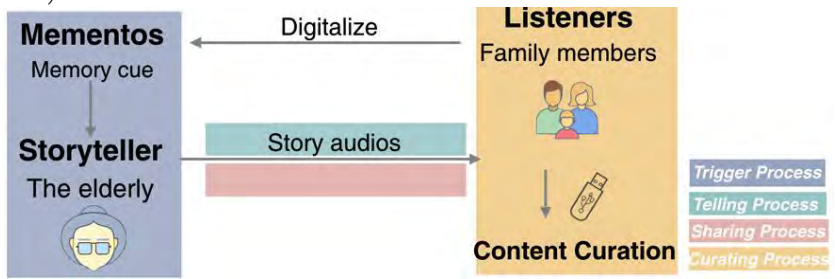


Figure 4-17 The process of story sharing in my study

For clarity, I break the intergenerational story sharing into four steps (Figure 4-17): (1) Triggering Process (the process of older adults' recalling), (2) Telling Process (older adults' storytelling), (3) Sharing Process (story sharing), and (4) Curating Process (the curation of digital stories).

*Design for older adults' reminiscence (Triggering Process)*

**Integrating memory triggers into their lives through a tangible device.** The interviews indicated that one major problem of their life story sharing was the apparent lack of topics, and memory triggers are so indispensable that they are one of the keys to success in terms of facilitating and supporting remembering (van den Hoven and Eggen 2014). A memory trigger is “a circumstance or piece of information which aids the memory in retrieving details not recalled spontaneously” (Stevenson 2010). Despite the numerous studies focusing on why and how memory triggers evoke people's reminiscence, I investigate how to integrate them into older adults' daily lives. In my case, I adopt trigger questions as memory cues. Compared to other types of memory cues, questions are more explicit and straightforward, and targeted answers will be triggered (Atkinson 1998). As men-

tioned, older adults and their children's daily schedules were antisymmetric, and their children's visiting time was limited (usually 2-4 hours). Therefore, I hoped older adults could tell life stories independently in their daily lives. Specifically, a tangible device with a simple operation was designed, which was accepted by older adults in the field study. From the perspective of design, *Slots-Story* is an interactive device with a sort of tangible interface. The classic appearance blends it into the environments of the older adults, which would encourage and attract them to use. In this sense, *Slots-Story* serves as a tangible reminder, embedded in their everyday landscape.

**Facilitate revisiting the trigger questions by randomization.** Although existing research points out that physical object is more embedded in the everyday landscape and may trigger memories by merely being seen (Golsteijn, van den Hoven, et al. 2012), simple physicality is not enough. In the field study, I found a noticeable novel effect during the use of the prototype. The trigger questions for displaying should be dynamic to attract older adults' attention and encourage them to use it. The questions could be displayed randomly like a slideshow, acting as spontaneous memory cues, to achieve long-term and sustained use.

**Implications for designing trigger questions.** Based on the above analysis, I suggest that trigger questions should contain four types: (1) **Routine questions**, (2) **Supplemental questions**, (3) **Personalized questions**, (4) **Optional questions**.

**Routine questions** cover most aspects of life themes (Atkinson 1998). Answering these questions contributes to an overview of their life course by recalling their experiences and events memorable. This overview of their life span offers two advantages: Firstly, as stated, the recalling allows older adults to review their lives, and new life insights will be generated. Through integrating past experiences with some view of the future in mind, the life story narratives help older adults acquire a new sense of personal authorship and life reflections in their life journey (Mayo 2001). Secondly, stories that irrelevant to trigger questions will also be recalled, as discussed in the thematic analysis.

**Supplemental questions** target for stories that older adults particularly want to tell, such as new life insights or stories generated after answering routine questions. I found that older adults told some stories that were irrelevant to the trigger questions. These story themes were personal and individual, which were not eas-

ily covered by the trigger questions, and were hard to be classified into a certain theme. Therefore, Supplemental questions are necessary to prompt them to tell stories they want to initiate, which could be like: "*Do you have some stories you particularly would like to tell?*" "*Do you have stories that the trigger questions don't cover?*" Secondly, after a life review process by answering the **Routine questions**, older adults will acquire a new sense of personal authorship and life reflections in life journey. Supplemental questions could be like: "*What's your new insights on life after a review of your life?*" Alternatively, "*Does the life review remind you of other interesting memories?*"

**Personalized questions** are raised by their children, and it is a way to involve the young generation. I found topics that the young were interested in varied, and not all the questions could fit every individual person. The diversity of uses requires personalization of the trigger questions.

**Optional questions:** Topics could be as comprehensive as possible, and negative topics could be optional. Although negative topics would bring negative memories to them, the interviews turned out that *Slots-Story* could help older people vent their bad memories to some extent. Therefore it might be better to tell them out than to bury them deep at the bottom of their memories. Of course, this did not apply to everyone, and the older adults should not be encouraged or forced to recall negative memories. Therefore, negative questions could be optional.

### *Design for older adults' life storytelling (Telling Process)*

Making the memory triggers materially present in older adults' home only supports their reminiscence. To facilitate older adults' storytelling, the following considerations of lowering the threshold of storytelling are derived.

**Improving the immediacy through integrated audio recording.** Similar to the situations of young generations' storytelling, which is hampered by the lack of immediacy (switch the computer on, navigate the files, and start pc application) (Golsteijn and van den Hoven 2013). According to my interview, although some older adults had the desire to write their stories, the load of writing hindered that. Given that they felt difficult in writing as they age, direct speaking is easier than handwriting. Moreover, the strategy of "integrated capture" was actually adopted in my prototype, where interaction with objects that are a natural part of the activity initiates capture of that moment (Jones, Merritt, and Ackerman 2017). To be specific, the stories told by older adults are recorded by a simple press



operation, offering a “seamless connection” between viewing trigger questions and storytelling. The behavior of recording audio is also less likely to intrude and disrupt the moment than other forms of capture.

**Adopting audio as the medium could reach the balance between retaining information and leaving room for imagination.** In my context, audio is considered to be a better carrier of storytelling than other forms such as text and video. Reasons are twofold. First, compared to text, audio contains explicit emotions, personalities, and feelings, conveying more information than text alone. The audio could evoke a deeper reminiscence and emotional response, since the sound draws the listener more into the recorded moment (Jones, Merritt, and Ackerman 2017). Second, audio shows advantages over the video. The video contains a higher density of information, requiring the viewer to do less interpretive work to understand (D. Frohlich and Fennell 2007). However, video is too real to allow room for thinking and talking about the past with others (Chalfen 1987). Other studies have reported that sounds are ideal materials to enrich digital photography (Dib, Petrelli, and Whittaker 2010). In my study, the ambient sound was further emphasized by the young participants. The ambient sound enabled the young to imagine the context of the storyteller’s storytelling by rendering the atmosphere and enhancing familiarity.

**Enabling accessibility and visibility through tangibility: including tangible interface, metaphor, and printed manual.** Although other studies have reported the physicality of the tangible interface conveys advantages over conventional graphical interfaces in terms of its support for real-world skills (Esteves and Oakley 2010), affordances, learning, and memorization (Klemmer, Hartmann, and Takayama 2006) and for collaborative activity (Ishii 2008). My work expands further the advantages of tangibility for senior users, which can be explained from three aspects.

First, the prototype can be positioned on a desk, occupying space, and act as an external physical reminder, adding to older adults’ daily landscape. The tangibility could produce deeper engagement than digital materials. Additionally, one unexpected finding in my field study was that older adults appreciated the flash disk as a tangible carrier to preserve their memories. Its physicality was better in accordance with their cognition of the concept of storing as they were familiar with tapes and DVDs. The tangibility seemingly brought them a sense of familiarity and “sureness”. Second, interaction is strongly associated with the content struc-

ture. Questions in *Slots-Story* are based on the metaphor of a slot-machine, which enables the question navigation to be more intuitive and natural: older adults are able to explicitly browse a question by pulling up and down the handle. Third, I found in the pre-study interview that older adults in nursing homes relied heavily on paper and preferred physical interaction, supporting the use of a paper manual (Figure 4-18). The instructions in paper manuals are static, which are easier for the senior users, as it matches their learning style. Research indicates that older adults have a stronger preference for using the device’s instruction manual over trial-and-error because it matches their learning style (Leung et al. 2012).

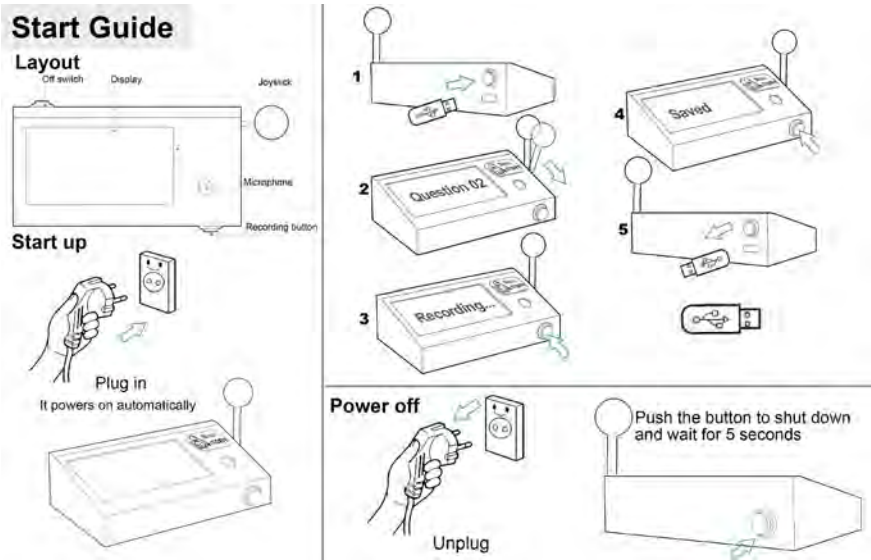


Figure 4-18 The printed manual for use

*Design for older adults’ life story sharing (Sharing Process)*

**Optimizing the process of the young providing feedback to older adults.** Feedback from the young could effectively encourage the storytellers to tell more, and also the feedback may act as a new memory cue. In the current situation, the use of flash disk brought inconvenience to the young participants. Efforts should be made to turn them into active participants. This could be achieved by optimizing the process of the young providing feedback to the senior, after

listening to the stories. As suggested by the young participants in the interview, a smartphone application could be designed for them, together with the prototype, as a complete system.

**The sustainability of story sharing.** Life stories range and increase across time. Regularly one older adult's life stories cover the events of his/her life course up to the present. Unless the storyteller is very old and sees himself/herself at the end of their life, any biographical account, as well as the life it purports to represent, will be presented as incomplete (Leung et al. 2012). Thus, the same trigger questions could be asked again when they grow older, and different stories and feelings will be generated. In addition, stories have new meanings at different times (Flint 2009). According to the senior participants, some mentioned they even would like to listen to their own stories in the future.

*Digital collections are raw materials for digital storytelling (Curating Process)*

The accumulation and proliferation of digital content inevitably bring overwhelming experiences, putting pressure on organizing and managing the digital collections. Although in my field study, most young participants stated they would make good use of the digital content and treasure them, currently they are in a state of being overloaded due to a lack of curation of digital content, which has a negative effect on long-term retrieval of digital content such as photographs (Bennett et al. 2015). To better make use of the digital content, the digital collections in my study can be used as raw materials for digital storytelling. Digital storytelling is the process of creating a narrative, driven by a central storyteller and supporting that narrative with a combination of text, still photographs, audio, graphics, and animations (Fields and Díaz 2008). Methods of storytelling collection are typically realized through interviews, and visual images and interview data to produce multimodal outputs (D. Davis 2011). Apparently, *Slots-Story* contributes to life story acquisition since it is a story collector in a sense. The digital collections could be further developed into a multimedia album, or transcribed into text to make a biography, et cetera.

4.7 Conclusion of Slots-Story


In this chapter, I report on the implementation of *Slots-Story*, a tangible device facilitating life storytelling for older adults. Given the above discussions, I summarize the findings in Table 4-10 to conclude the characteristics of older adults'

storytelling, and design strategies for facilitating intergenerational storytelling for older adults.

Table 4-10 Findings gathered from the field study and the corresponding design strategies

	Characteristics of Storytelling	Design Strategies
Triggering Process	Lack of talking topics	Integrating memory triggers into their lives through a tangible device
	There was a novelty effect during their use of <i>Slots-Story</i>	Facilitate revisiting to the trigger questions through a random display
	Older adults had difficulty in writing as they aged	Improving the immediacy through integrated audio recording
	Trigger questions should be optimized	Four types: Routine questions, Supplemental questions, Personalized questions, Optional questions
Telling Process	Most older adults in the nursing home are non-tech-savvy	Enabling accessibility and visibility through tangibility: (1) tangible interface (2) metaphor (3) paper manual
Sharing Process	Sustain the story sharing process in the long term	Optimizing the process of the young that provide feedback to older adults (e.g., designing an App)
		The sustainability of story sharing
Curating Process	Accumulation of digital content inevitably brings overwhelming experiences for the young	Digital collections are raw materials for digital storytelling

As is shown in Table 4-6, some stories were related to their family mementos, such as albums, souvenirs. Additionally, in my preliminary interviews, I found that most senior people had treasured albums and souvenirs. Broadly speaking, anything related to a person could be regarded as a memory cue for this person. Mementos are ideal memory triggers as they provide visual clues, which help older adults recalling events, even long-forgotten stories. This inspired me to explore their mementos and related stories in the next iteration.



## Chapter 5

# SLOTS-MEMETO: OLDER ADULTS' MEMENTO STORIES

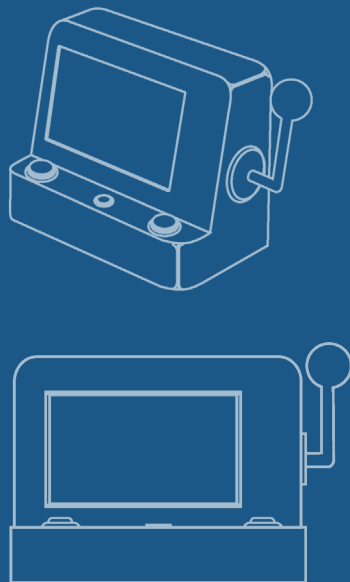
This chapter is largely based on

- Li, Cun, et al. "Supporting intergenerational memento storytelling for older adults through a tangible display: A case study." *Personal and Ubiquitous Computing* (2020): 1-25.
- Li, Cun, et al. "*Slots-Memento*: facilitating intergenerational memento storytelling and preservation for the elderly." *Proceedings of the thirteenth international conference on tangible, embedded, and embodied interaction*. 2019.



As mentioned in Chapter 4, some life stories told by the older adults were related to mementos. Mementos can act as memory triggers because they provided visual clues. Therefore, in the next iteration presented in this chapter, I focused on the older adults' memento stories. The following questions are addressed: (1) *What are the characteristics of older adults' memento storytelling?* (2) *In which ways could interactive technologies facilitate older adults to tell memento stories?* (3) *In which ways could interactive technologies involve their children?*

In particular, the prototype presented in this chapter, called *Slots-Memento*, was refined based on feedback from the interviews as presented in Chapter 4. It was used in a manner of cross-generational operation: the young took photos of older adults' mementos and copied them to *Slots-Memento*, while older adults used *Slots-Memento* to tell stories related to the mementos (Section 5.1). Section 5.2 is about the deployment of the prototype: eight pairs of participants (each pair consisted of an old adult and his/her children) participated and used *Slots-Memento* for around ten days, and interviews were conducted before and after the deployment. In total, 283 mementos were collected. Section 5.3 presents the findings of interviews, including the pre-study and post-study interviews. Section 5.4 presents the analysis of the mementos. Section 5.5 presents the analysis of the collected memento stories, which were analyzed in two dimensions: a structural and an interactional analysis. Section 5.6 is the discussion, including characteristics of intergenerational memento storytelling for older adults, and strategies of designing for older adults' intergenerational memento storytelling. Section 5.7 concludes this chapter.



## 5.1 Prototype: Slots-Memento

### 5.1.1 Prototype

The *Slots-Memento* prototype was created as a refinement of *Slots-Story*, based on feedback from the older adults. It displays the memento photos instead of trigger questions. Additionally, its appearance (Figure 5-1) was refined to highlight its decorative and vintage character, and make it an integral part of the older adults' homes. It still includes a tangible device and a flash disk, integrating functions of memento photo displaying and story recording. Its interaction and form still draw inspiration from a slots-machine. The user can pull up or down the handle to switch between memento photos and press the button to record stories. The handle operation can offer an intuitive and enjoyable experience to the non-tech-savvy user group, as was verified during the evaluation in Chapter 4.



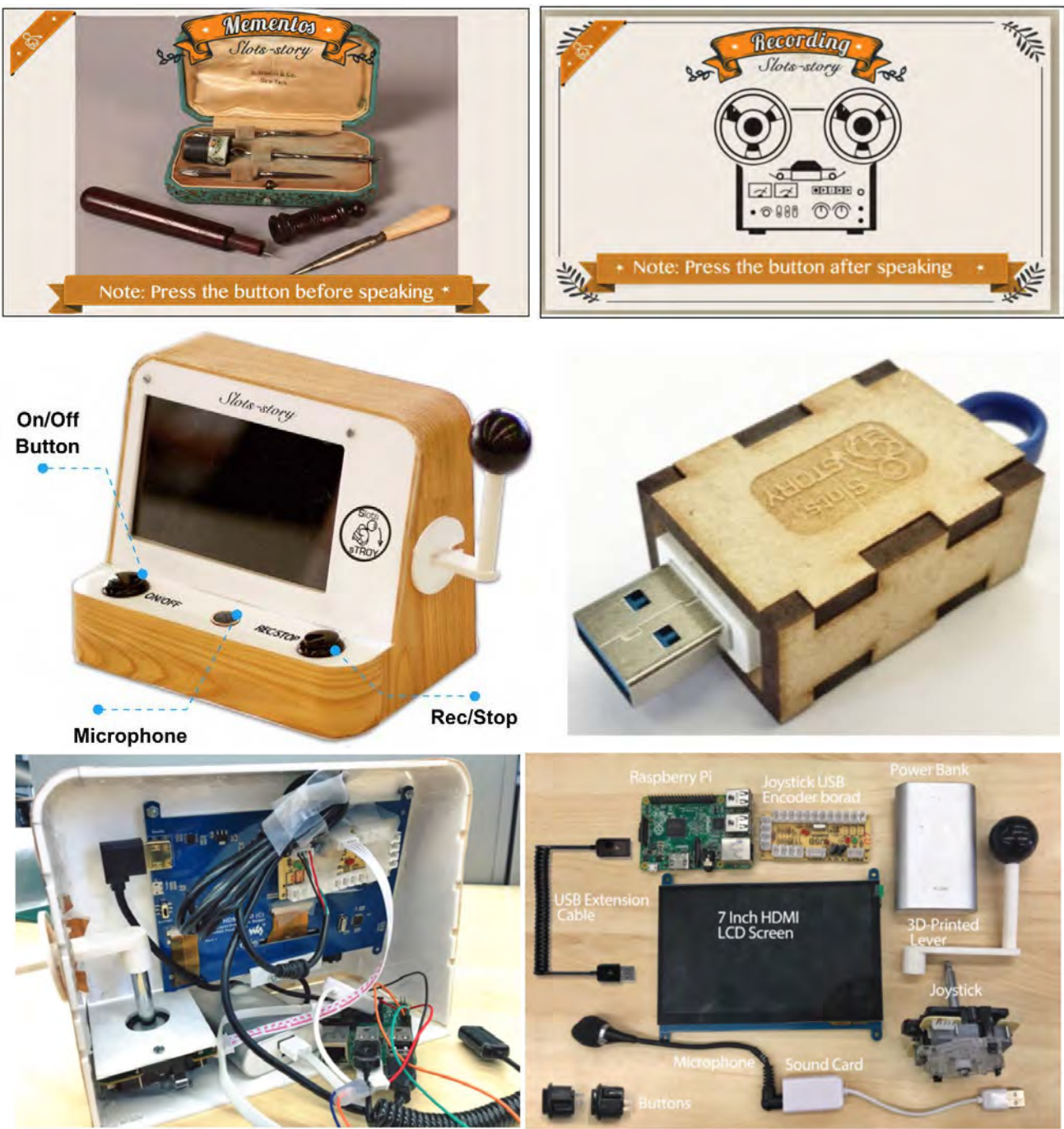


Figure 5-1 Prototype: *Slots-Memento*

Appearance

The overall shape has rounded edges, evoking an approachable and ergonomic design (Figure 5-1). The vertically oriented L-shaped appearance (from the side) makes the display easier to read, and buttons easy to press. The portable dimension also makes it easy to carry (L = 22cm, W = 11cm, H = 17cm). A 7-inch display is arranged in the upper part. Two buttons are arranged on the lower part. The left button is the switch, while the right one is the REC/STOP button. The lever is positioned on the right side. The main body is made of porcelain white acrylic, and the outer part of it is covered with wood-grained paper, making it look slightly old-fashioned, which is in line with the older adults' aesthetic taste. The flash disk is used to store memento photos and recorded story, and is embedded in a Medium-density fiberboard (MDF)-made shell.

Display interface

The design contains two display views: the Photo view and the Recording view. A vintage style is also applied to the graphic interface elements. Considering the fading eyesight of older adults, bold and large fonts are used. There are usage tips at the bottom: “Note: Press “REC/STOP button before/after recording.” The Photo view displays one specific memento photo, which could be switched to the next/previous photo by pulling down/up the handle. It will be switched to the Recording view when pressing the REC/STOP button. In this view, a dynamic recording icon and timer widget are placed to provide real-time feedback (Figure 5-2).

Interaction

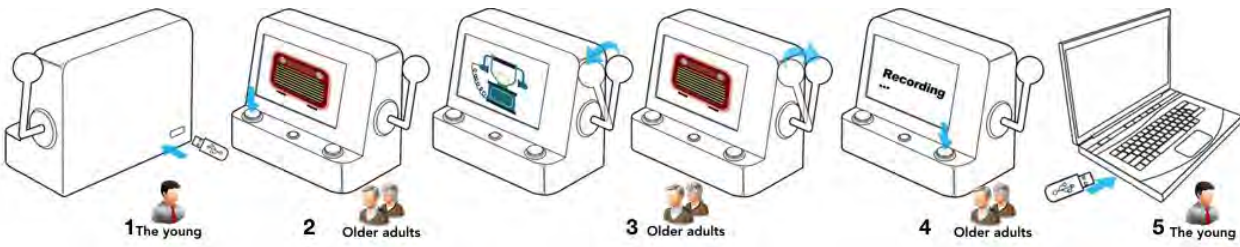


Figure 5-2 Interacting with *Slots-Memento*

- The young or the older adults insert a flash disk into the prototype. The flash disk contains the memento photos took by the young and the older adults



- The older adult presses the switch to turn it on
- The older adult pulls down/up the lever to switch between photos
- The older adult presses the REC/STOP button to start recording, and press it again to save the recording
- The young plugs the flash disk into a computer to listen and keep stories
- The *Slots-Memento* could also be used face-to-face

Hardware

As was the case with *Slots-Story*, it consists of a Raspberry Pi, a 7-inch display, a joystick, a lever, a portable battery, a microphone, an audio adapter, and a button. A raspberry Pi 2 Model B is chosen as the hardware platform, and the Joystick USB Encoder board is the medium to connect Raspberry Pi and joystick. The lever is 3D printed, which could fit into the joystick component. Assembly of microphone and sound-card provides audio input, and the 7-inch LCD display is for graphical output. The prototype is powered by the portable battery.

Use scenario

The use scenario includes share memento stories over a distance, share memento stories face to face, and modify memento photos. The use scenario is similar to the *Slots-Story* in Chapter 4. Therefore I will not repeat them in detail here. As is shown in Figure 5-3, ①-④ shows using prototype separately. ⑤ shows using prototype face-to-face. ⑥ shows modifying memento photos.



Figure 5-3 Use scenario

5.2 Field study

This Section reports the deployment of *Slots-Memento*. In Section 5.2.1, I report the field study procedure and method. Section 5.2.2 is about the participants. In Section 5.2.3, I introduce the interview topics.

5.2.1 Procedure and method

I recruited eight pairs of participants (each pair consisted of an old adult and his/her children). The older adults were recruited from two nursing homes in the Netherlands: *Vitalis-Berckelhof*, Eindhoven, and *WoonincPlusVitalis De Dreef*, Eindhoven. During the around ten days of deployment, interviews were conducted at the beginning and the end. The pre-study interviews were aimed at understanding how they currently share, manage, and preserve mementos. The post-study interview aimed at asking them to reflect on their use of the prototype. Three identical prototypes were made, and similar to the last time, each set was provided with a printed manual for use. The detailed procedure is shown in Figure 5-4, illustrating the following steps:

- Step one, I introduced the research purpose and process, explained the concept of “memento” to the participants (older adults and their children), and gave them some example pictures of mementos (souvenirs, albums, paintings, et cetera.). I then asked them to sign formal consent forms.
- Step two, the pre-study interview was conducted, consisting of a “guided tour” and a semi-structured interview. In the “guided tour”, the older adults showed me around their homes, and therefore I could examine their mementos. I then conducted interviews, aiming at understanding their current situation of memento story sharing.
- Step three, I showed them the prototype and the use scenario, and gave a short hands-on tutorial on how to use the prototype. Then each pair (older adults and their children) used the prototype for around ten days. I did not set the minimum or the maximum number of captured mementos for each pair of participants. However, I did encourage them to capture as many as possible. There was no restriction on who should choose the mementos. In most cases, the young chose mementos to ask for explanation stories from the older adults. If the older adults had a strong desire to share some mementos, the older adults asked their children to capture their mementos.



- Step four, I conducted the post-study interview. The primary source of data for my analysis included photo records of mementos gathered in their homes, and audio recordings kept of all interviews with participants, as well as the handwritten notes, which were taken during the interviews and the guided tours. All the collected data were anonymized, and I restricted access to the data to my research team only. I also made small edits in some of the quotes for clarity.

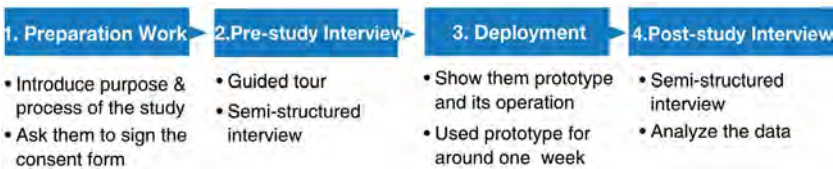


Figure 5-4 Field study procedure

5.2.2 Participants

Senior participants were recruited in nursing homes by the caregivers' recommendations. My recruiting criteria were: first, they had no significant impairments (including cognitive impairments such as dementia and Alzheimer); second, they owned a certain number of mementos and were willing to share them for research purposes, on an anonymous basis.

The older participants spanned a range of former occupations (nurse, teacher, et cetera.) and ages (between 73 to 87 years old), providing a range of perspectives. Table 5-1 provides an overview of the participants: basic information (age, previous job, marriage status), familiarity with technology, habits of keeping family mementos, interests, and their intergenerational connections. Older adults in the nursing home are highly representative of “Kodak Culture” photography, as opposed to users heavily focused on online communities (A. D. Miller and Edwards 2007).

Table 5-1 Overview of the participants (SP = Senior Participant, YP = Young Participant, F = Female, M = Male)

<p><b>Pair 1.</b> SP (F, 81), used to be a nurse, lives alone in a nursing home. She cannot operate a computer or digital device. She is good at handicraft, and still makes handmade dolls. She has several albums. The albums are carefully organized. Sometimes she looks through them. She has a son and a daughter. Her daughter (YP, 52) lives about 110km apart from her, while her son lives abroad, and she usually visited her mother once or twice a month.</p>
<p><b>Pair 2.</b> SP (M, 75), widowed, lives alone in a nursing home. He still works in an organization part-time. He studies cooking and sometimes gives a speech. He cannot operate a computer or digital device. His children visit him once a week. He has a daughter and a son, and four grandchildren. His photos were mostly related to family members. His daughter (YP, 47) works in a disabled rehabilitation center, in the same city as he is living. She usually visits him weekly.</p>
<p><b>Pair 3.</b> SP (M, 79), used to work in a gym, and now is a part-time barber. He lives with his partner. Albums are in the basement. He cannot operate a computer or digital device. He does not spend much time on organizing albums, but prefers collecting artifacts. He has a daughter and a son. Her daughter (YP, 54) lives around 20km apart from him, in the same city. She visits him once a week.</p>
<p><b>Pair 4.</b> SP (M, 73), used to be an engineer, lives with a partner. He has an iPad and uses it to browse news and watch videos. He used to travel every year and has many albums of traveling. He also likes collecting souvenirs, as well as organizing them. He has two daughters and one son. His son (YP) lives about 80km apart from him and usually visits him once a week. They connect via telephone and WhatsApp.</p>
<p><b>Pair 5.</b> SP (F, 78), divorced, used to be a teacher, and lives alone in a nursing home. She has lots of photos and videos of her students. She still actively participates in social activities. Therefore, she also has lots of photos of the activity. She has two daughters and one son, and one daughter (YP), the other two live abroad. YP (F, 49) lives about 90km apart from her and visited her once or twice a month.</p>
<p><b>Pair 6.</b> SP (M, 79), divorced, lives alone in a nursing home. He is an immigrant, and he used to work in a restaurant. He cannot operate a computer or digital device. He does not spend much time on organizing those photos, nor does he have many chances to talk about that. His youngest son (YP, 46) works in a government organization and lives about 40km apart from him. He usually visits his father twice a month.</p>
<p><b>Pair 7.</b> SP (M, 81), widowed, lives alone in a nursing home. He cannot operate a computer or digital device. He is an immigrant, and he used to be a crew member on ships. He went to many countries when he was young. He writes a brief autobiography. He has four children, who visit him regularly. Children live in different cities. YP (F, 47) is his youngest child, who leaves about 50km from him.</p>
<p><b>Pair 8.</b> SP (F, 87), widowed, lives alone in a nursing home. She cannot operate a computer or digital device. She moved home multiple times, and most of her mementos were lost. She has three albums. She has three children, all of them visit her regularly. YP (M, 54) lives in the same city, and visits her once a week.</p>

5.2.3 Pre-study and post-study interviews

The pre-study interviews were aimed at understanding how they currently share, manage, and preserve mementos. Some of the interviews were conducted with older adults and their children together, while some were separately. The interviews with the older adults were held in their homes, allowing them to describe their routines for memento storage and sharing in context. It consisted of a “guided tour” and a semi-structured interview. In the brief guided tour through their homes, I examined their mementos. With their permissions, I entered their rooms (excluding private or inaccessible rooms), and I took photographs and notes. I then conducted interviews; the topics are shown in Table 5-2.

The post-study interview aimed to ask the participants to reflect on their use of *Slots-Memento*, and their children’s feelings. The interview topics with older adults include the following aspects: validity, content, interaction, and others. The interview topics with their children include feeling, connection, and content. The detailed topics are shown in Table 5-3.

Table 5-2 Pre-study semi-structured interview questions	
Basic information	
Age, gender, physical condition, familiarity with technology	
Communication with family	
Who, frequency, and duration of contacting with family members	
Way of keeping in touch (face-to-face, phone, skype, et cetera)	
Current memento storytelling situation	
Mementos (like photographs, artifacts, everyday objects, et cetera.) they kept and the reasons	
Situations, and causes of sharing memento stories	
Who, when, how to share them (face-to-face, phone, skype, et cetera)	
Topics, duration, and frequency of story sharing	
Problems encountering during memento story sharing	

Table 5-3 Post-study semi-structured interview questions	
Interview questions with older adults	
Validity	
Would you like to use it?	
Do you think it could facilitate sharing memento stories? Why?	
Content	
Preference for mementos (photograph, artifact, paper document), Why?	
Interaction	
Do you understand the concept of the prototype?	
Do you find it easy to use? What is the most difficult part?	
Which part do you like/dislike most of the prototype? Why? A. idea of sharing memento stories with others B. memento pictures in the prototype C. the handle D. others	
Other	
Would you like to use it face-to-face or separately?	
Comments for improvements	
Interview questions with their children	
What's your feeling after listening to the stories?	
Did you contact your parents after listening to the stories?	
Preference of stories: A. Photograph B. Object C. Paper document D. Others	
Comments for improvements	

5.3 Findings of interviews

This section is mainly about the interview findings, focusing on the participants’ subjective perceptions. In Section 5.3.1, I report on the findings of the pre-study about the current memento storytelling situation. In Section 5.3.2, I report on the findings of the post-study interview.

Similar to the previous studies, I applied Grounded theory techniques (Corbin, Strauss, and others 2008) to analyze the interview data, so as to allow themes to emerge in a bottom-up manner. Interview transcriptions of each participant (senior and young) were coded, respectively, first using Initial coding, and then Focused coding. I chose a set of central codes from the initial dataset, which finally resulted in the identification of themes. The coding was conducted by myself.

5.3.1 Findings of pre-study: current memento storytelling situation

To better reveal the coding process, a concept indicator model was made to visualize the clustering of the codes (Figure 5-5).

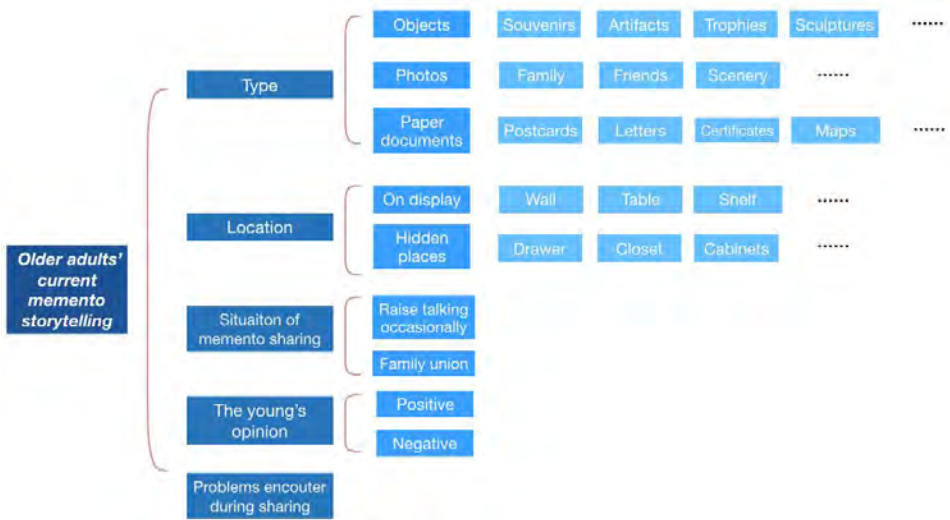


Figure 5-5 Concept-indicator model “Older adults’ current memento storytelling”

*Which mementos did the older adults keep?*

**Objects.** The types of their objects varied, including souvenirs, artifacts, trophies, sculptures, et cetera (Figure 5-6). The sources also varied: objects inherited from parents, gifts from friends, artifacts with special meaning, souvenirs from travelling, even artifacts made by themselves, et cetera. However, since most older adults moved homes multiple times, some of their artifacts were discarded, or given to their children. Therefore, only the part that was lightweight or precious was still in their possession. Also, rooms in nursing homes were too small to store all their belongings.

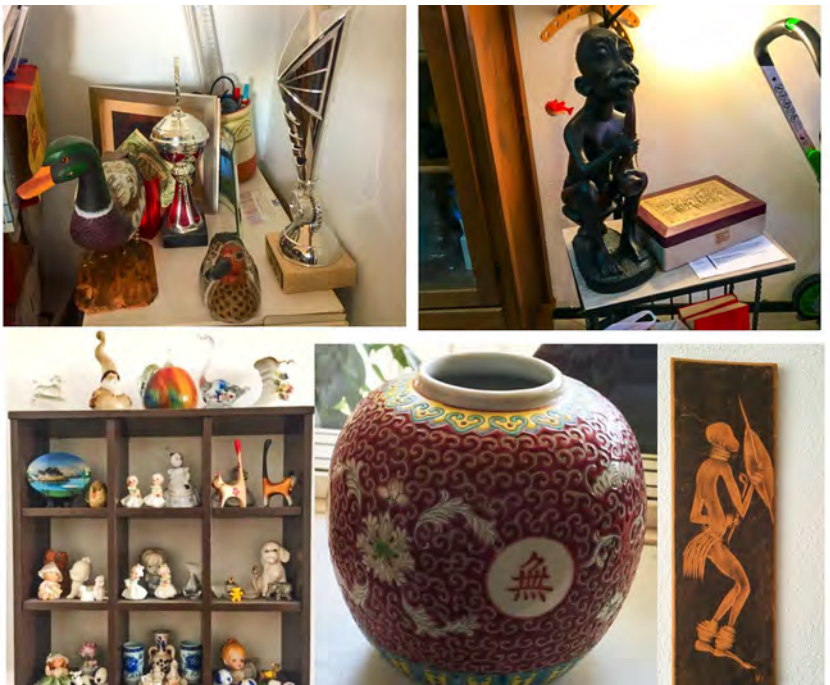


Figure 5-6 Part of older adults’ physical objects

**Photos.** Their photos were also mostly physical copies, often kept in photo albums. Compared with the majority of the artifacts, photos were more space-saving. Therefore, of all their mementos, photos were the most kept item of the older adults. Apart from a small part on display, most photos were stored in albums, envelopes, and boxes. Photos of old times that were more formal, such as weddings and family portraits were used to preserve for momentous occasions, (Figure 5-7).



Figure 5-7 Photos of different ages, changing from black-and-white, then half-colour, to full-colour



Except for one participant who left his photos unsorted, the others carefully organized their photos. The albums were organized by different themes, such as family, travelling, marriage, et cetera. The photos inside the albums were generally arranged in chronological order. *“When we were young, every year we had three weeks outside for travelling. I organized the photos in different albums. I used to spend lots of time on it. It cost too much time.”* (P5, F). Some senior participants needed to look at the time-stamps to recall memories, which were important clues to recall and search. Some participants added notes, theme tags, or dates on the photo, and one even taped related objects to the photos, such as a piece of rock from the scenic spots, local candy sticks, and maps. In this sense, albums were not just collections of photos, but carriers of their memories (Figure 5-8).



Figure 5-8 Inside the album, there were notes, rocks, candy sticks, and maps

**Paper documents.** Their paper documentation included postcards, letters, certificates, maps, et cetera. The certificates and maps were mostly displayed in their room. Postcards and letters were mostly tucked away in storage, either because they were hard to display, or because they were too private (Figure 5-9).



Figure 5-9 Paper documents: a letter, a postcard, a certificate, a hotel reservation, and a booklet

*Where did they locate their mementos?*

Overall, old mementos were located in storage rooms. Recent mementos were

placed in the study room and living room that were more accessible, while unique and private mementos were located in the bedroom. Consistent with previous research (Petrelli and Whittaker 2010), I found that most mementos were stored in hidden places (drawer, closet, shelf, cabinets), except for a part of the mementos which were placed on display throughout the home in both formal and informal locations, such as hanging on the wall and displaying on the table and shelves.



Figure 5-10 Mementos stored in cabinet and box

These mementos were displayed either because they are associated with special meaning (family photos, special gifts, favorite inscriptions, et cetera.) or because of their artistic values: *“These are fish, and I put them here. My daughter bought them for me because she knows I am Pisces.”* (P1, F). *“Well. For that painting, I just find it beautiful, and that’s why I hang it there, nothing more.”* (P6, M).

The mementos stored in hidden places were out of their sights, which made older adults seldom revisited them, not to mention sharing them with others (Figure 510). The older adults gradually forgot them, and that was why the participants showed great surprise when some mementos were rediscovered in the field study. They mentioned that the primary cause of storing mementos was space constraints.

*In which situations did they share mementos with their children?*

First, mementos for display raised conversations occasionally. They were easily noticeable, which effortlessly evoked conversations with guests. However, this happened only when family members or friends came to visit, which was occasional: *“Some people came, they saw photos of my family, and they would ask: oh, is that your wife? I would say yes, and start talking about my dead wife.”* (P2, M). Second, one senior participant said that sometimes during holidays, the whole family would sit together to look through albums together: *“When on holidays, we took out albums and talked about the past, but that happened not often.”* (P5, M).

### *The young showed interests in family mementos*

Most of the young stated they were interested in the mementos of their parents or grandparents. They knew some mementos, but they knew little about the stories behind them: *"Before my mother moved to the nursing home, some of her belongings were moved to my home. I was curious when organizing them."* However, in most cases, older adults' mementos were seemingly ignored by their children, and they realized its importance only when the older adults passed away: *"It was only when my father passed away that I realized I didn't know too much about him. I spent a whole week going through his belongings. I found some photos that I never saw before, and I scanned them."*

### *What problems did they encounter when sharing memento stories?*

First, mementos for displaying did not fully support personal reminiscence. The participants stated that those mementos in the home environment were so familiar that they often were not noticed or could trigger personal reminiscence. Second, they seemingly ignored or forget to share mementos and use them for storytelling. During my interview, when the mementos were rediscovered, they were excited and naturally immersed in recalling. Despite that they would like to recall, they rarely had chances to talk about the mementos specifically and deliberately in their daily lives, nor did their children ask about them. *"I don't talk about them often, nor do my children ask. Maybe when I am almost dying, they could realize it is time to remember their mother's stuff."* (P6, F). Distance also hampered the memento story sharing: *"Visiting time is short, so we couldn't make time for talking about her photos and souvenirs."* Lastly, the older adults worried that their children might not be interested in their mementos.

## 5.3.2 Findings of post-study interview

After the participants had used the prototype for approximately ten days, I interviewed them again.

### *Feelings and opinions on the prototype*

The senior users felt *Slots-Memento* could facilitate their memento storytelling and recording. They enjoyed telling the memories. The field study helped them to revisit and rediscover their mementos, some of which they had almost forgotten. *"It is so good to see these photos again. I almost forgot them. I think the device is really great, because I can put all my stories and emotions into it."* (P6, F). They showed interest in

the prototype, especially in the direct recording function. Compared to handwriting, they felt audio recording lowered the threshold of telling their stories, given that they experienced difficulty in writing as they aged. *"I wanted to write my stories down, but I generally don't feel motivated to do that. My eyesight declines. The recording is really helpful."* (P4, M). Feedback regarding usability showed that this was overall satisfying. The metaphor of slots-machine and vintage style with decorative effect was understood and accepted. The lever was easy to hold and brought interest when using. They thought the prototype was simple to use and easy to understand. Another motivation for recording the stories was they felt responsibility for carrying on family history.



Figure 5-11 Post-study interview with the older adults

The young participants showed interest and enthusiasm in their parents' photos, even though my project increased their burden on capturing mementos. They expressed their willingness to preserve the stories, despite the fact that capturing the large quantity of photos was time-consuming. *"The concept of recording stories is meaningful, and it helps to build a connection between the memento and its story counterpart. The recordings are kept easily."* They thanked us for giving them a chance and a reminder to pay more attention to parents' stories. Specifically, they learned new things about their parents from the audio recordings. Although most young participants knew the existence of the mementos, they knew little about the stories behind them. *"I didn't know that pipe was from my grandfather, until grandmother told this me in the audio recording."* For those who already knew the origins of a memento,



they understood it now from a different perspective. *"I know some photos, but now she tells the memories totally from her view."* They also felt the audio recordings contained emotions, familiarities, personalities, and feelings, which could convey more information than text. Listening seemed to be more natural. The field study also made them aware of the importance of preserving older adults' mementos and stories, which was currently overlooked. At present, the young didn't have many chances to sit together with older adults to listen to their stories specifically: *"Occasionally, my mother talked about her past stuff, and this device makes me aware of the importance of preserving these stories. Otherwise, these memories will disappear forever."* Furthermore, they felt the recordings were a treasure to pass on to the next generation: *"It is nice to preserve my mother's stuff, so that I can tell and play them to my children. The audios are a priceless present."*

#### *The young's preferences and attitudes*

The young's preferences for memento stories varied, and they had different interests. For example, some were interested in the old photos of family members, which could raise shared experiences with the older adults, and help to exchange feelings: *"The photos are about us. Talking about the past together with parents is better than seeing photos alone."* Some were interested in the deceased grandparents' souvenirs: *"I never saw my grandfather. I am interested in stories about him."*

They realized the importance of preserving them. *"Once my mother passes away, my daughter will never have a chance to listen to her grandmother telling stories."* Another motivation was "just in case". Once the content becomes digital, they tend to be conservative in building up extensive collections of materials. The literature indicates that the young find it hard to delete materials until they see how and when that information will be used (Whittaker and Hirschberg 2001).

#### *Comments for improvements*

Both the senior and young participants provided valuable comments for improvements. First, the older adults suggested the prototype should be able to stay always on, instead of having to be manually powered on and off each time, which was inconvenient. Second, they preferred an additional function for playing back the stories, as they hoped to show and play the stories to others. Other suggestions included a bigger display screen and a function for playing videos, since they also had some family videos. The young mentioned that the flash disk transfer

was not convenient, and wireless networks should be adopted.

## 5.4 Analysis of the mementos

In this section, the mementos collected in the field study will be analyzed. In Section 5.4.1, I describe the categorization method of mementos in my study. In Section 5.4.2, I describe the distributions of the memento categories. The proportions provide a good insight into older adults' preferences for mementos.

### 5.4.1 Categorization of mementos in my study

There are different methods for categorizing mementos in existing research. The coding scheme by Csikszentmihalyi et al. was developed by analyzing and coding 1,694 special objects from over 300 participants from 82 families (Csikszentmihalyi and Halton 1981). However, since it covers a range of everyday objects, such as animals, plants, vehicles, clothes, furniture, et cetera., it is over-generalized to apply in my study. David Kirk et al.'s study divides family mementos into physical, digital, and hybrid objects, among which the hybrid objects are physical instantiations of digital content such as CDs (D. Kirk and Sellen 2008). However, in my study, almost all the mementos had a physical form. Therefore, this categorization is not precise enough for my study either. I am looking for a method with which physical mementos can be further classified.

In my field study, as photos were the most kept mementos of older adults, they were classified as one particular theme. Ultimately, I classify mementos into three main categories: **Object**, **Paper document**, and **Photo**, and 25 sub-categories (Figure 512). The **Object** category is divided into seven sub-categories depending on their source (Gift from friends, inherited from parents, Travel souvenir, Bought, Self-made, Children's toy, and Other). The **Photo** category is divided into Family members, Marriage, Friends, Festival, Object, Scenery, Graduation, Interesting moment, Animal, Plant, and Other, depending on their themes. The **Paper document** category is divided into postcard/letter, Inscription, Map, Flyer, Booklet, and Other, depending on their forms.



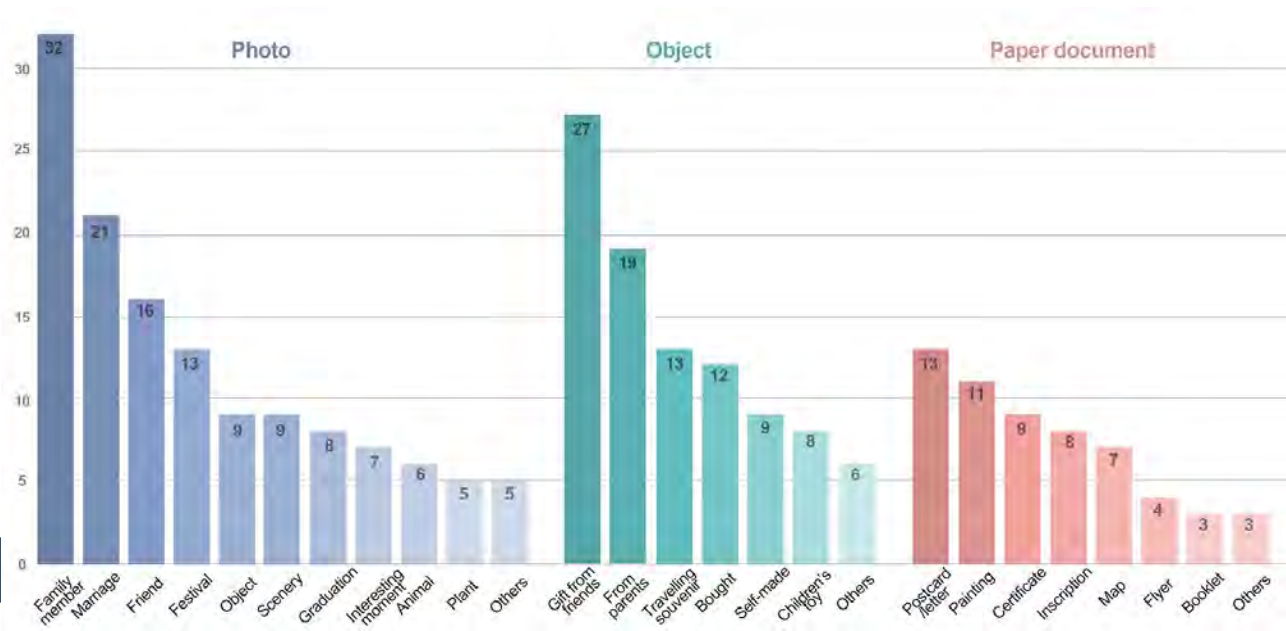


Figure 5-12 Types of the mementos, and the absolute number

5.4.2 Distributions of the categories

In this section, I will describe the distribution over the memento categories (Figure 5-12). In the field study, 283 mementos were collected. The average number of captured photos (after removing repeated ones, since one memento might correspond to multiple photos) was 35.4. For clarity sake, I present this section in the form of “distribution over categories” (quantitative data) + “reason for telling stories about it” (qualitative data from the interview).

The Photo was the most popular type accounting for 46.3%, among which “Family member” was seen the most. It was consistent with the interview that they mostly preferred to talk about photos of family members and old friends, as well as about photos when they were young. Reasons were twofold: First, nostalgia prevailed among them, and old photos were effective memory triggers for reminiscence of their youth: *“The earliest memories were blurred, you cannot recall without the photos. With photos, you could recall memories of a long time ago, even the details.”*—P8, F. *“When I look through the albums, I see my son grows from a little kid to an adult; I feel time flies.”* —P5, F. Second, some of their friends and family members had passed away, and browsing photos was a method to recall and honor them: *“Some people*

*on the photos are no longer alive. Whenever I see them, I can go back to that time.”* —P5, F. Next was “Marriage”, which belongs to major life events. Finally, we can discover photos from were friends, festivals, et cetera.

33.2% were Object-related, among which the most often seen objects were “Gift from friends” that could remind them of the relationship with friends. It was followed by the objects “Inherited from parents”, which they generally labeled very precious artifacts. These artifacts were unique to them, not only because of the value of memento themselves, but also because of the relationships they represented. Next was “Travel souvenir”, which was of aesthetic values. For this type of mementos, most of them could only remember where and when they bought them, but forgot the reasons and situations: *“Maybe I had lots of reasons for buying them, but now I almost forgot, they are now just for decoration.”* They seemingly did not have much interest in telling stories about them, despite the large quantity of these souvenirs. The reason for not wanting to share related stories, one of the senior participants explained: *“I want to tell my stories, those (the travel souvenirs) are other’s stories.”*

The remaining 20.5% were Paper documents, among which “Postcards/letters” were seen the most. These types of mementos represent the relationships with the senders. Finally, they were proud of their “Certificates”, including graduation and qualification certificates.

5.5 Analysis of memento stories

Similar with the case in Section 4.5, stories collected by *Slots-Memento* will be analyzed. The aims are twofold: to understand narrative patterns of older adults’ stories, and to understand the dialogic process between teller and listener.

Specifically, the structural analysis and interactional analysis were conducted. Similar to the last iteration, The stories were translated from Dutch to English by native student assistants, then were transcribed, following Robert Miller’s transcription guideline (R. L. Miller 1999). I first read through all the stories once to familiarize myself with the content.

5.5.1 Structural analysis

Narratives are structured. They have plots with both temporal and spatial features (Abbott 1997), and the structure of stories is more stable than the content

of stories (Sellen et al. 2007). I applied *Labov's* model (Labov 1982) to conduct a structural analysis, because in my case, the stories are related to the storyteller and are told in an informal manner, i.e., they are “natural narratives” (Johnstone 2016). *Labov's* model is applicable to “natural narrative” as its origins are situated in the everyday practices of real speakers (Stoneley and Weinstein 2008). The second reason is that most stories that were collected in my study, are single narratives, and *Labov's* model is based entirely on a single person- the narrator, without considering the audience (Johnstone 2016). According to *Labov's* model, narratives have formal properties, and each of them has a function. A “fully formed” narrative includes six common elements: **Abstract**, **Orientation**, **Complicating action**, **Resolution**, **Evaluation**, and **Coda** (Labov 1982) (Figure 5-13, left). In my structural analysis, four structure types of stories emerged (Figure 5-13 right).

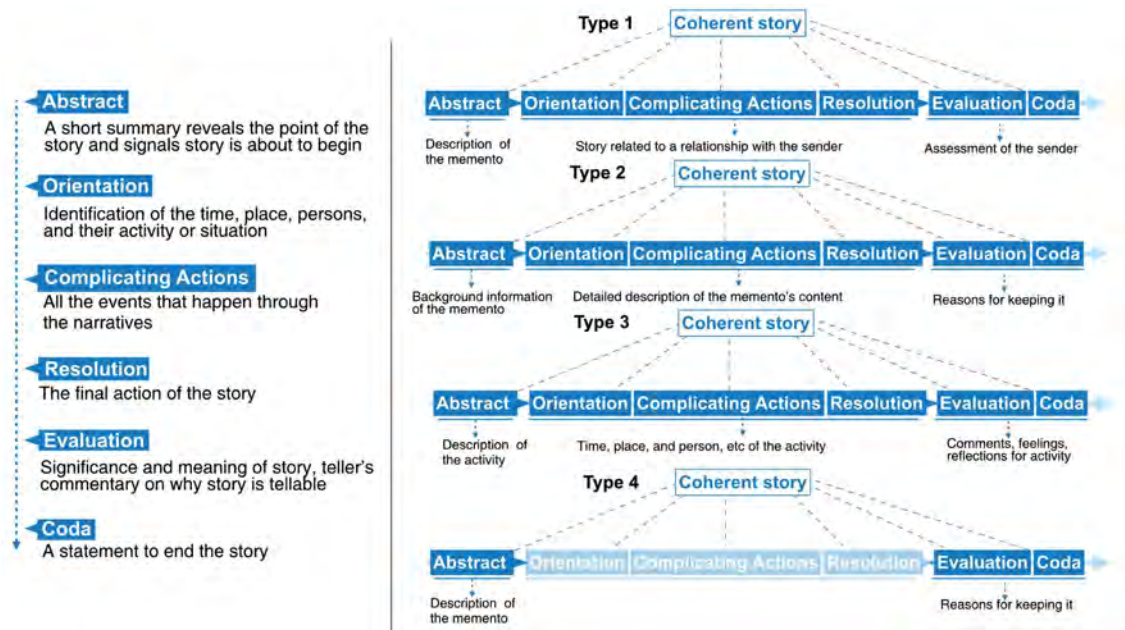


Figure 5-13 *Labov's* model of narrative (Labov 1982) (left), and the four structural types found in our cases (right)

*Four structural types of stories emerged in my study*

**1. The story describing and commenting on the giver of the mementos.** Stories of mementos receiving from others (gift, heirloom, postcards, et cetera.) are normally of this type. Specifically, a memento acts as an “**Abstract**”, which

is a short description of the memento, such as *what it is, what it is for, and where it is from*. Since the mementos are from someone else, the rest of the story turns to describe the giver of the mementos: such as who the giver is, stories that happened between older adults and the giver. Some stories end directly after a description of the giver, while some end up with “**Evaluation**” and “**Coda**”, which are opinions on the giver, or the storyteller’s feelings.

**2. The story describing the memento itself.** Stories of artifacts made by the older adults themselves, scenery photos, and artifacts of historical values are of this type. This type is more descriptive than narrative. Specifically, the story starts with the memento’s background information (name, origin, location, et cetera.), and the background information acts as “**Abstract**”. It is followed by a detailed description of the memento’s content, or the making tutorial (self-made artifact), acting as “**Orientation**”, “**Complicating Actions**”, and “**Resolution**”. Stories then ended up with reasons for keeping, acting as “**Evaluation**” and “**Coda**”. This type of story has knowledge values. Examples include Table 54 (F) and Table 55 (D).

**3. The story that is with high narrative features.** Stories triggered by photos of festivals, major life events, and memorable moments are of this type. Specifically, a memento also acts as an “**Abstract**”, which is a description of the activity. Next are the details, including identification of the time, place, persons, activities, and the final result, which can be labeled as “**Orientation**”, “**Complicating Actions**”, and “**Resolution**”. Finally are comments, feelings, or new reflections, acting as “**Evaluation**” and “**Coda**”. One thing to note is the photos of interesting moments that were captured unexpectedly, and most older adults would like to share actively (Appendix, Table 4-G). Two features of this type are: (1) Photos are series, and stories are continuous. (2) Older adults were easily immersed in the recalling, showing their happiness and excitement through their voices. Examples include Table 56 (B- H).

**4. The story without concrete plots.** This type is non-typical and without concrete plots. Certificates, family photos, and travel souvenirs are normally of this type. Specifically, audios of this type start with a description of the memento, acting as “**Abstract**”. However, what follows is not as detailed as the three other types. What follows is usually the reason or motivation of keeping them, acting as “**Evaluation**” and “**Coda**”. Example stories include Table 55(A), Table 56 (A), and Table 54 (E).

Table 54 Examples of objects and their related stories

(A) Artifact from friends	
	<i>That's a wooden artwork, and I took it from Africa; a local friend gave it to me. I have lived nearly 15 years in South Africa, a city 30 miles from Johannesburg. People there made money by selling this. So, they could have more food. I was then working in a shop. The guy came to my shop, and he said: "You are Dutch? I said, yes, I am from the Netherlands, and he said: "I used to study there, in Netherland. You are nice to our natives. Some people lived here before. They just made money from the farm, and they didn't like the natives so much. But you are different." Afterwards, we became friends. —P1, F</i>
(B) Artifact inherited from family members	
	<i>The fish (artifact) is from Indonesia, Java. My oldest brother, he served in the army in Indonesia, and he went to fight, after WWII. And he brought it back. He died very young. It was in August, he was 22, and I was 16 at that time, it was my birthday. And I was going to school. It was 10 o'clock in the morning, and the weather was the same as now. My teacher said: "You have to go back home. Is somebody sick?" I said: "I don't know." Actually, she already knew my brother was dead. He was killed in the war. I was so sad. So in the beginning, I didn't celebrate my birthday. I really miss my brother.—P3, M</i>
(C) Pipe inherited from father	
	<i>This is an old bark pipe, for smoking, from my father. In the early days, the tobacco. They smoke, they put the fabric in it. This is from my father, very old. Uh-hum, but he didn't smoke it, but he just bought it, and never used it, so it is totally new. —P10, F</i>
(D) Souvenir from travel	
	<i>This one is interesting, and it was once I went to Brazil, and found nothing to buy, then I found this. It was, uh-hum, the Amazon river piranha: it was special". — P7, M</i>
(E) Souvenir from travel	
	<i>Guests often ask for these house toys. These toys were from when I took a business class of KLM, and they gave them to me. And there should be more than 80 ones a row, but here are only 30. But now, I am retired, and don't take the business class anymore. — P4, M</i>
(F) Self-made doll	
	<i>This is my Easter chicken, three small chickens with rabbit's hats. Everyone likes it. My daughter took it away, to school, in the office. Ha-Ha, she put it there. Her colleague said it was so nice. I made a lot, but I sold them. I have made 25. I enjoy making them. Now I am making a new one. I learned to make this from a book, but I think I make them better than the book teaches. You see, its hands, I add hands to it. And its feet, I put bottle cap inside. I have lots of bottle caps. I never throw them away. "—P1, F</i>

Table 5-5 Examples of paper documents and their underlying stories






(A) Certificate	
	<i>This is related to my cooking. I got this a few years ago, I had this certificate because of food hygiene and the law of cooking, and it is important to my cooking. I still study cooking, although I am old. I am still busy, and I am responsible for my life. I don't want to sit down and do nothing."—P2, M</i>
(B) Postcard	
	<i>This is a postcard from India. You see the stamps, that's from a guy. Uh-hum. He was here, and he has left, he visited me for the haircut. Once he said he went to Texas, so he was called "the Texas boy", Ha-Ha. And he said: before I leave, I visit you for a haircut, and you can do whatever you want. Ha-Ha. I said...then I was waiting, waiting, waiting, but he didn't appear. And that's why he said: "sorry. I couldn't make it. —P3, M</i>
(C) Painted by family members	
	<i>This picture was painted by my daughter, my youngest daughter. She likes painting. Because I divorced, photos are usually only showing the three of us. She always wants to buy me a gift at festivals. I think that's a waste of money, and I told her that I hoped she could draw a picture for me, so she drew this. She sketched five people, two daughters and their boyfriends, standing together. I am in the middle, and the one with long hair is my eldest daughter, with short hair is the youngest daughter. She always likes painting. And I think this is a meaningful gift. You can feel she drawn it with her heart. I am always happy when I see this. —P5, F</i>
(D) Painting from friends	
	<i>It is Eindhoven, and you can see the church in the city center. It is very old. 17th century. It is a reproduction, and my friend got it. She was working in Philips, when she quit, she got this, but she didn't have children, so she gave it to me. Now it's hanging here. Ha-ha. Now the church is there, and this building at the right is still there. The building at the left was the city hall before. Now it is broken down. There was a long street, where all the shops were.—P8, F</i>



Table 5-6 Example photos and the underlying stories

(A) Photo of family members	
	<i>I stand here, the third from the right. It was in the war, November, WWII in the Netherlands. This was my family, all my sisters and brothers because we were with seven. We left my parents. But my brother in WWII, he died. He was killed, he was reading a newspaper, and there was a jeep, and he was sitting in front of the barrier, and the jeep was coming, the driver took the wrong pedal, he gave gas. My brother's chest was broken.—P1, F</i>
(B) Photo of an activity	
	<i>That was my 25th wedding anniversary, when we lived in the old house. At the bottom is my sister-in-law. That one in black was my sister. They came over that day, but I didn't know they arrived. They told the whole family except me. I was crying, and I looked outside, My sister, from Austria. I didn't know she would come. Everyone was dancing, dancing, my sister, was drinking the whole day. She got twins, but you could easily tell them apart. Uh-hum, but she's dead already.”—P2, M</i>
(C) Photo of a graduation ceremony	
	<i>This was in my graduation ceremony, my parents attended. It seems this was not the master ceremony, and it was the bachelor ceremony. The last one was the master. At that time, the president of our university was the governor of the city. There was the other president, for the administrative affairs. Oh, I remember, it was in 1974. Um, my father at that time was pretty young. Ha-ha. —P3, M</i>
(D) Photo of marriage	
	<i>This is our marriage photo. ha-ha...it was 40 years ago. You can see the fashion styles of that time was different. Haha. At that time, I'd like a hairstyle that was long, (Ha-ha). We did not belong to this church, this hall was the main hall of that church, but I finished my primary school there. In middle school, the same place, and the opening ceremony, and the graduation ceremony were often in there. My marriage ceremony was also here. —P7, M</i>
(E) Photo of a scenery	
	<i>It was in Austria, and I stood here, and I took the picture, I like it so much because everybody took pictures of people, but I don't want people photographs, I want only the scenery. Yes, that was my photo. Yes, it's perfect. I do like it so much, because it is halfway, the ... (Placename), in this cave, you could rest here, and then go up there. I didn't like people, so I took it. Peter, my friend, he said: this place, I know, but I had never seen a picture that looked like this. They always take photos of people. I didn't like people. Not so much. So they said: they know this place, but they had never seen a picture like this. I don't like the pictures they took. I like this.—P8, F</i>
(F) Photo of a scenery	

	<i>This was ... (Placename), we have been there, for all the nice water, we walked there at a lot of places. It was perfect. It was so beautiful there, we have walked everywhere the small ways up, up to the air, and that was nice, we went there by bus, then we got down and walked there, and we were here. And then I looked back. Took this photo: All the people walking over there, so far away. Yes, I went there, and I love it. Perfect.</i>
(G) Photo of the interesting moment	
	<i>The seagull, we found him on the street, when being on holiday. We walked outside, and we found him. He couldn't walk, couldn't fly. He was very sick. I picked him up and took him home. I went to the shop and bought fish. I didn't like fish, but I bought fish for him. I gave fish to him, but he couldn't eat, so I cut the fish into pieces, then he could eat, then I put him upstairs in my home, then he stranded on 2 feet. Oh, so nice, because he could walk. Then I put it outside, and it tried to fly. Up, up, up he went away. Then I went outside to say: Where are you. Then he turned around, and looked at me, and then went away. That was so nice when he could fly.”—P5, F</i>
(H) Photo of the interesting moment	
	<i>Oh, yes, ... (Placename), we walked on a small road, oh, we lived in Italy then .um. We walked on a small road. And we walked to the bush, and on the road, there were bulls, one young, one old. I didn't know. We walked to the bush. And we passed them. Then the bulls followed us. All the time. All the time. But we didn't like them much. But anyway, they followed us. And the old one looked at the young one.—P1, F</i>

Summary of structural analysis

Different types of mementos unlock different memories. Four structural types emerged, which correspond to four motivations for keeping the mementos of the older adults:

- Symbolizing a relationship with someone else.
- Mementos themselves are of high knowledge values (transferring skills, historical and geographic knowledge, et cetera.)
- Documenting life events, including wedding, graduation, et cetera.
- For special purposes, such as certificates (his/ her pride), family photos (for honoring), (artifact) family inheritance, and travel souvenirs (for decoration).

Another finding was that compared to objects, stories evoked by photos were more direct and specific. Photos could document moments with more vivid details, while stories evoked by objects were more indirect and implicit, despite the historical and aesthetic value they hold.

5.5.2 Interactional analysis

The interactional analysis emphasizes the dialogic process between the teller and the listener. In my field study, social interaction behaviors occurred in two situations: (1) the young contacted the older adults after listening to the stories, and (2) they used the prototype face-to-face during the conversations between them. For the former, the storytelling and listening were not performed simultaneously: The young contacted the older adult after listening to stories, either because they wanted to know more details of stories, or they expressed their viewpoints on the stories. While for the latter, the audio recordings included conversations between them.

Two examples of sharing objects and photos are shown in Table 57 and Table 58. The memento is the starting point of the conversation, and the prototype acts as a conversation topic generator. Storytelling is a process of co-construction, where the teller and the listener create meaning collaboratively. Two features of sharing mementos face-to-face could be formulated. First, storytelling gradually turned into a conversation, and the stories were short and fragmented. The listener influenced the storyteller in several ways: by acting as co-tellers (as in Table 58, the storyteller and the listener co-reminisced), by putting forward trigger questions (in Table 5-7, the listener wanted to know more details), and by evaluations (the listener expressed his/her opinion on the stories). Second, since the listener provided instant feedback, the conversations moved away from the mementos themselves. The feedback acted as a new memory clue to trigger the storyteller to tell new stories. Take Table 5-8 as an example: the co-present photo sharing facilitated the older adult and the young adult to relate their memories to each other, leading to a collective remembering, which was a highly communicative process.

Table 5-7 A snippet of a conversation between an older adult and a young adult. The older adult was using the prototype to share a photo of her glasses (The young = Y, Older adults = O)

Y	<i>Whose are these sunglasses? I never see you wear them.</i>
O	<i>These were your grandfather's. He used to work in the eyeglass factory when I married him.</i>
Y	<i>Really? I never heard about that. So these glasses were made by my grandfather himself?</i>
O	<i>Yes, he had many. Others were given to others, and these were the only pair left. I kept these.</i>
Y	<i>I never see you wear them, why don't you wear them?</i>
O	<i>I wear reading glasses, and I don't wear these often. But this pair is of good quality, it dropped many times, and they still work. um...Your grandpa had a lot, and all were given to others. I kept this pair because I like this style.</i>

Table 5-8 A snippet of a conversation between an older and a young adult, when using the prototype to share a photo face-to-face. They both appeared in the photo

Y	<i>You and my grandmother looked so young at that time.</i>
O	<i>Yes.</i>
Y	<i>My grandmother's hair was still black then.</i>
O	<i>Yes. You see the pink skirt I was wearing. It was made by myself. The white shoes looked like straw sandals, and that style was popular at that time. You were so skinny.</i>
Y	<i>Yes, except my head. Ha-ha. My head was always big. I was wearing a T-shirt, with a Mickey-mouse on it.</i>
O	<i>Yes, a yellow one, with stripes.</i>
Y	<i>Did you buy it for me? I don't remember.</i>
O	<i>Um. I also forget, maybe your aunt bought it for you.</i>

5.6 Discussion

This section discusses the characteristics of older adults' memento sharing and the problems they encountered, and proposes corresponding strategies derived from the field study.

5.6.1 Characteristics of intergenerational memento storytelling for older adults

Early studies have concluded the younger generations' habits of curating and sharing digital mementos, embrace the digital world (Banks, Kirk, and Sellen 2012). From this study, I conclude the following characteristics of older adults' memento storytelling, revealing the differences between the young generation.

**Their mementos were of limited quantity, carefully organized, and strongly treasured, as they had the desire to preserve them.** Previous research shows that people tend to non-selectively keep everything when putting digital artifacts into storage (Banks, Kirk, and Sellen 2012), and the almost unlimited storage leads people to regard it as a space needing no active management. However, mementos of older adults in the nursing home were of limited quantity, as their mementos had been selected, screened, and resettled. Most of them moved home multiple times, and many mementos were discarded, except the lightweight or precious ones. The limited living space also motivated them to manage mementos to avoid an unchecked accumulation. Unlike digital mementos that are archived

on a computer in disorganized collections of virtual folders (D. M. Frohlich, Wall, and Kiddle 2013), these physical mementos were carefully organized by the seniors. For photos, maybe one of the reasons is that prints go through a tougher selection than digital ones, while the young do not need to make a strict selection with digital copies (Jansen, van den Hoven, and Frohlich 2014). Moreover, the older adults would like to add notes, theme tags, and even objects to the related photos. In this sense, they saw the albums as not just collections of photos, but carriers of their memories. With this in mind, it's understandable why they had the desire to preserve them, and their current preserving methods included: recording DVD, making memoirs, scanning photos, et cetera.

**Older adults' memento stories could be generalized into four structural types, with different narrative patterns, revealing their motivations for keeping mementos.** In total, 283 stories were collected in my field study. Through the structural analysis, these stories were generalized into four narrative patterns, corresponding to four motivations for keeping mementos (Table 5-9).

Table 5-9 Four structural types of their memento stories, and the corresponding motivations

Story structural type	Motivation for keeping mementos
Describing and commenting on the giver	Symbolizing a relationship with someone else
Describing memento itself	Of high knowledge values: transferring skills, historical and geographic knowledge, et cetera.
Of high narrative features	Documenting life events, including wedding, graduation, interesting life moment, et cetera.
Story without concrete plots	Special purposes: certificates (pride), (artifact) family inheritance, family photos (honor), souvenirs (decoration), et cetera.

**The mementos could not fully support older adults' reminiscence and storytelling in their daily lives.** The reasons are as follows:

- Most mementos were stored and out of their eyesight. They were seldom re-accessed and gradually forgotten.
- Mementos on display were so familiar that they often were not noticed.
- The older adults rarely shared mementos deliberately with their children, nor did their children asked about them. Reasons were geographical distance and limited visiting duration.

- Despite that some older adults tried to write the stories, it was time-consuming, and they felt difficulty in writing at their age.

5.6.2 Strategies of designing for older adults' intergenerational memento storytelling

Based on the characteristics of current older adults' memento sharing, I propose corresponding strategies for designing for intergenerational memento story sharing in this section.

*The process of intergenerational memento story sharing*

The proposed process of intergenerational memento story sharing is presented in Figure 5-14. The older adults act as memento storytellers, due to their rich knowledge of family mementos. Their children are listeners, even co-tellers. The memento photos act as memory cues. The process of intergenerational memento story sharing can be divided into four steps: *Triggering Process* (older adults' recalling), *Telling Process* (older adults' memento storytelling), *Sharing Process* (memento and story sharing), and the upcoming *Curating Process* (the curation of digital collections). Next, I will present the strategies based on the "four steps".

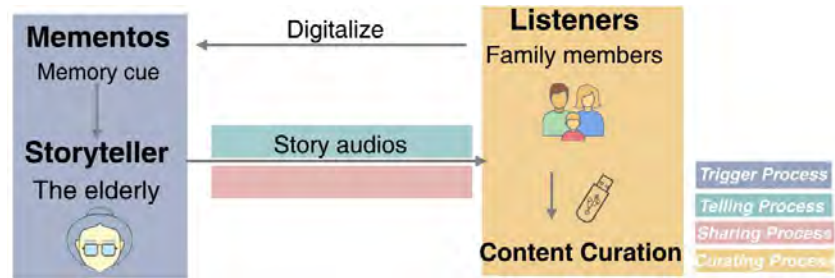


Figure 5-14 Process of intergenerational memento story sharing and preservation

*Design for older adults' memento reminiscence (Triggering Process)*

**Make the digital counterparts as effective complements to the physical mementos.** Physical and digital mementos have different characteristics. Features of physical mementos lie in its materialities, enabling interactions for people's reminiscing. The uniqueness and rarity make them more cherishable. Digital memento could be easily copied and shared, but it is hard to support daily reminiscence due to a lack of being present in the everyday environment. They are captured



and stored but seldom reviewed (Golsteijn and van den Hoven 2013). Therefore, digital counterparts could not replace physical mementos' richness of physicality and uniqueness. Physicality and digitality are irreplaceable to each other. To exert their respective advantages, I need to make the digital counterparts as an effective complement, to combine their individual advantages. Therefore, a digitalization process of physical mementos is needed, which also contributes to memento preservation. In my case, this process is done by the young generation.

#### **Integrating digital mementos into their daily life through a tangible device.**

It is important to make the digital memento a part of the everyday environment, instead of storing them in hidden places, I designed the prototype, based on the premise of physical memento digitalization, with the help of their children. Moreover, since the simple digital display could provide users only with limited material affordances and interactivity, I tried to create a display merging the interactivity of physical objects with digital objects, aiming to make digital content more accessible and interactive for the older adults. Specifically, the handle of the prototype aims to lend tangibility to the digital content to allow for more natural interactions. Although the mementos are digitalized, the device itself is physical to a certain extent. My prototype combined the advantages of both physicality and digitality to some extent. As mentioned by the participants, one of the merit they liked most was its tangibility of the prototype.

**Facilitate revisiting the memento photos through a memento display.** Although literature points out that physical objects are much more embedded in the everyday landscape and trigger memories by merely being seen (Golsteijn, Van Den Hoven, et al. 2012), my pre-study interview in Section 5.3.1 indicates that simple physicality is not enough: the mementos in the home environment were so familiar that they often were not noticed. Therefore, although the prototype itself should be unobtrusive when placed in the home, the photos for displaying should be dynamic when in standby mode, to attract the older adults' attention and encourage them to tell stories.

#### *Design for the older adults' memento storytelling (Telling Process)*

Making the digital mementos materially present in their home only supports revisiting their personal content. To facilitate memento storytelling, I need to make the threshold of the storytelling low:

**Enhance the integrality of stories by providing "Five Ws".** In my field study,

stories more detailed with more plots, another form of memory trigger could be adopted—namely, "Five Ws" questions. "Five Ws" constitutes a formula for getting complete stories on a subject. According to its principle, a narrative could be considered complete if it answers these questions starting with the following interrogative sentences: *Who was involved? What happened? Where did it take place? When did it take place? Why did that happen? And How did it happen?* (Hart 2002). One thing to note is since the "Five Ws" principle is typically applied in writing, and the validity of using this in storytelling needs to be verified. Furthermore, adding this formula to the storytelling process might influence their natural structure and be perceived as a load rather than an enjoyable process. Therefore, the "Five Ws" would be complementary rather than forcing. Older adults could use them as a reminder if necessary.

#### *Design for the older adults' memento story sharing (Sharing Process)*

**The intergenerational memento story sharing should be easier to be initiated by the young, considering that the older adults had the concern that their stories were not appealing to others.** Specifically, I found that although most young participants showed interest in family mementos, the older adults felt ambivalence. They would like to tell stories to their children, either because they hoped to be remembered, or because they felt the responsibility of carrying on family history. However, they worried their children were not interested in their stories. They did not want to bother their children, nor did they want to force them to listen. Therefore, there actually exists a gap between the two generations regarding memento story sharing, which needs to be bridged.

**Cross-generational cooperation.** Although older adults have abundant knowledge of family stories, they normally are not skilled at technology, whilst the young are empowered by technical competence. Therefore, my scheme is cross-generational cooperation: the young are listeners and memory trigger providers, while older adults are the story producers.

#### *Upcoming problem: curation of the digital content (Curating Process)*

**The transition of the memento curators after the physical mementos become digital.** The responsibility of organizing the family's mementos is taken on by a family's primary organizer, who also has a great deal of knowledge of which photos are available within the family's collection (Neustaedter and Fedorovskaya

2009). Generally speaking, older adults were the family’s primary capturer and organizers, who had the most knowledge of what photos had been captured, and what mementos had been collected (Neustaedter and Fedorovskaya 2009). However, after the mementos are digitalized, together with the audios recordings, it would be better to be organized by the young. In this sense, the young act as the curator/ primary photo organizer of digital counterparts (digital photo and audio). The young play the role of the curator of the digital collections.

5.7 Conclusion of *Slots-Memento*

Given the above discussion, I conclude this chapter with Table 5-10 and Table 5-11.

Table 5-10 Characteristics of intergenerational memento storytelling

Mementos	Unlike the young who non-selectively keep every digital artifact into storage, older adults' mementos were of limited quantity and carefully organized, and treasured by them.
	Older adults had desires to preserve mementos. Because they hoped to be remembered, or the responsibility of carrying on family history.
	Older adults' mementos could be classified into three categories: objects, paper documents, and photos (in descending order).
Memento stories	Older adults' memento stories could be summarized as four structural types, with different narrative patterns, and corresponds to four motivations for keeping them.
The young	The young's attitudes towards older adults' mementos and stories were conservative.
Problems	Currently, their mementos could not fully support their reminiscence and storytelling in their daily lives, and four reasons are concluded.
	The older adults had concerns that their stories were not appealing to others.

In the next iteration, to fully involve the older adults’ children, a smartphone application will be designed for the young, together with the re-designed prototype, turning it into a complete system.

Table 5-11 Strategies of designing for their intergenerational memento storytelling

Overall	Intergenerational memento storytelling could be organized into four processes: triggering, telling, sharing, and curating.
Triggering Process	Make the digital counterparts as effective complements to the physical mementos.
	Integrating digital mementos into their daily life through a tangible device.
	Facilitate revisiting to the memento photos through a random photo slideshow.
Telling process	Enhance integrality of stories by providing “Five Ws” when necessary.
Sharing process	The intergenerational memento story sharing should be initiated by the young.
Curating process	The young act as the organizer of digital collections.





## Chapter 6

# STORY-ME: CLOSE THE LOOP

This chapter is largely based on

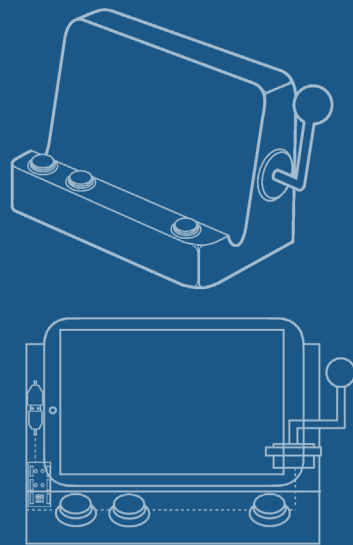
- Li, Cun, et al. “*Story-Me*: design of a system to support intergenerational storytelling and preservation for older adults.” Companion Publication of the 2019 on Designing Interactive Systems Conference 2019 Companion. 2019.



In the previous iterations, I focused more on the senior participants' side, while their children were relatively passive participants. In this iteration, an app was designed for the children, together with the prototype, to form an integrated system. The following questions are addressed: (1) In which ways could interactive technology involve older adults' children? (2) Does such intergenerational storytelling promote connections between older adults and their children?

The prototype in this chapter named *Story-Me*, consists of a slots-machine-like device used by older adults, and a smartphone application used by the young. The slots-machine-like device synthesizes the functions from the 2nd and 3rd iterations, and it focuses on two kinds of stories of older adults: life stories and family memento stories. I present the details of *Story-Me* in Section 6.1. This iteration encompasses two evaluations, preliminary evaluation (Section 6.2) and field study (Section 6.3). Section 6.4 is the discussion, followed by the conclusions in Section 6.5.

In this Chapter, I will not focus on the content that the older adults produce, since it has been explained in previous chapters.



## 6.1 Story-Me

*Story-Me* consists of a slot machine-like device used by older adults, and a smartphone application used by their children.

### *The slots-machine-like device*

The slots-machine-like device is used by the older adults (Figure 6-1). Its appearance follows the previous iteration, and I will only describe the differences. It integrates the function of *Slots-Story* and *Slots-Memento*, with two graphical interfaces: the “Photo interface” and “Question interface”. Accordingly, there are two buttons on the left, which are used to switch between the two interfaces. The button at the right is used to record stories (Figure 6-2).

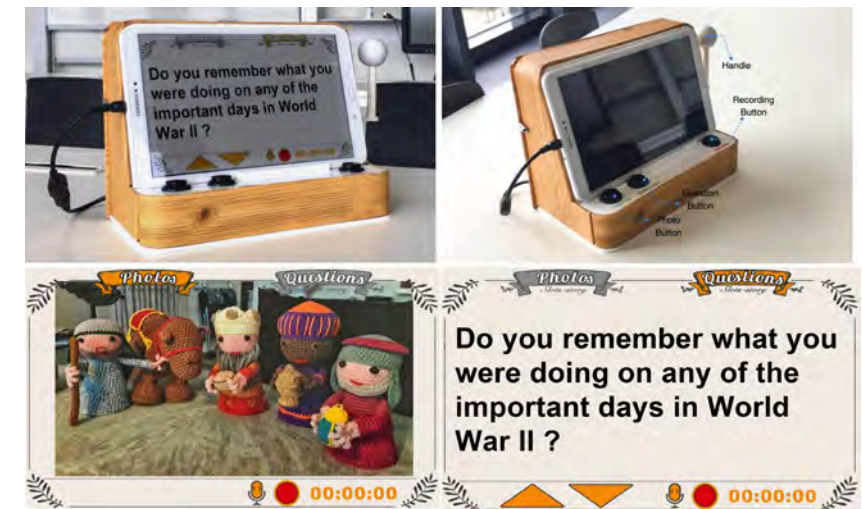


Figure 6-1 Slots-machine-like device and the interfaces



Figure 6-2 *Story-Me* of different views

The smartphone application

The smartphone application is used by the young, as shown in Figure 63. The young could take photos of family mementos and customize trigger questions, and listen to related stories told by the older adults. It contains four tabs, “Camera”, “Photo”, “Question”, and “Setting”.

- “Camera” is used to take photos of mementos.
- “Photo” displays the photo gallery, tap the photo and get to the corresponding audio recordings it present.
- “Question” displays the trigger question and the corresponding audio recordings.
- “Setting” includes often-used setting options.

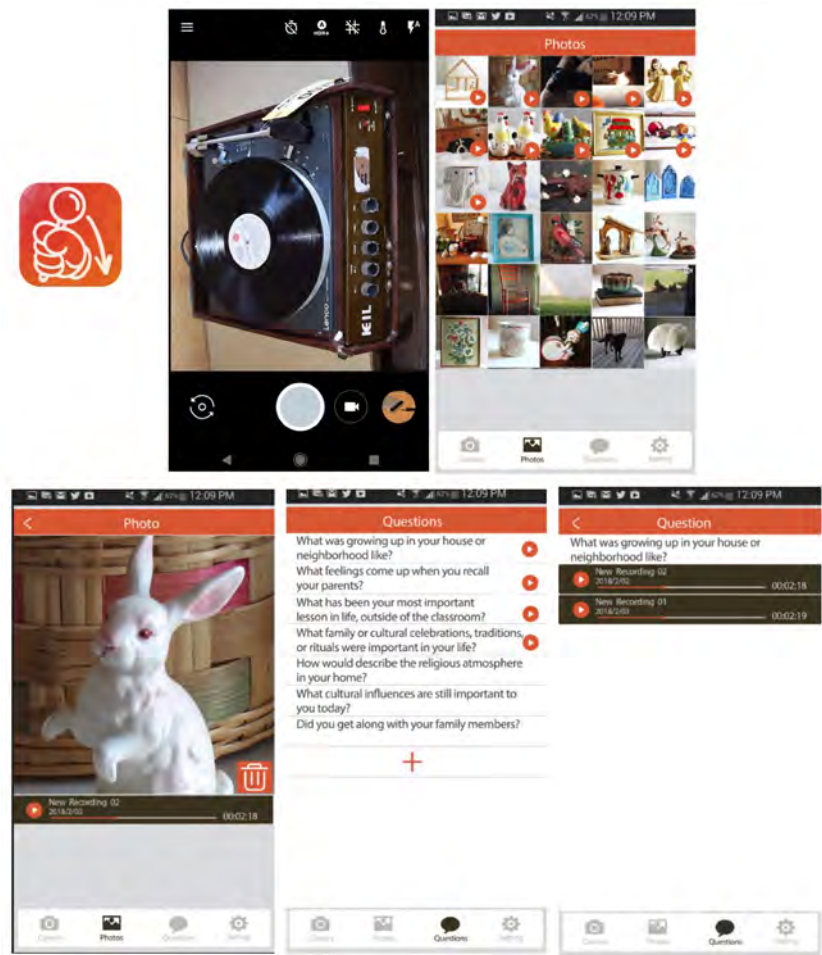


Figure 6-3 Smartphone application interfaces: “Camera”, “Photo”, and “Question”

Hardware

The hardware of *Story-Me* was based on an Android tablet, instead of the Raspberry Pi in *Slots-Story* and *Slots-Memento*. The reasons for choosing the Android platform were threefold. First, the performance and operating rate of Raspberry Pi was limited. Second, the integrated tablet is more stable than Raspberry Pi with external hardware (wireless card, microphone, audio adapter, et cetera). Third, the Android system is relatively open, which can support more external hardware, such as the joystick. The tablet used was Samsung SM-T580, with the Android 7.0 system. It could directly support the joystick without an extra driver. The smartphone application was also android based.

System architecture

Figure 6-4 shows the system architecture. The slots-machine-like device receives the trigger questions and memento photos from the online server, and uploads the audio recordings to the online server. The smartphone application receives the audio recordings and uploads the trigger questions and memento photos.

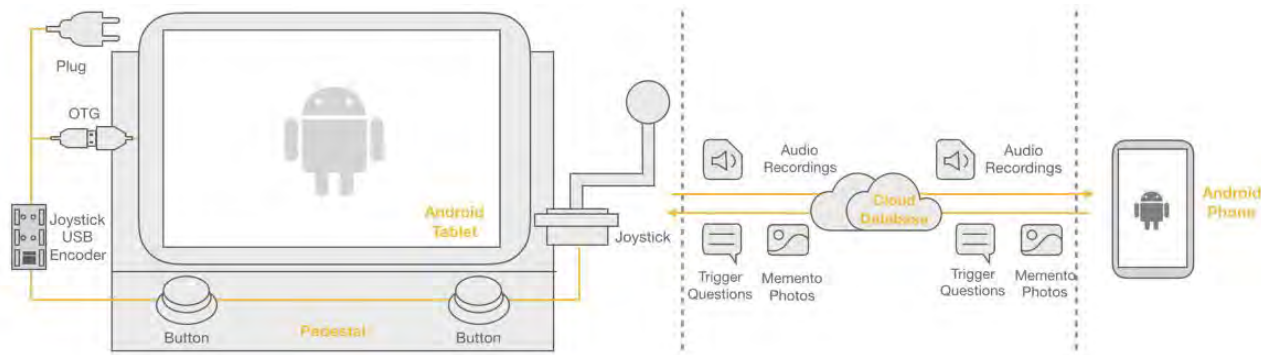


Figure 6-4 Architecture of the *Story-Me*

Figure 6-5 presents the components of the Slots-machine-like device. The Joystick USB Encoder board is the medium to connect the tablet, joystick, and buttons. The lever is 3D printed, which could fit into the joystick component.

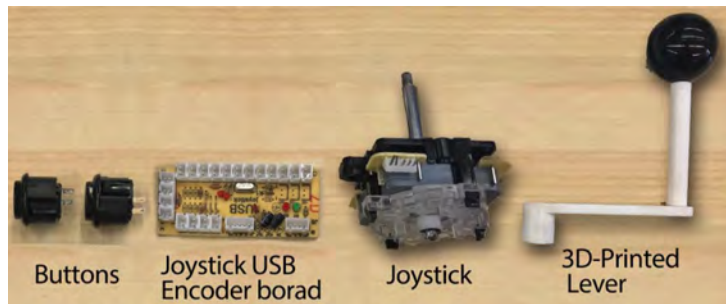


Figure 6-5 Operation components of Slots-machine-like device

## 6.2 Preliminary evaluation

Previous chapters have shown that the tangible device applying the metaphor of slots-machine was accepted by the older adults. However, the acceptability and usability of the integrated *Story-Me* still need to be tested before going into field study. The reasons are as follows: (1) *Story-Me* is a system consist of two components, differing from the previous single device. Especially the smartphone application needs to be evaluated by the young participants. (2) The hardware of the slots-machine-like device changed from Raspberry Pi to an Android tablet, leading to changes in use, such as opening an incoming message.

### 6.2.1 Participants, procedure, and method

#### Participants

The preliminary evaluation was conducted with four older adults living at Vitalis-Berckelhof, Eindhoven, and four young family members. The older adults were recruited according to the recommendations of the caregivers. The ages were as follows: three female older adults, aged 83, 85, and 88, and one male older adults aged 82. Two young female adults aged 31 and 33. Two young male adults aged 32 and 33.

#### Procedure

The evaluation followed three steps. (1) I asked them to sign a consent form; I introduced my research goal to them, and I showed them a video covering all the usage scenarios of the *Story-Me* system. (2) I introduced three tasks to each participant, and asked them to perform these tasks. (3) I interviewed the young and

old participants separately, and thanked all the participants for their contributions. The interviews lasted on average of ten minutes.

The tasks for the participants combined all the basic operations of the physical device or the mobile App, depending on the participant. Every one of them was asked to perform all the tasks related to their dedicated device, in an order that was randomized for each participant.

Tasks for the older adults were:

- Choose one trigger question, record your story and send the audio recording. This task aimed at understanding the acceptability and usability of telling and sending stories based on the trigger question.
- Choose one memento photo, record your story and send the audio recording. This task aimed at understanding the acceptability and usability of telling and sending stories triggered by mementos.
- Open an incoming message. This task aimed at understanding the acceptability and usability of reading new trigger questions and memento photos.

Tasks of the mobile App for the young were:

- Add one trigger question. This task aimed at understanding the acceptability and usability of adding trigger questions.
- Add a photo of a memento. This task aimed at understanding the acceptability and usability of adding mementos.
- Open an incoming message, and listen to the recordings. This task aimed at understanding the acceptability and usability of listening to stories.

#### Method

The methodology was observation combined with an interview. During the evaluation, they were observed to get further insights into their interaction with the system. Afterwards, there was a semi-structured interview, and the following topics were discussed with them:

- *Would you like to use it? And why?*
- *Do you think it could facilitate intergenerational story sharing? Why?*
- *Could you explain the concept of the prototype back to me?*



- *Do you find it easy to use? What is the most difficult part?*
- *Other comments.*

6.2.2 Results

Regarding the slots-machine-like device, overall, the older adults felt the device was designed with simple functions and operations. They thought the handle operation was natural and was consistent with their cognition. They understood the concept. During the observation, I discovered some of older adults encountered difficulties when performing the task for opening an incoming message. Since the opening notification was still touch-screen based on the Android-based prototype, some of them needed to be reminded to use the touch screen to operate. While other senior participants with the experience of using a tablet were familiar with this task and did not require instructions.

Based on the observations and interviews, other improvements needed to be made:

- Audio uploading time will be time-consuming when the recording is long. For example, a two-minute audio takes half a minute to upload. Therefore, feedback such as “uploading, please wait” and “uploaded successfully” were necessary.
- All the questions and photos should be able to be played in a loop.

Regarding the smartphone application, generally, the young participants felt it was easy to use. They appreciated the idea of using mobile phones with tangible interfaces to provide accessibility support to the older members. They believed it could enable stronger intergenerational collaboration. The following suggestions for improvements were made:

- Add number mark to the audio icons to indicate the number of audio recordings.
- Audio files should be named with date and time.
- Questions and audio files should be displayed in a reversed chronological order.

The prototype was further refined accordingly for the field study.

6.3 Field study

This section reports on the deployment of *Story-Me*. As mentioned, in this iteration, I will not focus on the story that the older adults produce, which has been illustrated in previous chapters. Specifically, Section 6.3.1 reports on the method. Section 6.3.2 presents the quantitative results. Section 6.3.3 presents the qualitative results.

6.3.1 Method

Participants

Seven pairs of participants were recruited for the field study, and each pair included an old adult and one of his/her children. Senior participants were recruited in nursing homes by the caregivers’ recommendations. My recruiting criteria were: (1) the older residents had no severe physical or psychological disorders (such as cognitive impairments, such as dementia and Alzheimer’s disease). (2) They were willing to share stories and mementos on an anonymous premise for this study. The education background, previous occupations, and gender were considered as random variables. During the field trial, there were no real hard requirements for the number of trigger questions and mementos. After using the prototype, they were interviewed to reflect on their use of *Story-Me*. Names and data in this thesis are anonymous, and the access to the data is restricted to the research team only.

Table 6-1 Demographic information of the senior participants (SP = Senior Participant, YP = Young Participant, F = Female, M = Male)

Participants	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7
SP	75, F	83, M	81, F	77, M	85, F	76, F	79, F
YP	41, F	43, F	50, M	41, F	56, F	44, M	51, M

Interview

Interview topics with the older adults included the following:

- *Did you and your children contact with each other, during and after the deployment? Why?*
- *Do you feel closer to each other? Why?*
- *Would you like to use it face-to-face or remotely?*

- *Do you find it easy to use?*
- *What are your feelings and opinions on the project?*

Interview topics with the older adults’ children included the following:

- *What are your feelings after listening to the stories?*
- *Did you and your parents contact with each other, during and after the deployment? Why?*
- *Do you feel closer to each other? Why?*
- *Which one do you prefer: stories with plots, or subjective feeling?*
- *Would you like to use it face-to-face or remotely?*
- *Which part of the App do you like/ dislike? Why?*
- *Do you have other comments for improvement?*

The Grounded theory techniques (Corbin, Strauss, and others 2008) were applied to analyze the interview data, so as to allow themes to emerge in a bottom-up manner.

6.3.2 Quantitive results

In this section, I first present an overview result. Since in Chapter 4 and 5, I have analyzed the stories comprehensively, I will not focus on the content of their stories. Rather, I will report the trigger questions and mementos of the field study.

Overview result

A total of 303 trigger questions and 112 memento photos were chosen and captured by the participants. The average number of trigger questions for each pair was 43.3, and the average number of memento photos was 16. As is shown in Table 6-2.

Table 6-2 Number of trigger questions and mementos used by each pair

	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7
Number of trigger questions	26	105	43	29	36	32	32
Number of memento photos	14	18	15	20	12	15	18

Results of trigger questions

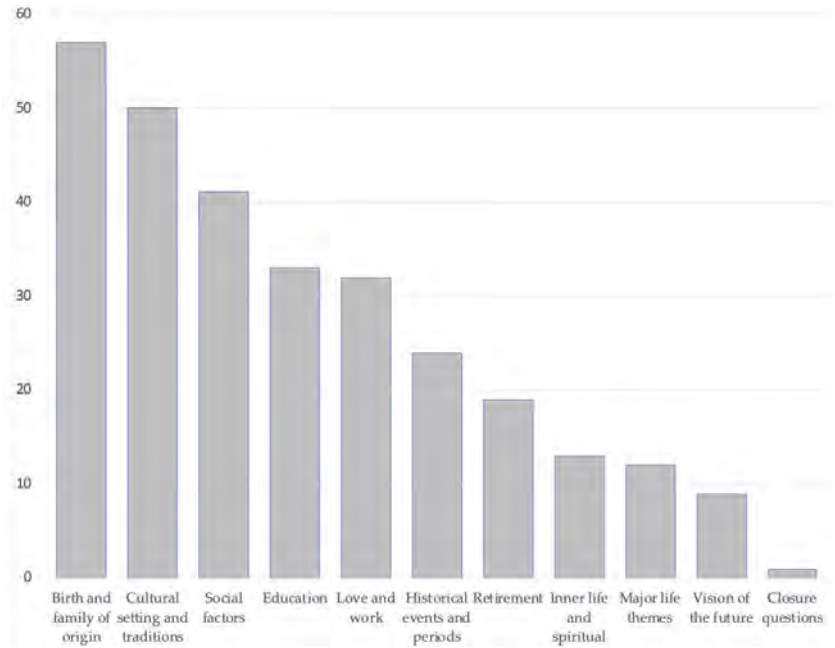


Figure 6-6 Overall results of the categories of trigger questions

As mentioned, the initial trigger questions in this study came from The Life Story Interview (Atkinson 1998), covering the following aspects: “*Birth and family of origin*”, “*Cultural setting and traditions*”, “*Social factors*”, “*Education*”, “*Love and work*”, “*Historical events and periods*”, “*Retirement*”, “*Inner life and spiritual awareness*”, “*Major life themes*”, “*Vision of the future*”, and “*Closure questions*”. Young participants could directly choose questions, and add personalized questions. Figure 66 gives an overall result of the categories of trigger questions chosen by each pair. The top three trigger question categories were “*Birth and family origin*”, “*Cultural setting and traditions*”, and “*Social factors*”. While the last three categories were “*Closure questions*”, “*Vision of the future*”, and “*Major life themes*”. This result was basically consistent with the results in Chapter 4.

The following table shows the detailed trigger questions of each pair:

	P1	P2	P3	P4	P5	P6	P7
BIRTH AND FAMILY OF ORIGIN							
What was going on in your family, your community, and the world at the time of your birth?		1	1		1		1
Were you ever told anything unusual about your birth?		1	1				1
Are there any family stories told about you as a baby?		1	1		1		1
Do you remember anything about your first year of life?		1	1				1
What characteristics do you remember most about your grandparents? What do you like most about them? What do you like least?			1		1	1	
How would you describe your parents?	1						
How would you describe your mother's personality and emotional qualities?			1	1			1
How would you describe your father's?			1				1
What do you think you inherited from them?			1	1		1	
What feelings come up when you recall your parents?			1		1	1	
What is your earliest memory?		1	1			1	
CULTURAL SETTING AND TRADITIONS							
What is the ethnic or cultural background of your parents?					1		
Were there any stories of family members or ancestors who emigrated to this country?							1
Was there a noticeable cultural flavor to the home you grew up in?							1
What family or cultural celebrations, traditions, or rituals were important in your life?					1		1
Was your family different from other families in your neighborhood?		1		1			
What cultural values were passed on to you, and by whom?							
What beliefs or ideals do you think your parents tried to teach you?	1			1			
What was your first experience with death? What was that like for you?		1					
Was religion important in your family?		1					1
How would describe the religious atmosphere in your home?		1					
Did you attend religious services as a child, as a youth? What was that like for you?		1		1			1
Was religion important to you as a child, as a youth?		1		1			1
Were there any religious ceremonies that you observed?		1					
Is religion important to you now?							1
What cultural influences are still important to you today?		1			1		
How much of a factor in your life do you feel your cultural background has been?	1	1					
SOCIAL FACTORS							
Did you feel nurtured as a child?							
Were you encouraged to try new things, or did you feel held back?	1						
What do you remember most about growing up with, or without, brothers and sisters?		1	1	1	1	1	1
Did you get along with your family members?		1					1
Did your parents spend enough time with you?		1	1				1
What did you do with them?		1	1				1
What were some of your struggles as a child?		1			1	1	
What was the saddest time for you?		1					
How was discipline handled in your family?		1		1		1	
What would you say was the most significant event in your life up to age 12?		1			1		
Did you make friends easily?	1	1				1	
What childhood or teenage friendships were most important to you?		1		1			
What pressures did you feel as a teenager, and where did they come from?		1	1				
Were you athletic?		1					1
What clubs, groups, or organizations did you join?		1					
Did you enjoy being alone, or was that too boring?		1					
Was social class important in your life?		1					
What was the most trouble you were ever in as a teenager?		1					
What was the most significant event of your teenage years?		1	1				
What was being a teenager like? The best part? The worst part?		1	1	1			
What was your first experience of leaving home like?		1			1	1	1
What special people have you known in your life?		1					
Who shaped and influenced your life the most?	1	1		1		1	
Who are the heroes and heroines, guides and helpers in your life?		1					
What social pressures have you experienced as an adult?		1					
Were you in the military? What was this experience like?							
How do you use your leisure time?		1			1		
Is a sense of community important to you? Why? How?		1				1	

EDUCATION							
What is your first memory of attending school?	1	1				1	
Did you enjoy school in the beginning?	1	1				1	
What do you remember most about elementary school?	1	1					1
Did you have a favorite teacher in grade school? In junior high? In high school? How did they influence you?	1	1					
What are your best memories of school?	1	1	1				1
What are your worst memories of school?	1	1					
What accomplishments in school are you most proud of?	1	1					
What do you remember most about college?	1	1					
What organizations or activities were you involved with in school? In college?	1	1					
Was the most important course you took in school or college?	1	1				1	
What was the most important book you read?	1	1					
What did you learn about yourself during these years?		1					
What has been your most important lesson in life, outside of the classroom?	1	1					
What is your view of the role of education in a person's life?	1		1				
LOVE AND WORK							
Do you remember your first date? Your first kiss?							
Did you have a steady boy or girlfriend in high school?							
Was it a struggle for you matching your own attitudes toward sex when you were growing up with those of society?							
What was the most difficult thing about dating for you?							
How would you describe your courtship?							
What was it about her or him that made you fall in love?						1	
What does intimacy mean to you?							
What roles do they play in your life?							
What values or lessons do you try to impart to them?						1	
What has been the best and worst parts about marriage?						1	
Did you have any dreams or ambitions as a child? As an adolescent? Where did they come from?	1	1		1			1
Did you achieve what you wanted to, or did your ambitions change?		1				1	
What events or experiences helped you understand and accept your adult responsibilities?	1						
Has your work been satisfying to you, or has it been something you had to put your time into?							
What is important to you in your work?						1	
What is most difficult about your work?							1
Why do you do this work?							
When did you realize you had become an adult?						1	
Do love and work fit together for you in your life?							
HISTORICAL EVENTS AND PERIODS							
What was the most important historical event you participated in?	1			1			1
What is the most important thing given to you by your family?	1				1		1
What is the most important thing you have given to your family?	1						1
Do you recall any legends, tales, or songs about people, places or events in your community?	1	1	1				1
What is different or unique about your community?	1	1	1				1
Are you aware of any traditional ways that families built their buildings, prepared their food, or took care of sickness?	1					1	1
What did your work contribute to the life of your community?							
RETIREMENT							
What was retiring from work like for you?							
Did you miss it, or were you glad to have it over?						1	
How do you feel about your life now that you are retired?							
What do you do with your time now?							
What is the worst part about being retired? What is the best part?						1	
Have all your children left home?							
Do you have grandchildren?						1	
Do you like spending time with them?		1	1				1
What do you enjoy most about your grandchildren?		1	1				
What do you hope to pass on to your grandchildren?	1	1	1			1	1



INNER LIFE AND SPIRITUAL AWARENESS							
Do you think you had a happy childhood?	1	1		1	1	1	
What was your happiest memory from childhood?		1	1	1	1	1	1
Did you feel loved as a child?	1	1					
Did you have any deep thoughts, or inner dreams as a teenager?		1				1	
What was it like to turn 30, 40, 60?		1	1				
What are the stresses of being an adult?		1					
What transitions or turning points did you experience as a teenager/as an adult?	1	1			1		
What changes have you undergone since 40? since 50 (or beyond)?		1					
What primary beliefs guide your life?		1	1				
How do your spiritual values and beliefs affect how you live your life?		1					
Do you have a concept of god or a higher power?							1
Has imagination or fantasy been a part of your life?							1
Do you feel you have inner strength? Where does that come from?						1	
How would you renew your strength, if you felt you were really drained?	1				1		1
What values would you not want to compromise?		1	1				
What do you see as the purpose of life?							
What do you see as the highest ideal we can strive for?							
Do you feel you are in control of your life?							
What single experience has given you the greatest joy?	1	1	1				
What is your view on why there is suffering in the world?				1	1		
Did you ever have any doubts about achieving your goal in life?							
Do you feel at peace with yourself? How did you achieve this?	1	1		1	1		
MAJOR LIFE THEMES							
What gifts (tangible or intangible) are still important to you?	1	1			1	1	
What were the crucial decisions in your life?		1				1	1
What has been the most important learning experience in your life? What did it teach you?		1					
Have there been any mistakes in your life? How have you overcome or learned from your difficulties?		1					
How do you handle disappointment?	1	1			1		
Are you satisfied with the life choices you have made?		1					
Is there anything you would change?		1	1				
What has been the happiest time in your life?		1	1		1	1	
What was the least enjoyable time?		1	1				
What relationships in your life have been the most significant?		1					
Has there been a special person that has changed your life?	1	1				1	
What have been your greatest accomplishments?		1					1
Are you certain of anything?		1	1				
What are some things you hope you never forget?	1	1			1		
How do you feel about yourself at the age you are now?		1					
What is your biggest worry now?		1		1			1
In what ways are you changing now?	1	1					
What has been the greatest challenge of your life so far?		1			1	1	
What has been the most awe-inspiring experience you ever had?		1					
What matters the most to you now?		1					
What time of your life would you like to repeat?	1	1					
What was the most important thing you have had to learn by yourself?		1		1	1		
How would you describe yourself to yourself at this point in your life?							
Is the way you see yourself now significantly different than it was in the past?							1
How would you describe your worldview?			1				
Vision OF THE FUTURE							
When you think about the future, what makes you feel most uneasy?				1		1	
What gives you the most hope?	1	1					
Is your life fulfilled yet?							1
What would you like to achieve so that your life will seem fulfilled?					1		
What do you see for yourself in the future. In 5, 15, 25 years?							
What is your view on death?							
What do you want most to experience before you die?							
Do you have any advice or wisdom for the younger generation?		1		1	1		
CLOSURE QUESTIONS							
Is there anything that we've left out of your life story?		1					
Do you feel you have given a fair picture of yourself?							
What are your feelings about this interview and all that we have covered?							
PERSONALIZED QUESTIONS							
	2	3	1	0	2	4	2

Figure 6-7 The detailed trigger questions

Results of mementos

I will have a brief report in this section, in addition to the detailed analysis of the mementos in Chapter 5. In total, 122 mementos were collected in the field study. The average number of the captured mementos per pair (after removing repeated ones, since one memento might correspond to multiple photos) was 17.4. The categorization follows the method used in Chapter 5, which is: **Object**, **Paper document**, and **Photo**. In this study, **Photo** was still the most popular memento type accounting for 50%, among which “Family member” was the most used photo, which was consistent with the previous iteration. It is followed by “Activity”, including festivals and life events. Next was “Marriage”. The **Object** related mementos, they account for 29.5%, among which the most used memento was “Inherited from parents”, which were normally very precious artifacts. It was followed by “Bought”. Next was “From friends”, which could remind them of the relationship with friends. The remaining 20.5% were **Paper documents**, among which “Certificates” were the most used, including graduation and qualification certificates, which they were proud of. It is followed by “Postcards/letters”, representing relationships with the senders. This result was consistent with the results in Chapter 5.

Table 6-3 Types of the mementos, the absolute numbers, and the percentages

Memento	N (%)	Memento	N (%)	Memento	N (%)
<b>Photo</b>	<b>61 (50)</b>	Animal	2 (1.6)	<b>Paper document</b>	<b>25 (20.5)</b>
Family member	19 (15.6)	<b>Object</b>	<b>36 (29.5)</b>	Certificate	8(6.6)
Activity	13 (10.7)	From parents	13 (10.7)	Postcard/letter	7 (5.7)
Friend	11 (9.0)	Bought	8 (6.6)	Painting	5 (4.1)
Marriage	7 (5.7)	From friends	6 (4.9)	Other	3 (2.5)
Object	3 (2.5)	Travel souvenir	4 (3.3)	Inscription	2 (1.6)
Scenery	3 (2.5)	Self-made	3(2.5)		
Other	3 (2.5)	Other	2 (1.6)		

### 6.3.3 Qualitative results

This section presents the interview findings, including the following aspects. The older adults' feelings and opinions on the prototype; the young participants' feelings and opinions on the prototype; their communication during and after the field study; whether the intergenerational storytelling promotes connections between older adults and their children; two types of audio recordings: stories with plots and subjective feelings.

#### *The older adults' feelings and opinions*

- First, the senior participants appreciated that *Story-Me* provided an opportunity for them to tell stories for which they generally did not have an opportunity for sharing. One said: *"The project builds a bridge for us two generations. This allows me to talk about what I usually never get a chance to say, and what I can't remember."*—SP5, F. The other said: *"When I was little, I dreamed of being a writer. I have never talked about my dreams to my children, until this project."*—SP1, F.
- Second, the project helped enhancing intergenerational mutual understanding. One said: *"The cause of generation gap, is lack of mutual understanding. I think talking about past things contributes to it."*—SP7, F.
- Third, the project also contributed to family history preservation. One said: *"My children maybe not interested now, but they could listen to it in the future."*—SP6, F.
- Finally, while for the reminiscence process, they enjoyed and felt happy. One said: *"I feel as if I going back to the past, and suddenly, I realize I am old."*—SP4, M.

#### *The young participants' feelings and opinions*

For the young participants, I concluded the following finding.

- First, despite that they knew most of the stories, they still learned something they did not know before, as one said: *"We didn't talk much about stories when I was an infant. It is blank to me. I have just known that it was snowing when I was born."*—YP3, M. Even for the stories that the young had known, they re-learned their parents in a more detailed way, as one said: *"I realize that she experienced the ups and downs of life, after listening to her stories."*—YP7, M. They understood their parents from a deep level, as one said: *"Without the storytelling in person, I couldn't have such a deeper understanding."*—YP4, F.

- Second, the young were moved by the stories, as one said: *"I can feel that my mother was very happy when she recalled her youth, and I feel happy for her."*—YP6, M. This emotion of being moved also stemmed from the great contrast between their parents' youth and now, as one said: *"He tells his happy childhood, but now he is more than 80. This is indeed a huge contrast."*—YP7, M. Therefore, they sighed, when realizing time flies and realized the importance of staying in touch with parents, as one said: *"Time is flying. I feel I have more to lose than gain. I didn't treasure the family time."*—YP2, F. The young were also touched by their parents' love for them, as one said: *"I felt moved with tears in my eyes when I heard that she said my birth gave her the greatest joy."*—YP1, F.
- Third, the stories raised their empathy and increased their understanding of their parents, especially for the second-generation immigrant, as one said: *"Only after I had heard his childhood and youth, did I understand my father's living environment was so different."*—YP5, F.

#### *Communication during and after the field study*

As expected, most of the young contacted their parents after listening. The first motivation was that they wanted to know more details of the story, as one said: *"I ask her a lot about her childhood life, after listening to her recordings."*—YP6, M. Second, the project made the young realize the importance of staying in touch with parents, as one said: *"I realize I spent little time with my mother, let alone heart-to-heart talk with her."*—YP3, M. Surprisingly, some young participants did not want to contact their parents specifically, as one said: *"I won't deliberately make a phone call to ask my mother. But next time when I visit her, I will talk about that naturally."*—YP5, F.

#### *Whether intergenerational storytelling promotes connections between older adults and their children*

All of the young participants agreed that after listening to the stories, they felt closer to their parents. Based on the interview, I concluded the following reasons.

- The first reason was obvious. They better understood their parents through the shared stories, in a comprehensive and multi-dimensional way. One said: *"My mother's image in my heart is clearer and more vivid, after knowing her past."*—YP6, M. For some participants, they even felt they rediscovered the older adults, as one said: *"She told her life experiences, from school to work, I feel like I know her again."*—YP5, F.

- Second, they realized to look at issues from their parents' perspective to look at issues, and respect them more, especially for the second-generation immigrant. One said: *"I think it is possible to deepen my understanding of my parents, and I feel that life in his time was hard. I have more respect for them."* —YP4, F.
- Third, some participants discovered commonalities with their parents inadvertently, such as interests, dreams, and character. These commonalities contribute to strengthening the bond between the two generations. One said: *"I find she had the same dream as me. We all wanted to be a teacher during our childhood. I didn't know before."* —YP5, F. The other said: *"I find we had both a very naughty childhood. Haha."* —YP1, F.
- Fourth, the stories made the young feel their parents' love, and they were touched. One said: *"I remember that for the question What experience has given you the greatest joy? She said it was my birth, and I was really moved when hearing this."* —YP1, F.
- Finally, it can be related to the family identity. The family stories raise amongst the young participants a sense of belonging with their family. As one said: *"He was taught by his father to value the family harmony. It is the most cherished tradition in our family. I agree with that, and I think that's why I have a happy home atmosphere."* —YP2, F.

### *Two types of audio recordings: stories with plots and subjective feelings*

Some of the audio recordings were concrete stories with plots. For example, some audio recordings were related to the trigger questions *"What are your best memories of school?"*. At the same time, other audio recordings were about subjective feelings. For example, some audio recordings were related to the trigger question *"What do you hope to pass on to your grandchildren?"*. I was interested in the young's preferences for these two types. I found that most young participants had preferences for concrete stories. First, because audio recordings with concrete plots were not tedious but absorbing. One said: *"Stories are more interesting, and it brings me back to childhood's story times."* —YP7, M. Second, because they were relatively more concrete than subjective feelings. One said: *"Stories are vivid, and let me understand things that happened to her more clearly."* —YP3, M. Third, because audio recordings with concrete plots were more impressive and memorable. One said: *"Stories could leave me a deeper impression, because they are concrete people, events and things."* —YP2, F.

### *Comments and suggestions*

Regarding usability aspects, most of the older adults found it easy to learn and operate *Story-Me*. As one said: *"It is not hard to use. Press the button before talking, and press it again after talking."* —SP2, M. Some participants mentioned they got help from their children. One said: *"At first I didn't quite understand how to use it, and my daughter taught me."* —SP4, M. Two senior participants appreciated the repeat recording for the same question or photo. One said: *"If I need to add anything after recording, I just need to push the recording button again. That's why I have several recordings for each question."* —SP1, F. The other said: *"Once I remember, I could add by simply pressing the button. It is like writing a diary."* —SP7, F. As for the improvements, most older adults complained about the lack of a delete function. As one said: *"I don't know how to delete the useless recordings, So I need to make drafts in my mind before speaking. It makes me a bit stressed."* —SP6, F. Finally, there was an older adult who had an iPad and had related use experiences, so he could use the Android tablet directly.

All the young participants reported that the App was generally satisfying. Regarding usability, since currently there was no delete function in the App for the young, not surprisingly, they hoped to add that function. The young suggested adding more functions to the current simple App. One said: *"The interface and functions of this App are too simple. Apps we use every day, like WhatsApp, Facebook, are far more complicated than it. After all."* —YP6, M. Specifically, the App should also record the young's voice. As one said: *"I have lots of feelings when listening. The App should help me to record them, and they could be sent to my mother, or kept by myself."* —YP1, F. Moreover, they suggested to improve the curation of digital content. Moreover, some trigger questions were too closed, as one said: *"For the question 'Did you enjoy being alone, or was that too boring?' his answer is just 'I enjoy being alone. That's all.'" —YP4, F. Next, the "Photo Interface" could also include trigger questions. One mentioned that: "For example, his watch, he talked about the date, the price, et cetera. But I want to know why he bought the watch."* —YP2, F. Therefore, to make the memento storytelling more concrete, related trigger questions could be provided, such as Who was involved? What happened? Where did it take place? When did it take place? Why did that happen? And how did it happen? (Spencer-Thomas 2012). Regarding usability, one mentioned that the sensitivity of the touchpad needs to be enhanced.

## 6.4 Discussion



This section discusses the two research questions.

6.4.1 In which ways could interactive technology involve older adults' children?

*Coordinate the interests of different generations to avoid aimless story collecting*

The interests of these two generations should be coordinated. In order to avoid blind storytelling by the older adults, in this research, the young could choose trigger questions and mementos for their parents. This way, the role of the story listeners(the young) is highlighted. Previous research indicates the importance of the role of story listeners, pointing out that story sharing is a collaboration process requiring the participation of both storyteller and story listener, and it makes sense only when both old and young generations participate and engage in (Waycott et al. 2013) and (Kemper 1984). My research further points out that the story listener could not only be the audience, but also be the memory trigger provider (trigger questions and mementos in my case), acting as “filter” and “selector”. That is, the young generation chooses what they are interested in to invite the older adults to tell. The overall story sharing is achieved in a generation cooperation manner. During this process, the older adults gain a sense of satisfaction and fulfillment, while their children understand the family better. It also makes older adults feel that their children are interested in their life stories.

*The older adults' children act as the curator of the digital collections*

There was a transition of the role of the curator after the story and memento became digital. Older adults were the primary capturer and organizers of family mementos and stories (Neustaedter and Fedorovskaya 2009). However, after the mementos and stories are digitalized, the content will be organized by the young. In this sense, the young act as the curator and the primary organizer of digital photos and audios. The young further play the role of the curator of the digital collections.

**Three directions of digital content curation.** The accumulation of digital content will inevitably bring overwhelming pressure on organizing and managing the digital collections. For example, Figure 6-8 shows the audio recordings and questions of the *Story-Me* smartphone application. Although most young participants state they would make good use of the digital content and treasure them,

currently, they are in a state of being overloaded due to a lack of curation of digital content (Biemans et al. 2009). Collecting serves little purpose without retrieval. Therefore, curation and easy retrieval are two critical issues. Based on the feedback and literature, three directions could be derived:

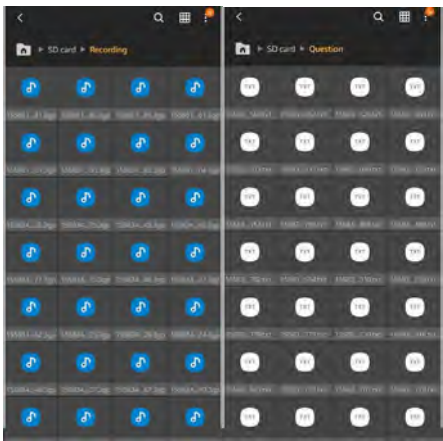


Figure 6-8 Audio recordings and questions of the *Story-Me* smartphone application

First, facilitate curation through metadata. Curating digital content with the aid of metadata is not new. Digital collections contain metadata (information about the time, location, duration, et cetera.), which could be clustered according to the parameters in the metadata (Cooper et al. 2005). Despite that not all the metadata are available in my case, the metadata could reduce the burdens of management and maintenance to support access and retrieval of digital media. An accompanying system or function that aids in organizing the digital collections could be further developed in the future.

Second, digital collections in my study are raw materials for digital storytelling. Digital storytelling is the process of creating a narrative, with a combination of text, still photographs, audio, and animations (Fields and Díaz 2008). Figure 6-10 (left) is an example of a digital story from the website “digitalstorytelling”. Traditionally, methods of storytelling collection are realized through interviews, and visual images and interview produced multimodal outputs (D. Davis 2011). *Story-Me* contributes to life story and memento story acquisition since it is a story collector. The digital collections could be developed into a multimedia album, or transcribed into text to make a biography, et cetera.

Third, building links between physical mementos and related audios facilitates

retrieval. Previous research suggests that people like to augment their mementos with spoken stories, and physical mementos are logical access points to the digital collection (Jansen, van den Hoven, and Frohlich 2014). QR codes or NFC tags can be used (Figure 6-9: right). Therefore, to make easy access to digital collections, building links between physical mementos and related audio recordings could be an option.



Figure 6-9 Left: Website “digitalstorytelling” (screenshot taken on 6-April-2020) <sup>1</sup>. Right: NFC technology enables storytelling from Bizongo (screenshots taken on 6-April-2020) <sup>2</sup>

*Differences between using the prototype independently and face-to-face*

**Three advantages of using the prototype independently by older adults.**

The first advantage of using the prototype independently is eliminating the interplay between the interviewer and interviewees. Traditionally, a life story biography needs to be conducted by a professional interviewer. In the traditional manual life story interview, the interplay between interviewer and interviewee was a central concern. The interviewer’s characteristics are bound to affect the course the interview will take. The interviewee may be influenced or even dominated by the interviewer, which made collecting information positively misleading (R. L. Miller 1999). Non-involvement of the interviewer is the ideal but unattainable situation. The *Story-Me* could eliminate the interplay between interviewer and interviewees to some extent. Older adult interviewees could freely choose wherever and whenever they want to tell their life stories. In this sense, *Story-Me* makes it possible that stories could be told in a way that is both natural and comfortable for older adults.

Second is making the storytelling more focused and less interrupted. When older

adults use the prototype by themselves, in an asynchronous way, they can totally calm down to reminiscence and are entirely concentrate to tell the past with deeper insights. As one senior participant pointed out in the interview, when telling stories by herself, she could focus on the reminiscence and recalling, and she needed not to care about other’s attitudes or expressions, nor did she worry about being interrupted.

The third advantage is that it leaves rooms for older adults to tell their life stories. As the young interviewees pointed out, the prototype was a promising way to ask some questions that would be awkward to ask face-to-face. Likewise, older adult interviewees also expressed their concern that they felt shy when talking about embarrassing topics. Using *Slots-Story* separately could naturally alleviate this problem.

**Story-Me is a conversation topic generator when used face-to-face.** It is a natural chat, and the storytelling serves for conversations- the young act as the listener and provides instant feedback. The storyteller (older adults) monitors the reaction of the audience. They need to ensure the audience stays engaged by appealing to the audience’s attention. Accordingly, the audio recordings are mixed with both the storyteller and the audience, and stories they told are not complete but fragmented.

**6.4.2 Does such intergenerational storytelling promote connections between older adults and their children?**

The field study leads to a conclusion that intergenerational storytelling promotes connections between older adults and their children.

First, intergenerational cooperation promotes intergenerational communication. The *Story-Me* system contains two phases: The young provide memory triggers and the older adults tell stories. Older adults have the demand for preserving their lives, but they lack appropriate tools. Given that older adults usually are not skilled in technology, with the scheme of intergenerational collaboration, the young and older adults had different duties: memory triggers are provided by the young, and older adults are the story producers. Not only the stories themselves retain elements of intimacy and personal connection, but also intergenerational communication and conversation are generated. In the sharing process, the young generation gets a better understanding of their families’ past, while older adults feel more fulfilled.

1 Screenshot taken from [https://digitalstorytelling.coe.uh.edu/view\\_story.cfm?vid=478&otherid=searchds&d\\_title=none](https://digitalstorytelling.coe.uh.edu/view_story.cfm?vid=478&otherid=searchds&d_title=none)

2 Screenshot taken from <https://www.youtube.com/watch?v=JZ4sTow17tk>

Second, based on the interview, intergenerational bonds could be promoted by intergenerational storytelling in the following ways:

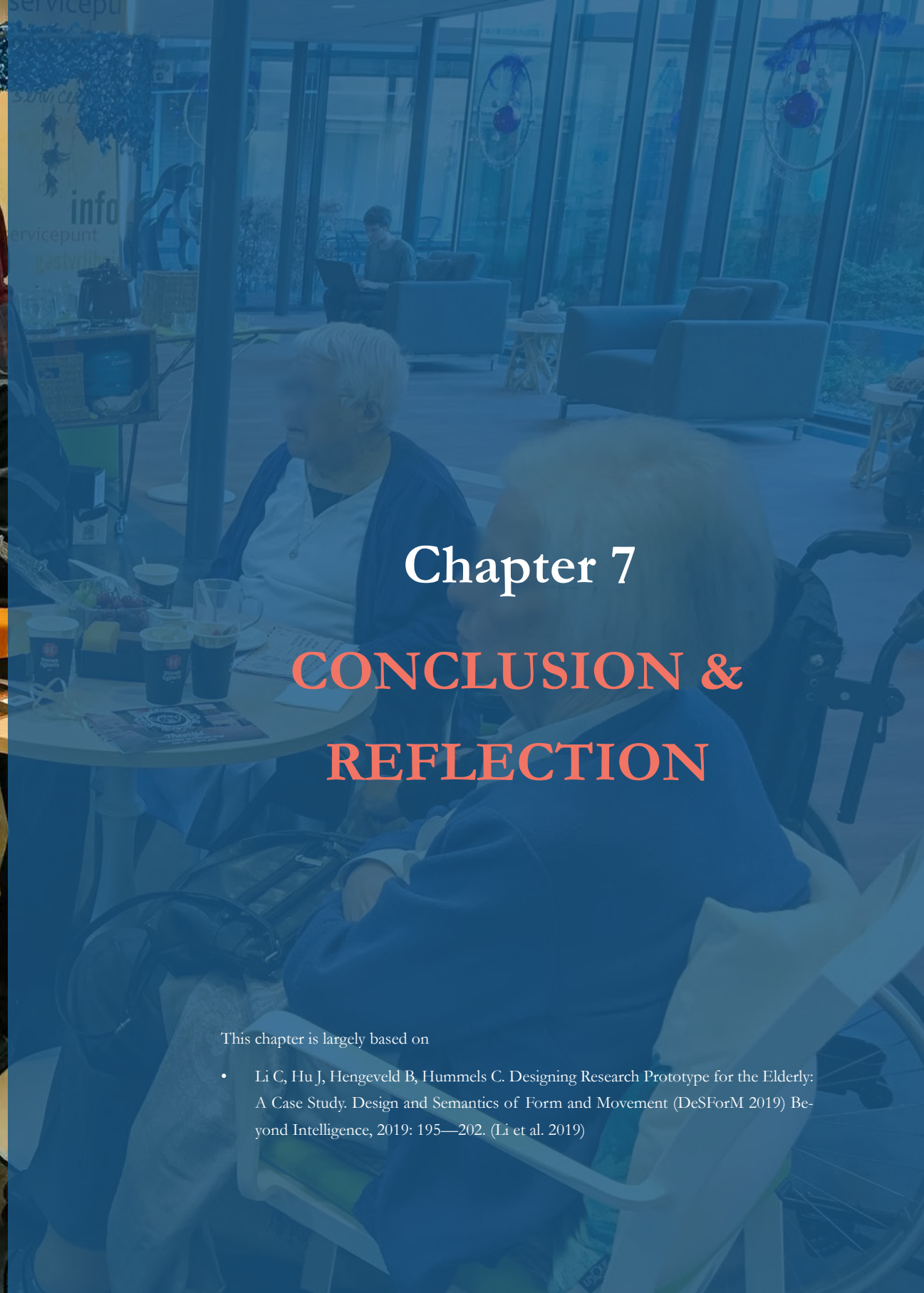
- Story sharing helps the young understand their parents in a comprehensive and multi-dimensional way.
- Story sharing enables the young to have empathy for their parents.
- Story sharing helps the young to discover similarities between them and their parents.
- Story sharing makes the young feel their parents’ love.
- Finally, story sharing raises the young participants’ sense of belonging with their family.

6.5 Conclusion

In this chapter, I reported on the deployment *Story-Me*, a system facilitating intergenerational story-sharing between older adults and their children. The field study indicates that story sharing could promote the connections between the two generations. Given the above discussions, I conclude with the following insights.

In which ways could interactive technology involve older adults’ children?
Coordinate the interests of different generations to avoid aimless story collecting.
The listener could not only be the audience, but also be the memory trigger provider.
The older adults’ children act as the curator of the digital collections.
Using the prototype separately eliminates the interplay between interviewer and interviewees, makes the stories complete, and leaves rooms for older adults to tell their life stories.
Using <i>Story-Me</i> face-to-face promotes conversation between the two generations, and vice versa.
How does such intergenerational storytelling promote connections between older adults and their children?
Intergenerational cooperation promotes intergenerational communication.
Intergenerational storytelling promotes intergenerational bonds, through understanding, empathy, similarity, and feeling love and belonging.





## Chapter 7

# CONCLUSION & REFLECTION

This chapter is largely based on

- Li C, Hu J, Hengeveld B, Hummels C. Designing Research Prototype for the Elderly: A Case Study. Design and Semantics of Form and Movement (DeSForM 2019) Beyond Intelligence, 2019: 195—202. (Li et al. 2019)



In this closing chapter, I present the conclusions and reflections. The former is aimed at answering the research questions, while the latter presents additional reflections.

At the very beginning of this thesis, I formulated an open question of study:

*How can interactive technology facilitate intergenerational storytelling, specifically for non-tech-savvy older adults?*

The four sub-questions were:

*RQ1: What are the characteristics of older adults' storytelling?*

*RQ2: In which ways could interactive technology facilitate older adults to tell stories?*

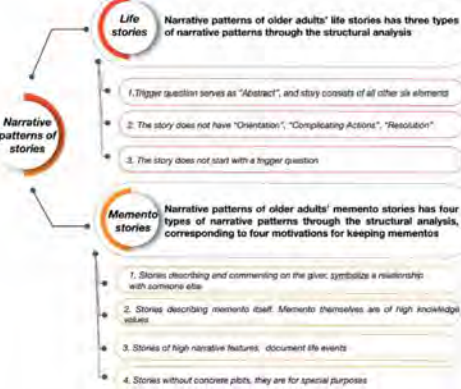
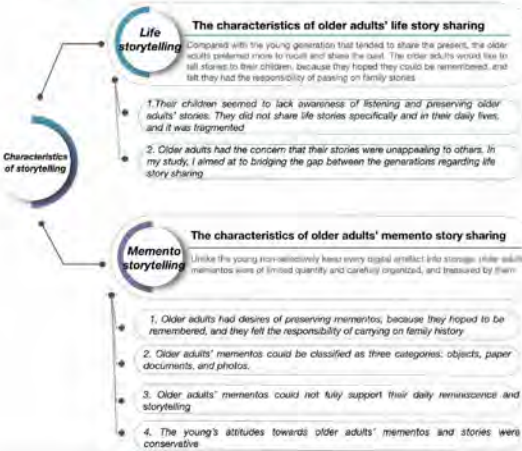
*RQ3: In which ways could interactive technology involve older adults' children for intergenerational storytelling?*

*RQ4: Does such intergenerational storytelling with interactive technology promote connections between older adults and their children?*

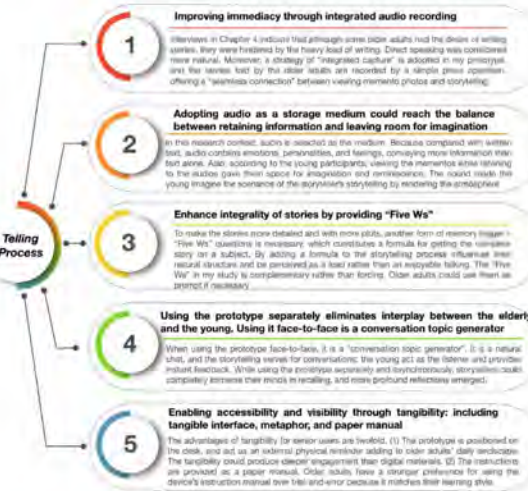
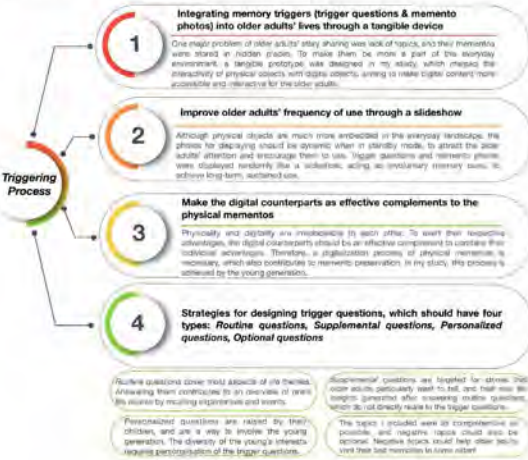
To answer this question, I followed a design research process of explorations and iteration. I described the exploration to identify my research focus in Chapter 2: a team project named *Vien-brick* together with Xu Lin and Kai Kang (Lin et al. 2016) (Kang et al. 2018). We developed and implemented the system, yet from different perspectives. For me, the *Vien-brick* was an explorative system, aiming to understand the situation of older adults' social interaction, narrow down my research focus, and define my PhD research question. The results indicated that older adults could be deemed as story content producers, and their children as their "audience". To offer insights into my research focus, I carried out a literature review (Chapter 3), exploring the state-of-art in the field of older adults' intergenerational storytelling and technology accessibility.

Chapter 4, 5, 6 presented my three Research-through-Design iterations: Chapter 4 focused on the life stories of older adults. In the field study, interviews were conducted after the deployment. Stories collected through the prototypes were analyzed from three dimensions: thematic, structural, and interactional analysis. As some story themes were concerning family mementos (photos, souvenirs, letters, et cetera.), I turned my attention to them in Chapter 5. Chapter 5 focused on memento stories of older adults. The prototype presented in this chapter was *Slots-Memento*, which was an iteration of *Slots-Story*. In the field study, semi-structured interviews were conducted with older adults and their children, before and after the deployment. Mementos were categorized and analyzed. Stories were transcribed, then analyzed with the method of thematic, structural, and interactional analysis. Finally, I found the importance of optimizing the process of the

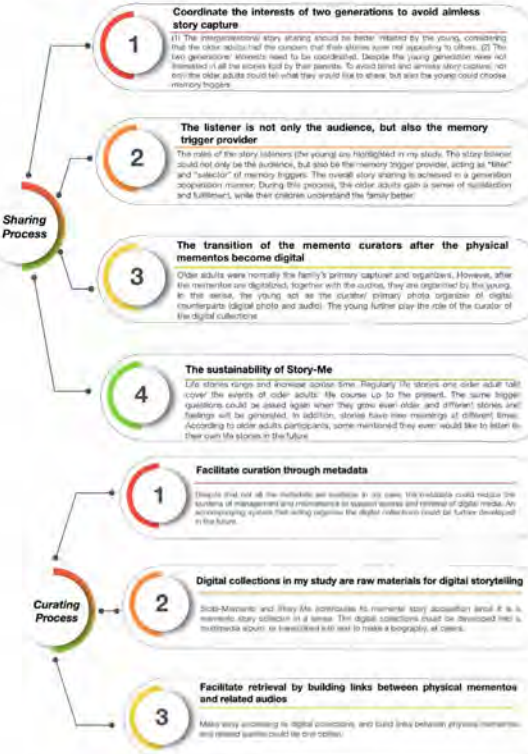
Answering RQ 1: What are the characteristics of older adults' storytelling?



Answering RQ 2: In which ways could interactive technology facilitate older adults to tell stories?



Answering RQ 3: In which ways could interactive technology involve older adults' children?



Answering RQ 4: Does such intergenerational storytelling promote connections between older adults and their children?

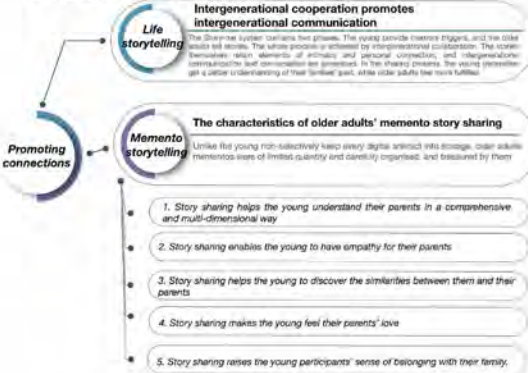


Figure 7-1 Overview of the conclusions



young providing feedback to older adults after listening to the stories. In chapter 6, to close the loop of story sharing, a smartphone application was designed for the young, together with the re-designed prototype, creating a complete system. Chapter 6 reports the implementation and evaluation of the system.

In this closing chapter, I present the conclusions and reflections. The former is aimed at answering the research questions, while the latter presents additional reflections.

7.1 Conclusions

In Section 7.1.1, I conclude the research process of intergenerational story sharing of the older adults, which is divided into four steps: Triggering Process, Telling Process, Sharing Process, and Curating Process. The Research questions are then answered based on these four steps: from Section 7.1.2 to Section 7.1.5, I answer Research question 1, 2, 3, and 4, respectively. The overview of the conclusions is shown in Figure 7-1. In Section 7.1.6, I reflect on the challenge of this study.

7.1.1 The process of intergenerational story sharing of older adults

Memory cues take various forms, such as trigger questions and mementos. Stories come in various forms (text, drawing, audio, video). In my study, the emphasis was on audio. I see story sharing not as a solitary but a collaborative process: the listeners not only provide feedback on the stories but also are the memory trigger providers. The listeners' role has an important role, making a story the product of two minds rather than one.

The process of intergenerational story sharing could be summarized as follows. The older adults act as storytellers, due to their abundant knowledge of family stories. Their children are listeners; trigger questions and mementos are used as memory cues. The intergenerational storytelling process has four steps (Figure 7-2): Triggering Process (the process of older adults' recalling), Telling Process (older adults' storytelling), and Sharing Process (story sharing), and Curating Process (the curation of digital stories).

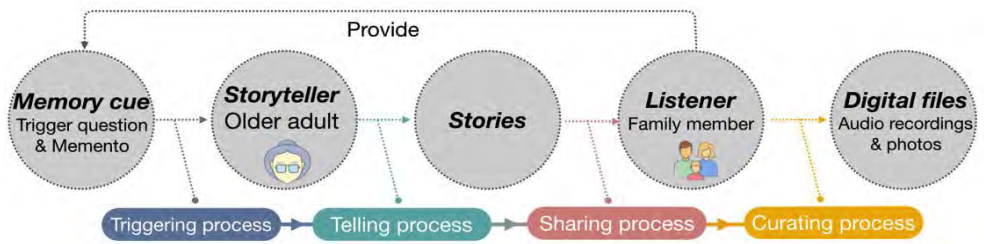


Figure 7-2 The process of intergenerational story sharing

7.1.2 Answering Research Question 1

*What are the characteristics of older adults' storytelling?*

*The characteristics of older adults' life story and memento story sharing*

The characteristics of older adults' life and memento story sharing are concluded as in Figure 7-3.

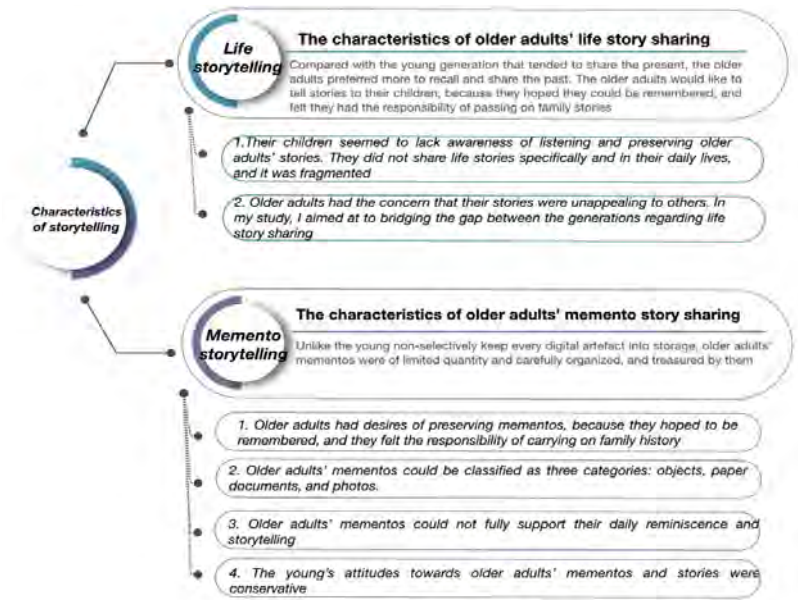


Figure 7-3 The characteristics of older adults' life and memento story sharing

Narrative patterns of older adults' stories

The narrative patterns of older adults' life and memento stories are shown in Figure 7-4.

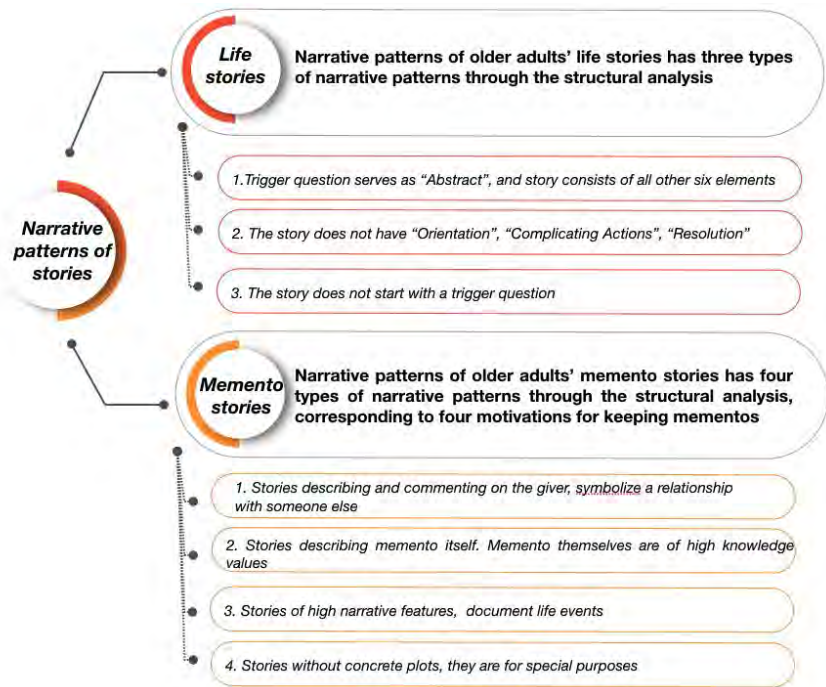


Figure 7-4 The narrative patterns of older adults' life and memento stories

Preferences for story topics

Their life story topics from high to low were: Childhood (funny thing, historical event, impressive thing, lifestyle, dream, horrible thing), Family (family member, parents teaching, impressive thing, family story), Perception (feeling, insight, self-evaluation, world-view, belief, regret), School (proud thing, bad thing, impressive thing, club, funny thing, teacher, regret), Work (job, colleague, impressive thing, proud thing, promotion, danger,) Marriage, Friends, Hobby, Retirement, Birth, Skill instruction, Memento, Fairy tale, and Other. The stories collected in the study could be roughly divided into description and perception. The former is mainly concerning the descriptions of an event, objects, or people. The latter is mainly concerning feeling, self-evaluation, life insight, et cetera. Details can be

seen in Figure 415.

Their mementos were classified into three main categories: from high to low they were: **Photo**, **Paper document**, and **Object**, and 25 sub-categories. Regarding **Photo**, "Family member" was the most, then "Marriage", which belonged to major life events, and followed by friends, festivals, et cetera. Regarding **Object**, the most was "Gift from friends". It was followed by the objects "Inherited from parents", then "Travel souvenir", et cetera. Regarding **Paper document**, "Postcards/letters" were the most. It was followed by certificates, inscriptions, et cetera. Details can be seen in Figure 5-12.

7.1.3 Answering to Research Question 2

*In which ways could interactive technology facilitate older adults to tell stories?*

As mentioned in the beginning of this chapter, the intergenerational story sharing has four steps: Triggering Process, Telling Process, Sharing Process, and Curating Process. I present the conclusions based on this framework.

(1) Design for older adults' reminiscence (Triggering Process)

The conclusions of designing for older adults' reminiscence (Triggering Process) are shown in Figure 7-5.



Figure 7-5 Design for older adults' reminiscence (Triggering Process)



(2) *Design for the older adults' storytelling (Telling Process)*

Making the memory triggers materially present in their home only supports their reminiscence. To facilitate their storytelling, the threshold of the storytelling should be lowered. Specifically, the following considerations are derived (Figure 7-6).

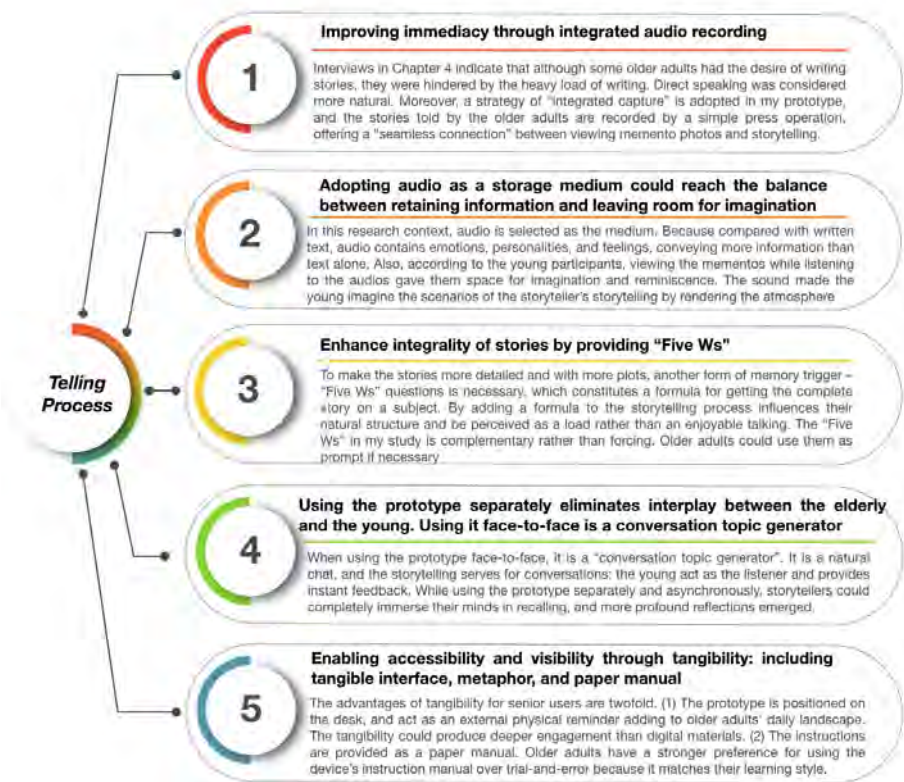


Figure 7-6 Design for the older adults' storytelling (Telling Process)

7.1.4 Answering to Research Question 3

*In which ways could interactive technology involve older adults' children?*

*Design for the older adults' memento story sharing (Sharing Process)*

The conclusions of designing for older adults' memento story sharing (Sharing Process) are shown in Figure 7-7.

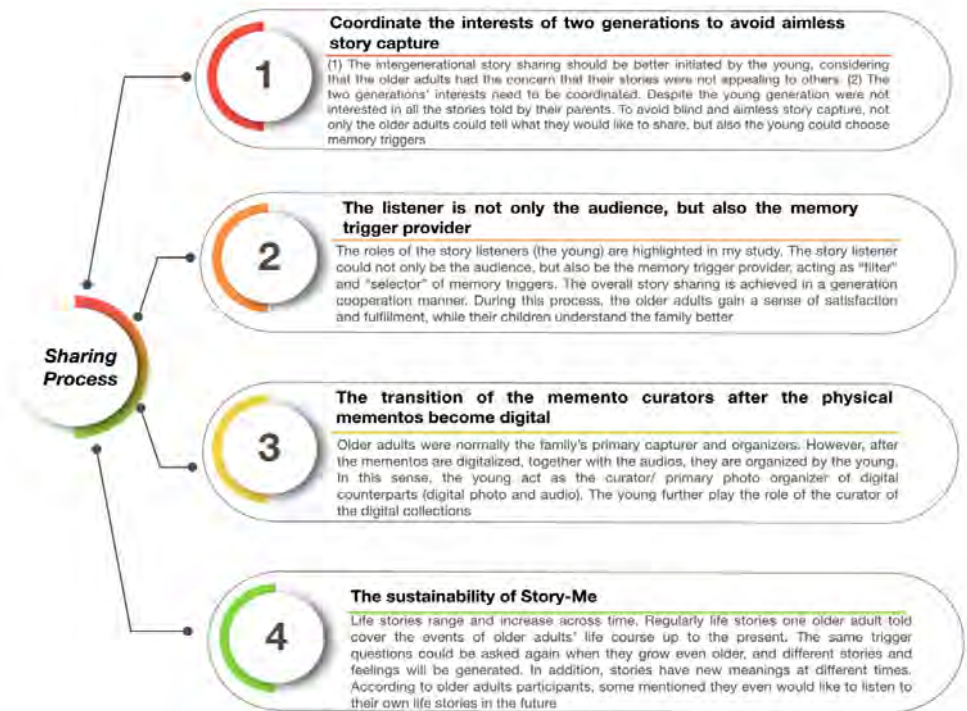


Figure 7-7 Design for the older adults' memento story sharing (Sharing Process)

*Curation of the digital content (Curating Process)*

Three directions of curation and retrieval of digital content in the future are concluded as follows. The accumulation of digital content will inevitably bring overwhelming experiences for the young. Currently, they are in a state of overload due to a lack of curation of digital content. Collecting serves little purpose without retrieval. Therefore, curation and easy retrieval are two critical issues. Based on the feedback and literature, three directions were concluded (Figure 7-8).





Figure 7-8 The curation of the digital content (Curating Process)

7.1.5 Answer to Research Question 4

*Does such intergenerational storytelling promote connections between older adults and their children?*

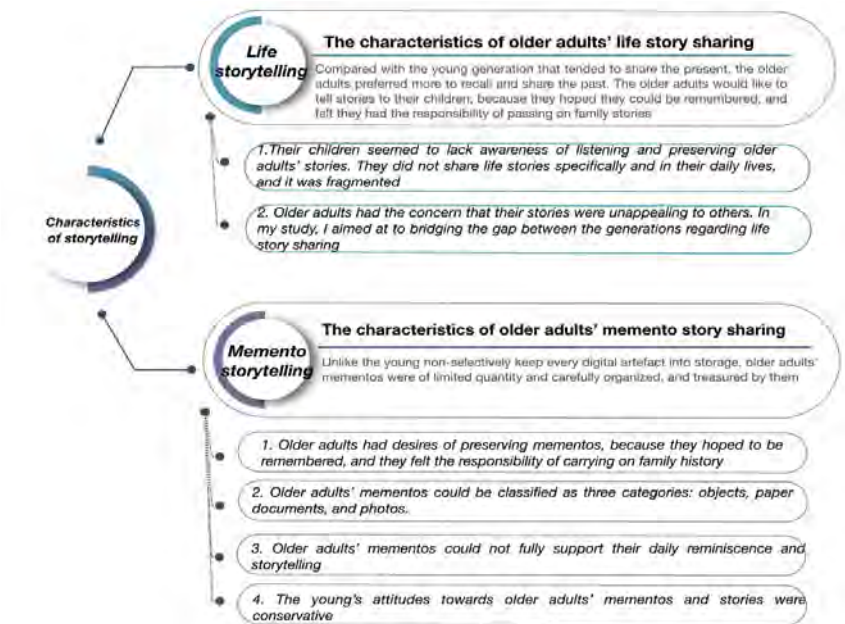


Figure 7-9 Intergenerational storytelling promote connections between older adults and their children

The conclusions are shown in Figure 7-9.

7.3 Discussion

7.3.1 The sustainability of story sharing

In the current research, the story sharing systems were used by the participants for an only limited time (ranging from one week to two weeks). Therefore, the sustainability of story sharing needs to be considered in the future.

Life stories range and increase across time. Regularly one older adult's life stories cover the events of his/her life course up to the present. Unless the storyteller is very old and sees himself/herself at the end of their life, any biographical account, as well as the life it purports to represent, will be presented as incomplete (Leung et al. 2012). Thus, the same trigger questions could be asked again when they grow older, and different stories and feelings will be generated. In addition, stories have new meanings at different times (Flint 2009). According to the senior participants, some mentioned they even would like to listen to their own stories in the future.

7.3.2 Challenge

This Ph.D. study cannot be investigated in a lab setting. This is because storytelling and memento studies should go beyond controlled studies since their primary purposes – reminiscing, self-reflection, and sharing of personal experiences – are strongly dependent on subjective perceptions and experiences (Thudt et al. 2016). The field study puts forward high requirements for the stability of the working prototype. Moreover, the recruitment of participants (older adults in nursing homes and their children) that owned a certain number of mementos and were willing to share them for a research purpose, was also challenging.

7.3.3 Towards a wider research audience

First, in the current research, the target older adults were from the Netherlands. Therefore, the metaphor of slots-machine, which the Dutch older adults were familiar with, was adopted to lower thresholds of technology access. Obviously, different metaphors can be adopted for older adults of different cultural backgrounds.

Second, during this research, I also have some insights that are not directly related to the research questions, but are meaningful for a wider research audience. I will elaborate in Section 7.2 Reflection.

## 7.2 Reflection

In this last part of my thesis, I highlight some insights that are not directly related to the research questions. Section 7.2.1 is on Research-through-Design (R-t-D). Section 7.2.2 is on designing prototypes for non-tech-savvy older adults.

### 7.2.1 Reflections on Research-through-Design

Research-through-Design (R-t-D) is described in the literature as an approach for scientific inquiry, taking advantage of the unique insights gained through design practice (Frayling 1993). Despite there have been many research activities in R-t-D, the field does not(yet) entail practical guidelines and cases for researchers to hold on to (Reeker, van Langen, and Brazier 2016). Although the term of R-t-D is not a new concept, it is until recent years that it has been widely discussed and used in the HCI field, and became an increasingly recognized approach in design. R-t-D is conceptualizing research done by means of the skillful practice of design activity, revealing research insights (J. Zimmerman, Stolterman, and Forlizzi 2010). One of the features lies in that it acknowledges and embraces professional practices' contributions to knowledge (Godin and Zahedi 2014). There is little research that specifically discusses the application of R-t-D for designing for older adults. This thesis exemplifies how R-t-D may unfold in practice regarding intergenerational story sharing of the older adults. My reflections on Research-through-Design (R-t-D) are as follows.

#### *R-t-D as a way of identifying and answering research questions*

**R-t-D acts as a means of narrowing down the research focus.** First, Design research is a way to ask broader questions beyond the limited scope of a design problem, through the practice of design itself (E. Zimmerman 2003). My research focus and detailed research questions were identified through the explorative prototype *Vien-brick*. As mentioned, social interaction of older adults is a broad and macroscopic research area, including their social connections with fellow residents, family members, old friends, people from the local community, caregivers, et cetera. Explorations with *Vien-brick* helped to focus my research on

intergenerational storytelling of older adults. The findings emerged from the explorations guided my follow-up research. My first prototype *Slots-Story* focused on the life stories of older adults, and some stories emerged from the explorations with this prototype were related to family mementos, such as album, souvenir, artwork, et cetera. This inspired me to explore their mementos and related stories in the next iteration with *Slots-Memento*.

**Answering research questions in stages through the evolution of prototypes.** My overall research question was answered in stages. R-t-D itself is highly iterative as the design evolves while conducting R-t-D-led research (Reeker, van Langen, and Brazier 2016). As mentioned, I detailed the overall research question with four sub-questions. To answer RQ1, RQ2, and RQ3, I designed and deployed *Slots-Story* and *Slots-Memento*, which focused on older adults' life stories and memento stories, respectively. To answer RQ3 and RQ4, I designed the *Story-Me*, to fully involve the older adults' children. The evolution of prototypes is not only the response to the development of research questions and insights, but also the feedback of the participants. For example, the appearance of *Slots-Memento* was refined based on the feedback from the participants on *Slots-Story*, as older adults thought it should be unobtrusive when putting it at home, and therefore decorative and vintage effects were applied.

During the research process, I switched between reflection and practice. Knowledge is gained by conducting the design practice and continuously reflecting on direct and indirect observations, beliefs, and experiences (Reeker, van Langen, and Brazier 2016). In my R-t-D cycles, reflection is the result of the current iteration, also the input for the next iteration. Reflection is the cut-off point between analysis and practice. It is a catalyst for knowledge generation.

### 7.2.2 Reflections on designing for non-tech-savvy older adults

R-t-D also highlights the importance of research prototypes. The use of design prototypes within the research process has been well acknowledged in the context of R-t-D. Prototypes are created as research instruments, tailored to each individual study (Boer, Donovan, and Buur 2013).

**Non-tech-savvy older adults.** My target group is the older adults in the nursing home. According to literature and my investigation, most of them are non-tech-savvy users.

The following are some insights on designing prototypes for the non-tech-savvy older adults. Since all of my prototypes adopted a tangible interface, the presentation of my insights is partly based on Hornecker et al.'s framework on tangible interaction (Table 7-1). The framework is structured around four themes: Tangible Manipulation, Spatial Interaction, Embodied Facilitation, and Expressive Representation. Each theme concludes several concepts (Hornecker and Buur 2006).

Table 7-1 Hornecker et al.'s framework on tangible interaction (Hornecker and Buur 2006)

Tangible Interaction			
Tangible Manipulation	Spatial Interaction	Embodied Facilitation	Expressive Representation
Haptic Direct Manipulation	Inhabited Space	Embodied Constraints	Representational Significance
Lightweight Interaction	Configurable Materials	Multiple Access Points	Externalization
	Non-fragmented Visibility		
	Full-Body Interaction		
Isomorph Effects	Performative Action	Tailored Representations	Perceived Coupling

Providing Haptic direct manipulation through a tangible interface

It has been well acknowledged that tangible interfaces are more accessible and suitable for the needs of senior people, as they could provide a natural style of interaction. Haptic direct manipulation refers to tactile contact, haptic feedback, and material qualities when manipulating the interaction objects (Hornecker and Buur 2006). All my research prototypes adopted tangible interfaces providing haptic direct manipulation. *View-brick* was equipped with big buttons, and older adults could manipulate it by a simple hand-press. *Slots-Story* and *Slots-Memento* provided tangible interfaces and intuitive interactions through the lever.

Providing Representational significance through metaphors

Representational significance refers to the interrelation of physical and digital representations, and how users perceive them (Hornecker and Buur 2006). It is important to communicate information with analogies and metaphors that are relatable to the systems that older adults are familiar with, and a new product that is designed in familiar metaphors can reduce the barriers of senior users to use. Metaphors of the gallery, sending-postcard, and a slots-machine were applied in

the prototypes. The interaction styles were based on older adults' familiar knowledge to help them understand the designs and its functionality easily.

Providing printed manuals

As my prototypes were used independently by older adults, an instructional manual was needed to guide them on how to operate the prototypes. Research indicates older adults have reported that they are afraid of using new technological devices as they are afraid of damaging the device (Laguna and Babcock 1997). Research also indicates that older adults have a stronger preference for using the device's instruction manual over trial-and-error because it matches their learning style (Leung et al. 2012). Therefore, when designing *Slots-Memento*, I provided older adults with printed manuals, which consisted of step-by-step instructions and corresponding illustrations. The paper manual could also afford easy annotation that older adults were generally more familiar with, compared with online content. The instructions in paper manuals are static, which are easier for older users, as they matched their learning style.

Tailoring interfaces to older adults: aesthetics and visibility

User interfaces need to be tailored to the needs of the specific user group of older adults. Two aspects were considered in my R-t-D process, namely, aesthetic and visibility.

Firstly, according to my study, senior people were interested in traditional physical objects, vintage and old-fashioned objects. Therefore, the vintage style was applied in the appearance of the *View-brick*. In the interviews with older adults regarding the appearance of *Slots-Story*, it was found that decorative and vintage effects needed to be applied, as the older adult hoped that the prototype could be unobtrusive when they could put it at their homes. Secondly, big and bold fonts were adopted, considering fading the eyesight of older adults. The capability of the eye to focus on near objects is diminishing for older adults (Sun et al. 1988). The visual presentation of information should consist of large text, big and clear buttons.



### *Avoiding accurate operation*

Large movements rather than delicate operations were applied in my prototypes. Older adults suffer from a decline in fine motor skills and accuracy of movements (Huppert 2003), which makes it harder to use small buttons and switches. In my designs, big buttons and a lever were used in *View-brick* and *Slots-Story*, respectively, to compensate for the older adults' decline in the accuracy of movements.

### *Providing Embodied constraints through minimizing the number of interface components*

Embodied constraints refer to the physical set-up constraining users' behaviors (Hornecker and Buur 2006). This restriction eliminates the possibility of making errors, which could lower the anxiety older adults experience with new interfaces. I provided Embodied constraints by minimizing the number of interface components. In *View-brick*, there was a big button for printing postcards. While in *Slots-Story*, there were only two sets of operation components: a handle and few buttons.

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Miss Eindhoven, miss the Netherlands.

## Curriculum Vitae

### Biography

Cun Li was born on the 12th of August 1988 in Jinan, Shandong Province, China. In 2015, he received his master's degree in Design Science from the School of Design, Jiangnan University. During his master's studies, he was a visiting researcher at the School of Design, Politecnico di Milano, Italy between 2014 and 2015. After graduating, he started in September 2015 his Ph.D. research at the Department of Industrial Design at Eindhoven University of Technology. The Ph.D. project was conducted under the supervision of Prof.Dr.Ir. Caroline Hummels, Dr. Jun Hu PDEng Meng, and Dr.Ir. Bart Hengeveld. This dissertation is the result of his doctoral research on the topic of "Design for Story Sharing: connecting seniors with their children".

### Publications

#### Journal articles

- **Li, C.**, Hu, J., Hengeveld, B. J., & Hummels, C. C. M. (2020). Supporting intergenerational memento storytelling for older adults through a tangible display: a case study. *Personal and Ubiquitous Computing*, 1-25. <https://doi.org/10.1007/s00779-020-01364-9>
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