THE UNIVERSITY OF QUEENSLAND

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Thinking of You: Enhance Family Connection

By

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The Dean
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Dear Professor Simon Biggs,

In accordance with the requirements of the degree of Master of Interaction Design in the school of Information Technology and Electronic Engineering, I present the following thesis entitled “Thinking of You: Enhance Family Connection”. This work was under the supervision of Dr Stephen Viller.

I declare that the work submitted in this thesis is my own, except as acknowledged in the text and footnotes, and has not been previously submitted for a degree at the University of Queensland or any other institution.

Yours sincerely,

Yi Zheng

ACKNOWLEDGE

I need to thank you for Anita Melissa Bamert and Prof. Catherine Haslam. Without your help and effort, the evaluation would never come true.

I appreciate my supervisor, Dr Stephen Viller, as well. Due to his coordination in this interdisciplinary research group, we can communicate efficiently.

CONTENT

1. ABSTRACT

Research on older people has been more and more prevailing because of the increasing aging population. Improving seniors' wellness status is the core consideration. However, due to their mental and physical status, social isolation has a severe negative impact on them. Thinking of You is a digital photo frame app, which is designed to trigger social connection by just one touch. In this study, we evaluate TOY amongst older people and reflect the findings to refine this interesting idea by applying user-centered design process.

2. INTRODUCTION

a) Background

The "population aging" has become a significant issue in the world. It is hard to reverse the increasing trend of aging population because of the conflict between the declining of the younger population and the growth of human lifetime. The elderly population has to face a lot of personal issues. For example, they quit career life and lost income; children grew up and left them; physiological declining confines the movement and the capacity of taking care of themselves; friends and beloved are gone [1]. All those problems make them feel unconfident and live with no companionship [2]. As a result, the elderly population is suffering from social isolation deeper than other demographic groups and their wellness is at risk as well.

Whit the emerging social communication technologies in recent years, some researchers point out that improving social contact can reduce the degree of isolation [3, 4]. The god-feeling tells us that enhancing social connections and intervening social isolation by applying those technologies is an alternative way to solve the issue.

The previous work, Thinking of You, has proved that a simple message telling other people you are thinking of them is a useful way to reduce social pressure and isolation feeling among university students. Some similar projects and studies have examined that the applying of ICT in the daily life of aging people to enhance the cross-generation connections has a definite meaning [5-7]. Therefore, we can rationally suppose that TOY has a positive potential to leverage older people as well.

b) Project Overview

This research aims to iterate the previous design of TOY. By following the human-centered design methodology, I start from a systematic evaluation in elder people to understand how they manipulate TOY in the latest context. To conduct the evaluation, I

collaborate with a clinic psychology group. Any issue, observation, feedback and data generated from the evaluation can be valuable to gain a sufficient understanding of the target audience. Subsequently, based on those learning, I will refine or redesign TOY.

3. LITERATURE REVIEW

a) Social Isolation

Social isolation has been as a research object in the long term. Thoits [8] used traditional psychological theory, like social identities and identity accumulation hypothesis, to reveal the psychological mechanism of social isolation. Then, researchers attempted to establish a practical model of it. Chappell and Badger [1] examined ten common indicators of social isolation and assessed the relationship between subjective wellness among elderly individuals and each index and some pair of combined indexes. Wenger et al. [9] identified the different correlates on social isolation and loneliness and refined models of isolation and loneliness. Moreover, many studies [4, 10, 11] apply social network methodology, such as social contact observation and self-reporting, to detect the social network situation of the target, which indicates whether an individual is suffering from social isolation.

The old age group has been suffering from social isolation seriously because of its negative impact on health and wellbeing [1, 12]. The academic world has focused on this field since many years ago [9]. Living without companionship and social connectedness are referred to principal manifestations of social isolation [2] which can be resolved many factors causing it, such as being unmarried, having no children, having no confidant and having no companion [1].

Jetten et al. study indicates that the health risk brought by social isolation is equal to the risk caused by smoking, drugs and insomnia. Human being is a community-living species. Keeping socially active brings a meaningful and healthy lives [13]. The experiment conducted by Chamberlain el al points out even if children with autism, in some degree, are discriminated in regular classroom, they still prefer to staying there rather than protecting by special facilities [10]. Involving in social communication with others is a cheaper, effective and enjoyable way to recover from both mental and physical diseases than receiving medical treatments.

b) Technologies and Social Isolation

In order to reduce the harm of social isolation on aging people, researchers have put such much effort on exploring a feasible approach to ameliorate it for older people. After reviewing the literature published over the last two decades on the evaluation of interventions aimed at reducing social isolation amongst aging people, Findlay [12] aroused an opinion that, so far, there is no substantial evidence supporting that those interventions could reduce social isolation. However, he also mentioned Internet-based way might be the most beneficial intervention type. Ballesteros [3] points out integrating different technical components and social networking is a potential way to reduce social isolation and support aging population living at home.

By comparing and analysing different years' GSS data (General Social Survey, US), Miller et al. [14] found that both sizes of close ties and weak network had decreased dramatically over last two decades. But, Hampton [4] who employed the same data source drew an opposite conclusion. That is because Hampton expanded on the GSS methodology and added social media and Internet network into the scale. In addition, Miller didn't illustrate the relationship between social isolation and core network size directly.

The rising communication technologies, like social media, serve as an effective approach to create social awareness in individual's daily life [15]. It gives people ability that they update and exchange ideas with each other without physically being together [16]. Some previous research also showed that good social connection can lead to a healthy life [15].

c) Photo and memory

Although, many digital form recordings, including videos, audios and even a piece of health tracking data, can carry on our memory [17, 18]. Photo refers to the most recognized item to recall people past memory comfortably [19]. Based on the study conducted by Borglin et al. [20], for aging people, reminiscence and recollection of previous life is an important way to anchor and preserve their life value. Therefore, old people like to review old photos

and share the story to others. When talking about stories behind the photos, they normally start at who was in the photo – the social connection between the person – and what the event was [21, 22].

Nonetheless, people have a low performance when they retrieve photos related to family events [23, 24]. Whittaker et al prove that people fail to find almost 40% when they complete this kind of tasks. This conflict engages Kim and Zimmerman [25] added a narrative note on digital photos exploratively, which wanted to address the need of memory reminiscence for older people.

With the prevalence of digital cameras and smart phones, the convenience will push to take photos for later review on any event [26]. A well-designed annotated system can help people, especially aging people, to organize, store and share memories.

d) Related Researches

i. ICT

The Electronic Family Newspaper

Given results of gerontology and psychology, ICT researchers made many efforts attempting to solve this issue. The Electronic Family Newspaper (EFN, Figure 2) [6, 27, 28] is a project attempt to reduce the isolated feeling of the elderly with no family nearby in Mexico, because of active migration. It acts as a web-based blogging tool that family members can access the system to share messages or photos and create new sections. It is an interesting trial to support old adults contact with remote family members by accessing a blog-like system on tablet with an elderly-friendly interface.

Figure 2: A sample screen of the Electronic Family Newspaper, showing a family recipe

Enmesh

The research come from the University of Melbourne developed an iOS application called Enmesh [5]. It examines that technology-based interventions promote the wellness of aging population with socially isolated by media sharing. The team also conducted an evaluation [29] which indicated that there were opportunities for future research to use social communication technologies to facilitate positive social interactions.

Figure 3: The Elder People Using Enmesh

ii. Digital Photo Frame

Family Digital Portrait

Furthermore, there are many examples of the digital frame. Family Digital Portrait project [7, 30] aimed to create the social awareness for elderly people in their social network in an easy way to be accessed. Meanwhile, Mynatt et al. [7] observed that implemented digital frame had improved the activity motivation of seniors to bridging the communication between generations. With the study progressing, they also initially propose that detailed rules on the photo frame display design.

Figure 4: Family Digital Portrait

CareNet

CareNet project is inspired by Family Digital Portrait [31]. The purpose of the project was to support medication and the target audience was those who took care of the elderlies. Researchers used the digital frame as a tool to make the connection between caretaker and their clients. It will work as reminder to tell caretakers what the next task their client need to do.

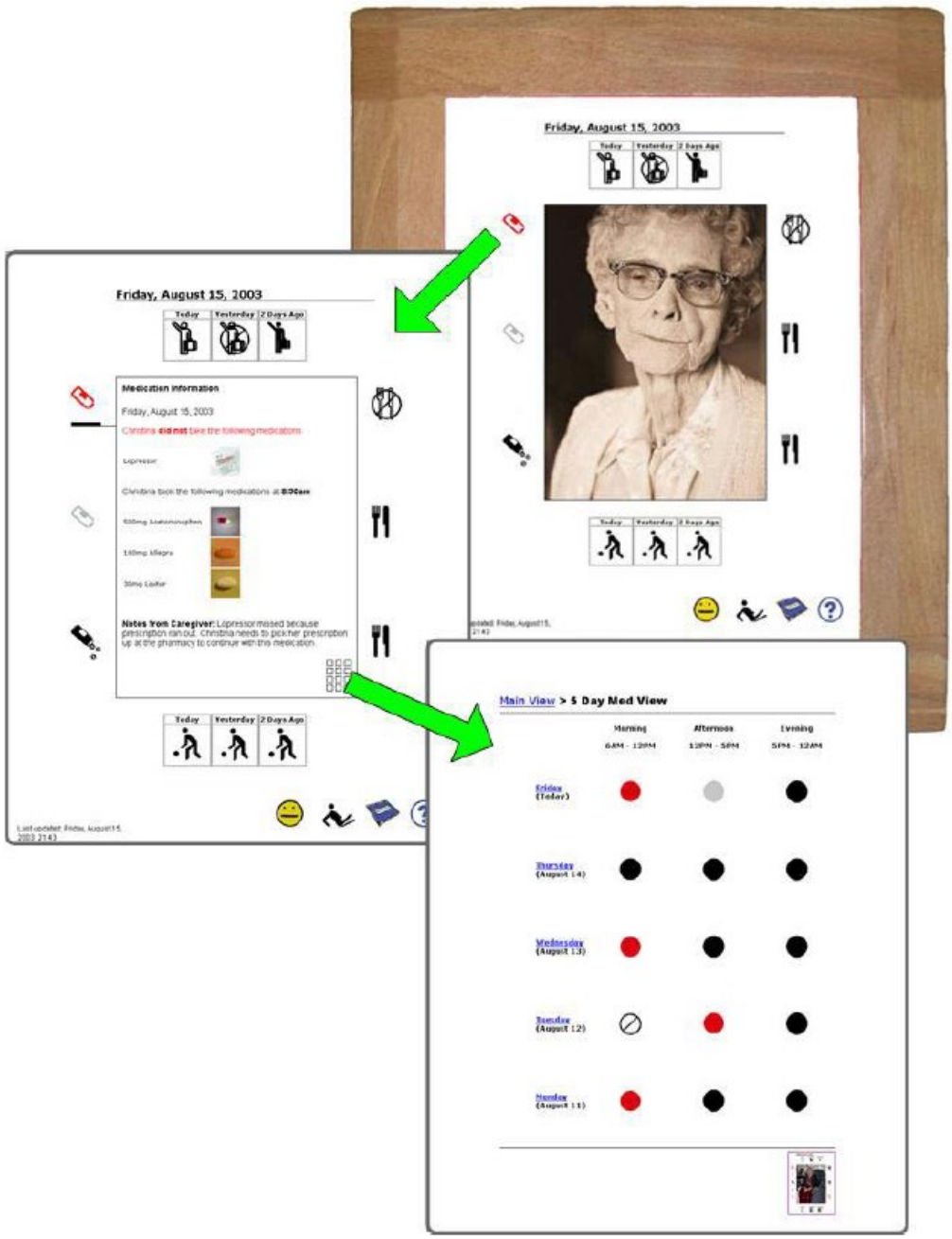

Figure 5: The CareNet Display prototype

Family Digital Frame Display Design

While Taylor et al [32] critiqued the above two projects contributed to a comprehensive and complete work regarding display design, they gave out an in-depth field study on designing a family digital frame and released three innovative designs (Figure 6).

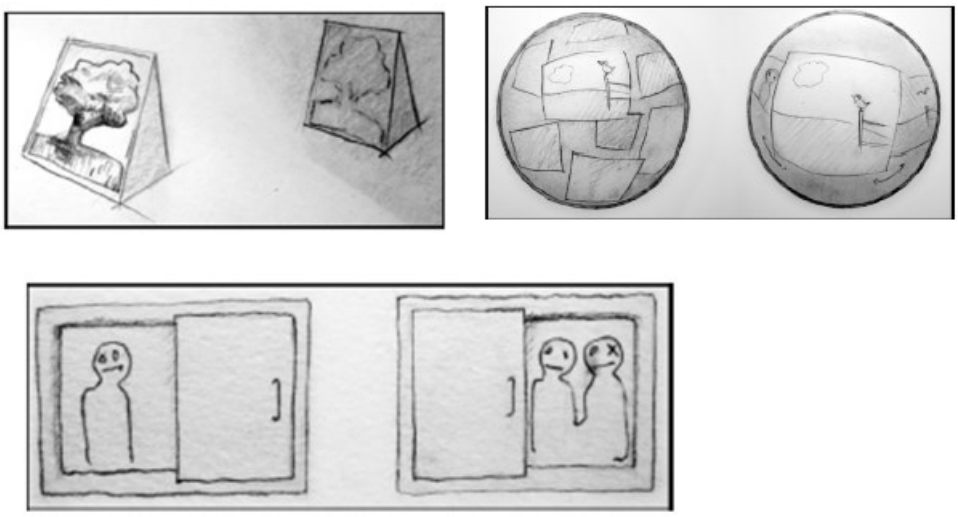

Figure 6: Three digital photo frame designs

iii. Thinking of You

Mika Halpin Hassanah had explored that use a touch screen based digital photo frame to foster the aging in place [33]. The concept of her prototype is that the older people can directly send a message, 'Thinking of You,' to the mobile phone of their family or friends by touching the digital frame (Figure 7). The message would trigger a positive response from the receiver activating an active social connection. Her research focused on the background and exploration level. Through interviewing target users and presenting prototype, she gained the positive feedback on the potential benefit for the combination of texting message and photo displaying enhancing people connections. However, this empirical result didn't undergo an experimental examination.

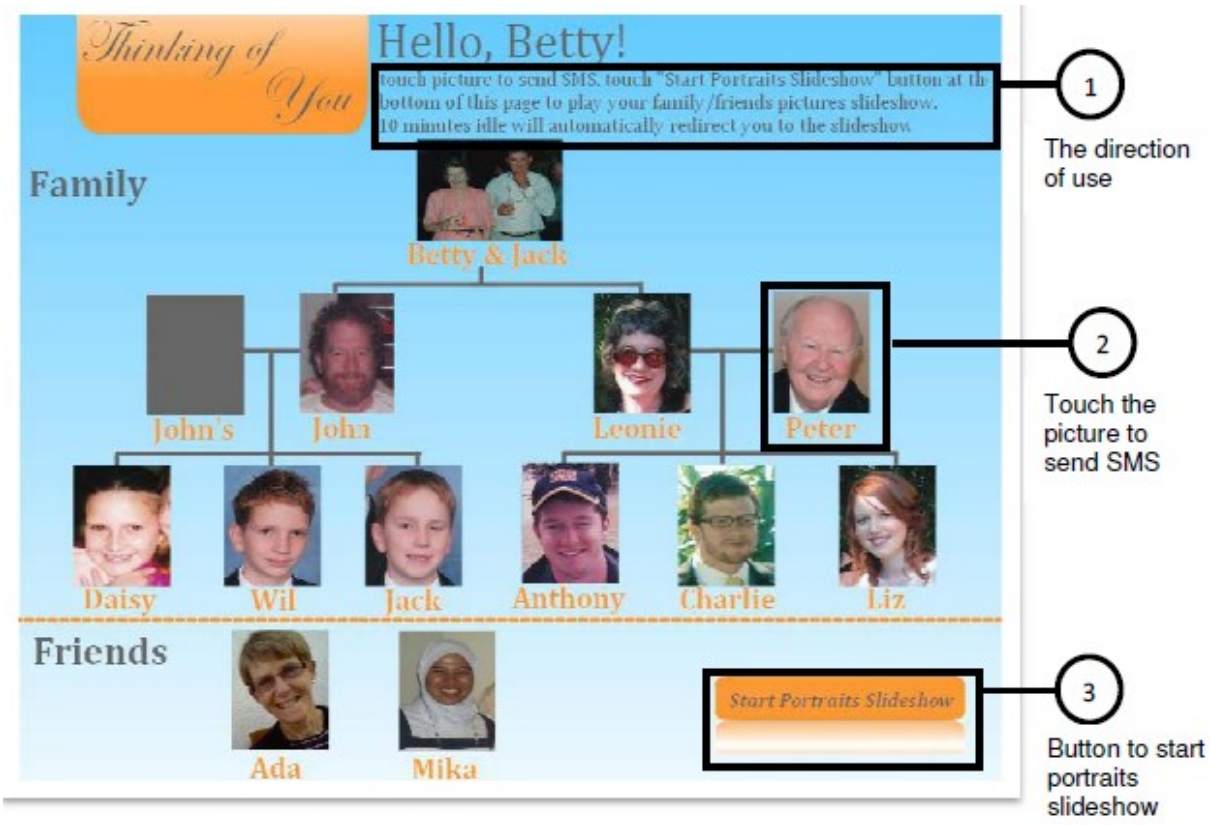

Figure 7. The primary version TOY designed by Mika

Her work inspired the follow-up project, Thinking of You, on 2014 [15]. Lin's research developed Mika's idea further. She applied the core concept that a 'Thinking of You' message will send to someone when touching their portrait on the screen (Figure 8). Not like Mika trying to support aging people live independently, Lin's goal was more straightforward. And her study proved that the more active social connections contribute to the reducing social isolations level amongst younger generation.

When the goal changes, the interface has an adjust as well. Mika displayed photos as a "family tree" which indicated the relationships among each member (Figure 7). When Lin applied it into friendships, it did not work. So, Lin directly showed all photos into a grid interface (Figure 8).

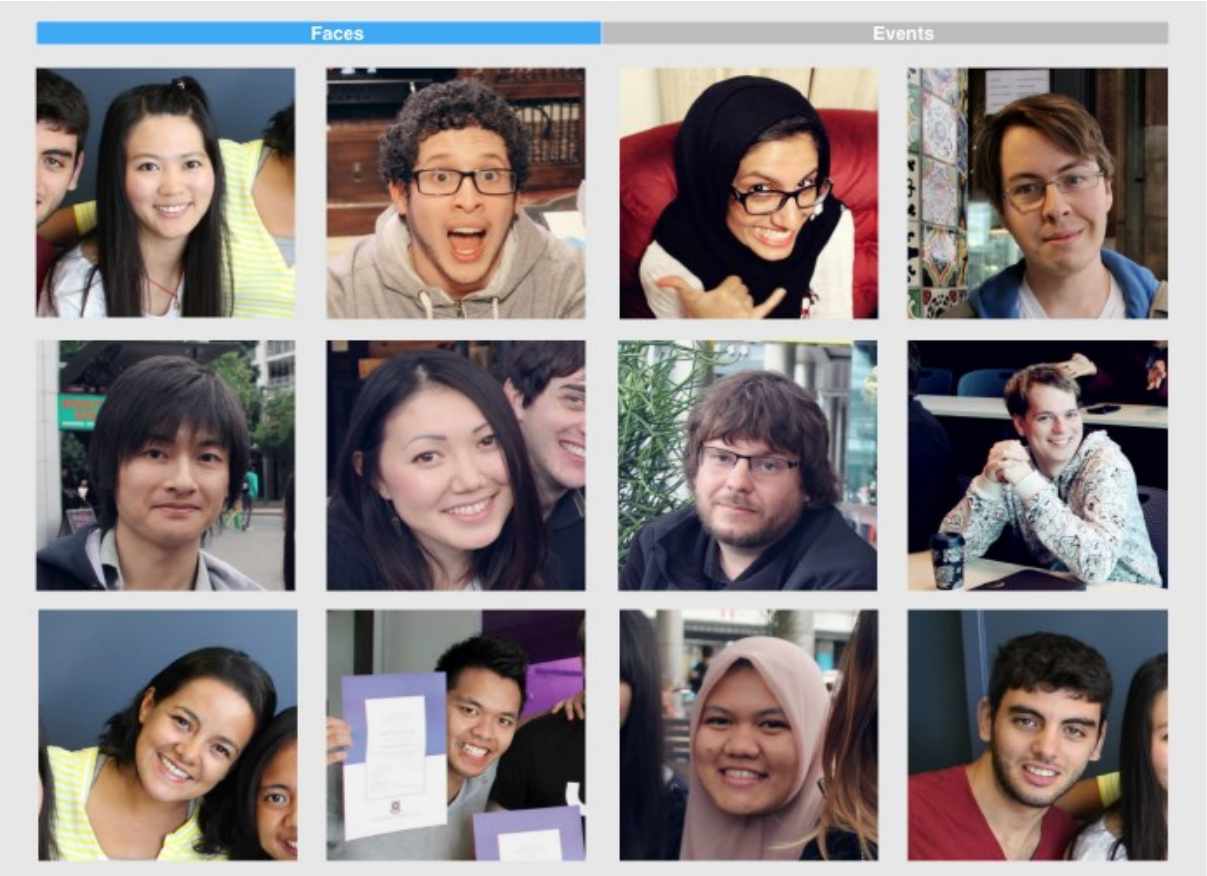

Figure 8. 'Thinking of You' interface developed by Lin

4. EVALUATION

a) Evaluation Design

i. Single-case research design framework

We apply single-case research design as the fundamental framework of the evaluation and follow the reversal design or A-B-A design. According to the plan, we were going to invite ten people, who in live Regis Aged Care Facility, Wynnum, as well as their nominated family members (also their contacts under this context) to join our research. For each of them, the evaluation spans six weeks, which is separated into three equal phases: baseline (A), implementation or intervention (B), and reversal (A). Under this pattern, we don't need to set

a control group. The differences in behaviour of single participant between baseline (A) and intervention (B) can be a self-comparison. And the efficacy of baseline resuming on reversal phase can largely give us confidence in the result achieved from implementation phase.

In the whole evaluation, we want both participants and their contacts to follow their daily routine, except that a tablet running TOY will be placed in participants' suite in the second phase, accompanying with multiple research techniques in gathering of data.

ii. Data collection

In this study, there are some attributes of participants involved: individual social status (including social network and self-identification), social satisfaction (including loneliness, mood, and life satisfaction) and social connections. To measure how TOY impacts those features, we employed serval research approaches relatively. The quantitative questionnaire (Appendix 1) and semi-structure interview outline (Appendix 2) employ Lin's work and my colleague, Anita, simplified the questionnaire [34].

Although this evaluation involves two groups of people – participants and their family members – participants still refer as the core role. In the very beginning, they take a quantitative questionnaire, which reflects their mental status, like Loneliness, Social Network Diversity, Mood, and Life Satisfaction. And we will reapply the same questionnaire at the end of the other two phases as well. This will help us to analyse the changing of the psychological status of participants.

At the end of the evaluation, there is a semi-structure interview hold to collect the qualitative information about participants' experience. These empirical data can assist us to understand their behaviour from another angel. Besides, in the beginning, we had a simple and informal interview to get in touch of the core information about participants and their previous experience. Furthermore, the psychological researcher always keeps in touch with their contacts and cares.

By using both quantitative and qualitative approaches to understand participants' psychological status, we conduct a mechanical way to measure social connections. It is hard to gather this data from participants so that we shift the view to contacts. Since we restrict each object to four contacts at most, the amount is also manageable. The deployed SMS transmission service will send a simple daily diary question to all contacts by SMS or Email at 7 p.m. every day. The question is:

"- Have you had any contact with [participant's name] today? Y/N

- If yes, how many times?"

When the evaluation goes into the implementation phase, the question will be changed a little bit, which turns into:

"- Have you had any contact with [participant's name] today by means other than 'Thinking of You'? Y/N

- If yes, how many times?"

We attempt to keep the answer handy from botheration so that contacts are willing to response in time. These records reflect the amount of participants' social connections within the pre-setting groups.

iii. Implementation Constraint

Since the target audience of previous version TOY inclined to the younger generation and an evaluation has been also conducted in The University of Queensland, Lin's TOY contains more sophisticated views and features. However, the target audience changes to aging generation this time. Especially, most people who live in Regis Age Care facility are lost the capacity of living alone. Due to this factor, we assumed that they had a low ability to handle with technology. Therefore, to make the evaluation more controllable, we decided to simplify the original design by cutting down the number of photos displaying on the screen

and giving up the other photo display views except for the static photo view. As the Figure 9 showing, the evaluation version TOY does merely have a static page with maximum four photos on the screen. The benefit is that by doing so, touching portrait becomes the only interaction participants need to do.

Figure 9: A Yoga tablet running TOY places on participant's cabinet

Moreover, we measure participants' social connection by collecting their SMS daily dairy, which aims to record participants' interactions with TOY and to make sure their device is working well. To meet these needs, I recode TOY and add logging and diagnosis modules as well as an SMS transmission service to it. Since it is not a large-scale and comprehensive product, I haven't brought security issue into consideration, which should be an essential feature in the final design.

b) Result

First of all, I have to concede that we had a mistake on choosing research object. We thought the aging care facility is a place where the elderly people are concentrated. Nonetheless, as I mentioned before, most people who live in there are facing cognitive or physical issue. In our case, amnesia is one of main problem. During the primary recruitment, many of them were interested in this project and their families presented positive attitude as well. However, when we went back again and prepared to assign the ethic approval. After all, just three people have enough cognition ability to be part of research. Unfortunately, during the evaluation, one went to hospital because of healthy issue, Jo's (name has been changed) cognition capacity had a serious retrogression so that she forgot to use TOY. Consequently, we only gained one set of valid data (this participant will be called Emma). Such as it is, through the evaluation, I had a deep touch with the old people and observed some behaviours enlightening me on the design. These observational material will put into the findings and discussion parts. While, in this part, I will just describe the only one rational result.

Emma was 73 years of age, married and had lived in the current aged care facility for 18 months. She had recently moved from another facility that she had lived in for about a year. Jo reported that her reason for relocating to aged care was due to increasing physical disability. She suffered a stroke several years ago and as a result was unable to adequately care for herself. She was visited by her two children once or twice a week, but indicated that she would like to connect with them more. Jo nominated her two children and their partners to participate in the study. All four of Jo's contacts agreed to take part in the study.

Emma did not identify strongly with the aged care facility, yet she reported being friendly with lots of people. Since moving to the facility, she still feels connected to the same social networks that she was part of before the move, but had not developed many new strong

ties. There were two groups that she identified as most important to her: her biological family and her 'spiritual' family (her church group).

Emma's psychological measurement result [34] (Table 1) doesn't show an obvious change except the value of Perceived Control and CES-D8. Perceived Control states that the device makes her feel uncontrollable. CES-D8 reflects she has more and more pressure with the evaluation progressing.

Table 1: Participant Scores on each of the measures

	Participant			
	Emma			Age related Norms
Measure	T1	T2	T3	Mean (SD)
CES-D8	15	17	21	17.52 (2.58)
Perceived Control	9	5	8	5.25 (1.35)
Well-being	2	3	2	norms unavailable
MMSE	30	30	30	28.07 (1.14)
GAI-SF	5	5	5	0.7 (SD 1.2)
Loneliness Scale	6	5	5	3.89 (1.34).

Note. T1 = pre intervention phase, T2 = intervention phase, T3= post intervention phase.

From the daily dairy recording (Appendix 3 and 4), neither the total amount of Emma's social connection or the amount of connection between her and individual show a significant distinction.

Two weeks after the removal of the tablet from her room, during the final interview Jo stated that she missed the TOY *App*. She stated she missed the photos and the ability to easily message her family whenever she wanted. She also liked that her family could call her back in their own time.

We didn’t continue Jo’s reversal phase evaluation because she didn’t complete deployment experience. Her record is useless for us.

c) Findings

First of all, we found that it is common for people who live in Regis to use an iPad. Some of them even have their own 4G hotspot device. However, they could just use it for a specific aim, like Emma usually uses it to read The Bible; Jo's daughter will sync some new photos into her iPad regularly, and she always shares these photos with others. After an in-deep touching, we found that they can remember an exact operation path to access that function, but can't handle unexpected issues. For an instant, the terminal device we apply is an Android tablet named Lenovo Yoga. It has a big soft power button on the bottom side which has a distinct touch-feeling with iPad's power button. Until the implementation phase finish, Emma still can't close the screen or open the device by herself. She needs to ask a nurse to help.

The interaction metaphor or feedback must be very clear. Apart from the blurred hand-feeling mentioned above, the Yoga’s approach, which can swap to four directions on unlock-screen to quickly start a certain function, is more complicated comparing with iPad’s one direction swap. This complexity is another factor impedes participants enjoy using TOY.

When we designed the evaluation, we expected the social connections of participants would follow the tendency showing in Figure 10. The amount of social connections might increase distinctly after deploying the device, and reversal's data could be a little bit higher than baseline's. On the contrary, according to Emma's recording, the amount of connections between a participant and contacts doesn't show a fluctuation as we expected. The quantity of

total weekly connections as well as individuals' data did not show a significant difference (Appendix 3).

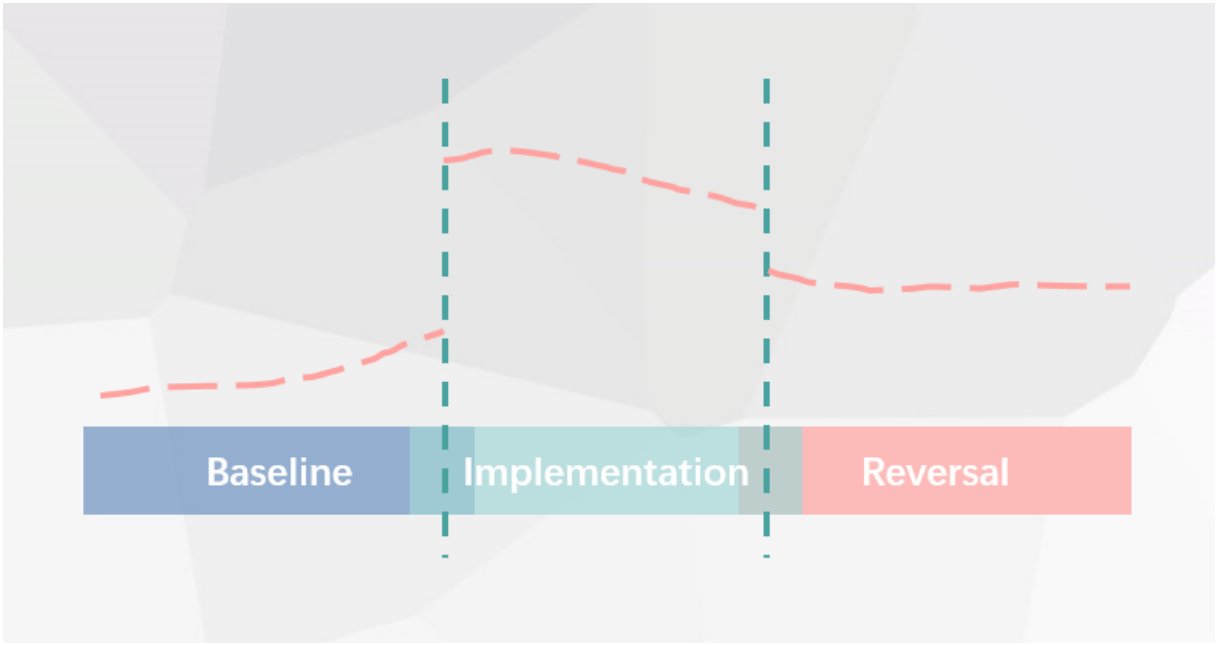

Figure 10: Expected participant's social connections tendency

From the recording, I found that participants only interacted with TOY at serval fixed moments in a day (see Appendix 4). Emma always touched the photo at around 12 pm and 4 pm because she finishes her lunch and afternoon tea at that time every day. Besides, each time she interacted with TOY, she tended to click all four contacts on the screen.

People living in Regis place many photo frames in their suite (Figure 10). Moreover, I observed participants I had visited who were pleased to share the story behind the photo if we talked about that. If they have updated photos of that person we were talking about their iPad, they were also glad to show them.

d) Discussion

i. Reflection on Emma's feedback

When designing for aging population, only considering the interaction within the interface is not sufficient. The media of interaction acts as an essential component as well. In another word, the context concludes all elements and factors between user and product. To deliver a good user experience, we need to go through a comprehensive consideration.

In above, I have mentioned Emma avoided to use TOY during the evaluation because screen backlight can't dim to dark or close at the night. It would cause participants hard to sleep. Although we had anticipated this point and install a backlight control app on the tablet which can dim up to 75% backlight at the night, we still got Emma's complain. Therefore, she attempted to shut the screen by herself before went to bed. Due to the different touch-feeling and blurred feedback, she closed the device unconsciously (short press – shut up the screen; long press – close tablet). At the same time, the complicated unlocking interface stops her open the device since old generation prefer reading instruction rather than trial-and-error [35]. Although, she could ask a nurse to help, "don't want to be burden" stops her, which is a dominate psychological feature for aging people.

The inferiority haunted by non-confidence is the other significant factor compelling Emma to avoid to use TOY. Feeling unconfident and self-esteem contribute a lot to social isolation amongst seniors [1, 4]. The data in table 1 shows Emma experienced more uncontrollable and felt higher pressure when TOY was placed into her suite. Asking nurse to help every day also made her uncomfortable, so she preferred not to bothering others rather than using a dispensable tool to build a connection with her family.

So, if we want to encourage older people to accept new technologies, besides good design, offering a sophisticated instruction to establish their confidence is one alternative approach.

Although Emma overtly stated she attempt not to use TOY, the last interview proved that she is impressive about TOY. She informed that she would want the tablet back if she could. "*I missed the ability to message my family whenever I want easily. I also like the fact that my family could call me back in their own time*" (Appendix 5 contains the complete interview transcript). To a large extent, the second half of the statement supports Chappell's idea [1]. When asking her "*How did you initiate contact with nominated family and friends? Was it using the TOY or other means?*", She said, "*It just depended on how quickly I needed to talk to them.*" In her context, TOY reduced her worry that she could interrupt her family for a non-essential issue. "*I touched the screen whenever I wanted my family to call.*" Based on those statements, I can assume that Emma has a clear awareness how TOY works, and she feels confident to send a message, "I am thinking of you", which is a better way to notice contacts without interrupting their routine.

ii. Design considerations about TOY

However, by considering the mental model of user and designer, in this case, a gap shows between user and designer. The user focuses on notification feature of TOY. For Emma, it is a handy tool to tell family member "I want to contact with you" without any disturbance and annoying text input. Therefore, she wishes this device can present more feeling of her besides just "I'm thinking of you." On the contrary, designer focuses on the simple interaction containing human emotion and wishes this simple message can empathy the same feeling of contacts, so they make a new connection. But, to reach this aim, the premise is that contacts don't have this awareness before they see the message.

Another issue found from the evaluation is the unchanged social connections. Through comparing the pattern of connection between Emma and each contact, I suppose it is because all nominated contacts come from the core social relation level of participant. They already communicate frequently. Even if TOY arises one more time per week, it is hard to detect and prove. Also, based on the statement made by A, her family made a call back in their own time

after she sent the message. Is it possible that connections triggered by TOY replace the original ones?

For elderly people, reminiscence and recollection of memory is a significant approach to anchor and preserve their life value [20]. Sharing photos' stories to others is a practical need for aging population [25]. Therefore, Kim and Zimmerman [25] integrate narration into digital frame to help older people recall their memory. Whilst, it is troublesome to update latest family photos by official sync tool. A photo streaming service may a feasible way to solve this conflict. In China, there are serval cloud services providing family album or called photo streaming.

iii. General comments

"Thinking of You" is really powerful. Recently, my colleague contacted with the charge nurse of Emma. She informed us an exciting situation. She found Emma's families came to visit her more frequent than before. One possible reason she inferred is that TOY turns over their communication pattern. Rather than adult children call her – she doesn't want to bother them, so she seldom contacts her children actively – Emma started to initialize a conversation because of TOY. And it is the first time that her families know how often their mother thinking of them.

There is an interesting episode happened when we teach Jo how to use TOY. We click her daughter's photo and send a TOY message. Then, her daughter mistakenly replies a message with an excited language to system number. Mika [33] also identified this situation in her research. These moments can be a consolidate evidence to prove the performance of TOY empirically.

5. REDESIGN PROCESS

a) Need Analysis

i. Photo presenting – slides view

When I imagine from a practical product, as a digital photo frame, presenting photo is a task taking up the majority of time. Compared with traditional photo frame, one of advantage of digital frame is displaying different photos with interesting way. Taylor et al [32] identify this needs in their research. Also, the classic digital photo frame seemed a beautiful and elegant sliding view as a significant sale point. In Lin's digital prototype, users can switch between a carousel slider and a static grid view. Consequently, I keep this idea in the new design, but prefer other stunning animation effects rather than the simple carousel.

ii. Memory reminiscence – narrative note

Photo is the media of memory. Sharing photos is an important event for aging people [20]. On the one hand, it is a general topic within their generation, which can help them to bridge communications with others. On the other hand, those communications would trigger the other old stories at the time when they browser photos by themselves. This approach can satisfy the demand of reminiscence and recollection of memory [25].

Kim and Zimmerman's exploration inspires me. Giving photo a narrative note is a possible way to support old people recall their memories. It is not a brand-new idea which has been applied by Media Industry since a long time ago: News in Picture consisting of a photo with a short illustration.

iii. Cross generation communication – dialogue on the photo

Sharing memory not just happen between old people and their friends, but also serves as an important scenario within cross-generation family members. The photo streaming may cut down the face to face chatting opportunity, but there is still another way to solve that problem The popularity of caption-style sticker (Figure 11) on Chinese social media inspired me that adding. a word as a dialogue into the photo, which gives the uploader a chance to speak something to viewer, can also initialize a possible conversation. A to-the-point word also can achieve unexpected effect and expend the imagination space of the photo.

Figure 11: a sticker with caption, "I am very satisfied"[1]

[1] Retrieve from: http://media.people.com.cn/n1/2016/0812/c40606-28630417.html at 06/11/2016

iv. Update photo – family photo streaming

The discussion above has mentioned that the old people are able to and like to share photos and memory with others on iPad or other tablets. However, my observation indicates that the updating work is a pain point and their children usually take this time-consuming task instead of them. The children need to bring tablet back to home and use PC to sync new photos into device and return back to their parent in the next visit. If it happens in a big family, it is easy to imagine how complex this progress is.

The family photo streaming is a great solution for this issue, which is a mature technology with many exiting examples. Then, each family member can upload their up-to-date photos to a cloud and people who have an accessible account can see new photos on their devices without waiting.

v. Support old people living alone – Enhanced TOY message

In Mika's [33] study, she identified that, for young family members who was always worry about their old parents living condition, the fixed time of TOY message seemed to be an indication that the old people were fine. The projects of Georgia tech [30] and intel [31] present that the ambient displays have a power to leverage aging in place by promoting peace in mind to the adult children. The device placed at their home indicates the information associated with the aging people. Through these displays, the adult children can keep peace in mind because they not only know their old generation is safe and healthy, but also can perceive unusual information displays, which can help them to prevent dangerous issue.

The TOY developed this idea by an indicating message of "I'm fine". Compared with the photo display, the plain text is indirect and inaccurate. The prevalence of digital cameras and smart phones provide an opportunity for TOY to introduce the photograph feature. So the TOY message will attach with one intraday photo of aging users. It makes up the disadvantage of plain text and increases the enjoyment of TOY message.

vi. In-time communication, feedback – short message

In the evaluation version, after touching the screen, a notification will jump up on the bottom of the screen and tell user a TOY message has been sent. The aim of this feedback is to decrease users' confusion so they know they did a right operation. While, in one of discussion with my classmate, he pointed out this feedback may arouse aging people's anticipation for an upcoming social connection, which means that if it took a long time to give a response, or even there was no response at all, the feeling of loneliness would aggravate drastically.

His concern wakes me up. The classic theories of interaction, like Nielsen 10 heuristics for user interface design, advise that system should visualize its status to "keep users informed about what is going on" [36]. In our case, that refers to the feedback's pro – users informed the interaction situation beyond than its con – the unpredictable social isolation.

Until the end of project, I still can't find a support on this field. My compromise has no feedback after touching the screen but when young family members get the message, they can reply it directly with a short message. According to the result got from evaluation, within family communication context, younger generation has a high willing to do a response in time, but subjecting to their life routine, replying by a call in any time is difficult. A message response is an alternative choice for them to respond old people's emotion quickly. What's more, old people do not have to wait a long time for the coming call. Without feedback, in some degree, could offer a surprising feeling when they receive the message.

b) Prototyping

So far, I have achieved some potential ideas for the subsequent design iteration. However, the limited user number confines my ability to make convincing design decisions. Justifying user demand level for each idea is difficult. To address this defect, I transfer these needs into detailed solutions and features, then integrate them into TOY.

i. Core Concept of TOY

There will be a bunch of new features added into TOY. Under this circumstance, one point should be proposed: do these features distract the core user goal and user experience of TOY? Therefore, I need to figure out what is TOY exactly.

Based on my understanding, the essence of Thinking of You is embedding the sensitive, emotional interaction into a simple behaviour. In a practical way to explain is that it sends a message with plentiful emotion by a simple touch to trigger a resultful social connection. Here, "I'm thinking of you, xxx" is the message embedded with sensitive human emotion which is powerful but hard to speak out in daily life. Touch the photo or click the screen is the simple behaviour. And digital photo frame is a natural and appropriate approach to carrying it. To a large extent, all of those above compose a mutualism. Beyond that, the duty of the other features is to assist in enhancing this idea.

ii. Feature Sketch

From a design process, when ideas or concepts come out, we should conceptualize them quickly. The sketch is a great option to present these ideas to other people by a visual approach so that they can understand quickly. In this section, I will show sketches which correspond to each of the needs pointed out above respectively.

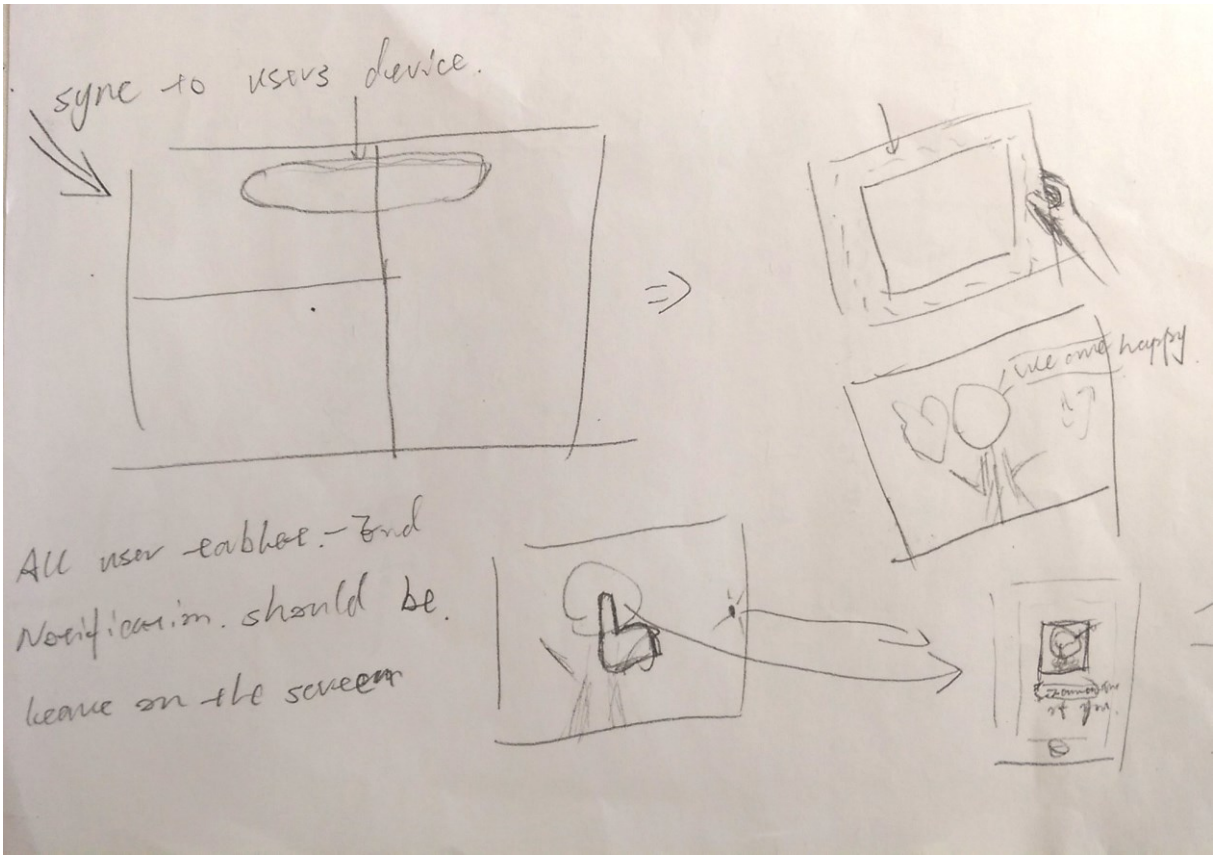

Figure 12: Activate device by holding up

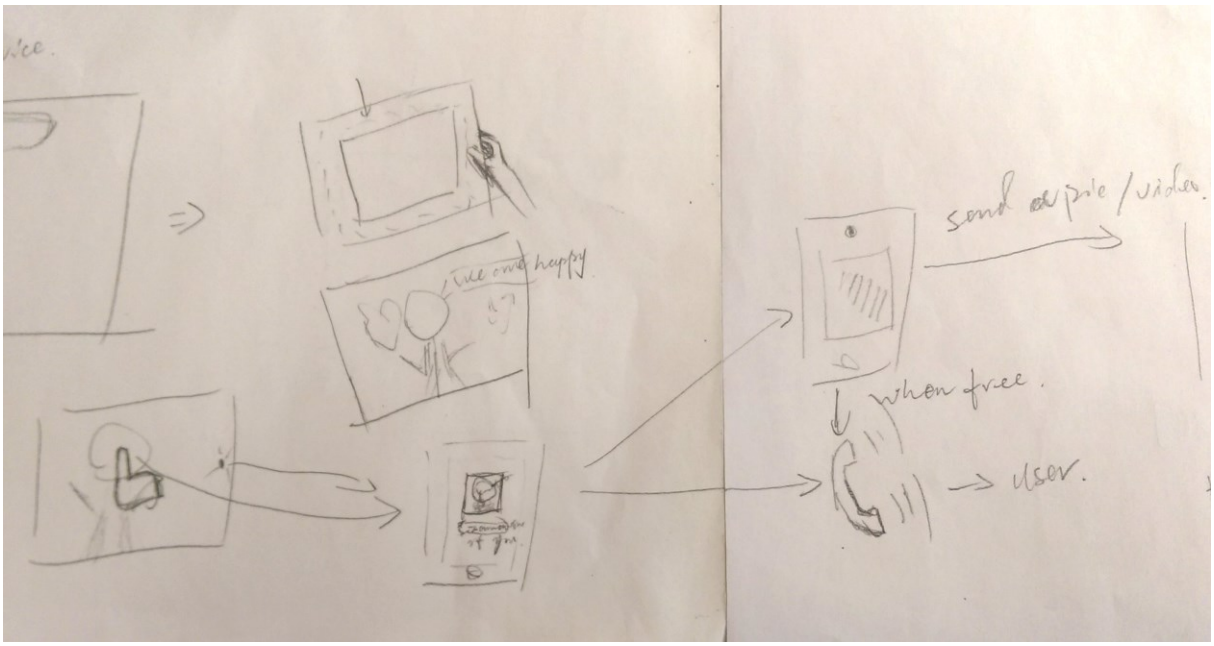

Figure 13: Touch photo to send TOY message;
Receiver can call directly or reply a message as well

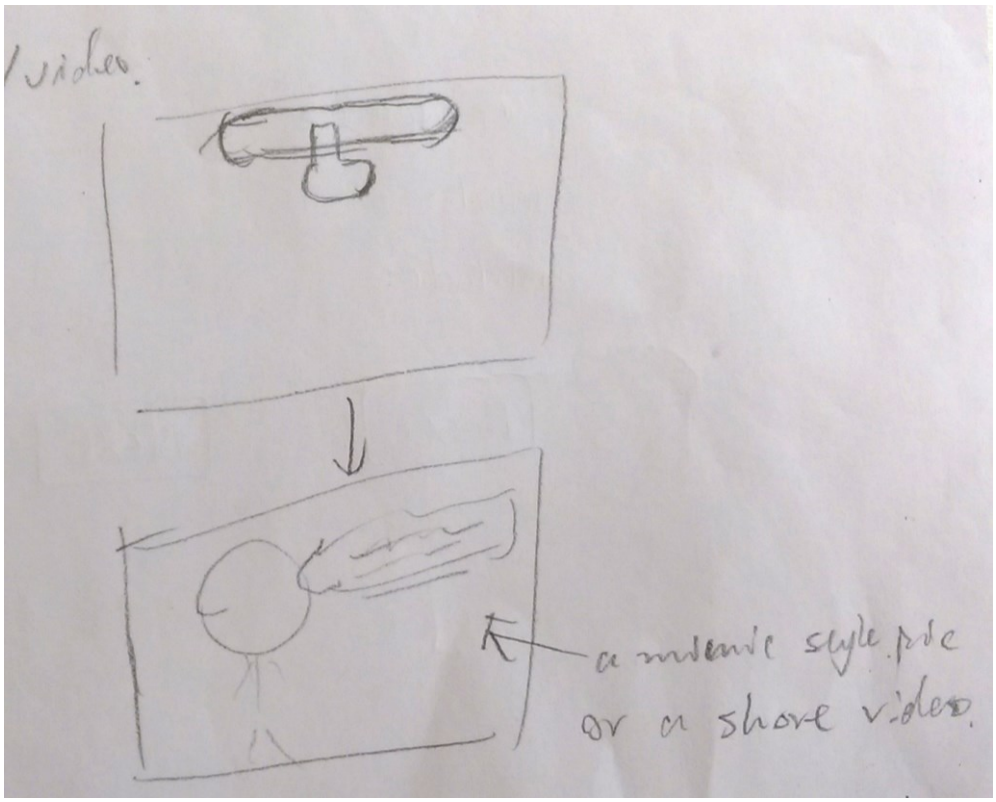

Figure 14: Touch notification to see the information

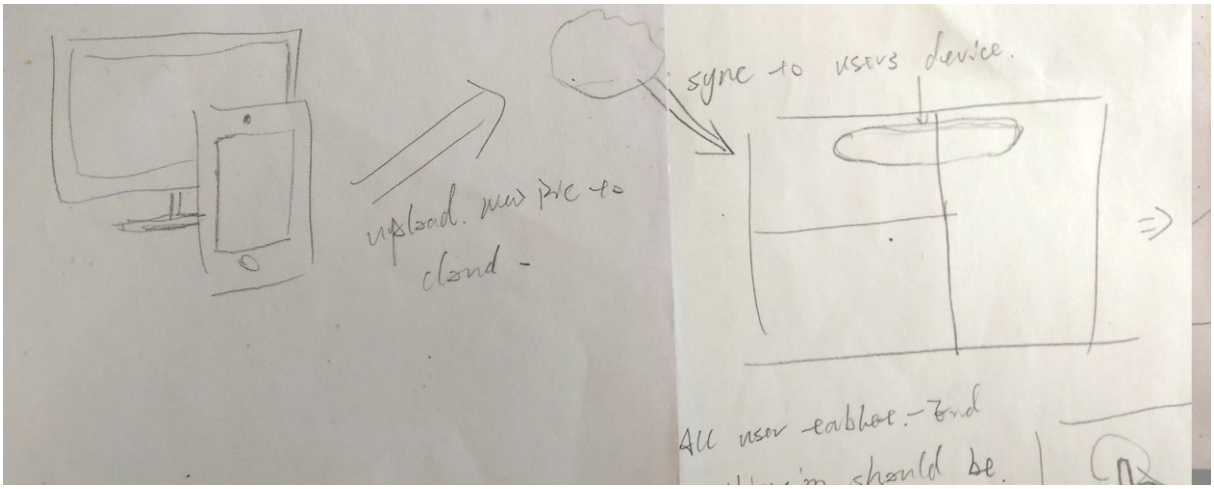

Figure 15: the diagram shows how photo streaming works

iii. Digital Prototype

Story Note

A photo display page has been separated into two parts: photo display area and note bar (see Figure 3, 4). This design refers from Kim and Zimmerman [25]. But I think their content is too much so that the font size is too small to see for senior citizens. Because of the limitation of note area, when content overflows, users need to scroll to see the continuing text, which adds an unnecessary operation. To keep a simple interaction and interface, my design requires the uploader (the young families – their children, young cousins, and granddaughter) uses the simplest word to describe the basic information of photo including when, where, who, what and how in a narrative style.

In practical, I have tried to follow the 80% rule posted by Mynatt [7, 30] through making the photo filled in the whole screen and place note text over the photo directly. If we don't use a bar to highlight the note text, most time, the complex background distracts human eyes to identify the content. Also, the visual is disorganized.

Another factor I consider is the ratio of the photo is not universal as well as the ratio of the screen. The common solution is to accommodate the screen by stretching photos – enlarging the size of the photo, then cropping. In some degree, the note bar can reduce this kind of concern. It can provide two display ratios to photos. Figure 18 demonstrates the situation when photo ratio is close to the screen ratio. Translucence effect can be a visual balance between photo content and story note.

Besides, to diminish the conflict between colourful photo and pure colour bar, ideally, the application will adjust the bar's colour according to the photo. For example, picking up the dominate colour of the photo, or calculating the geometric mean or arithmetic mean of all colours contained in the photo. The font colour will also change with the bar colour to keep the content clear enough (compare Figure 16,17,18).

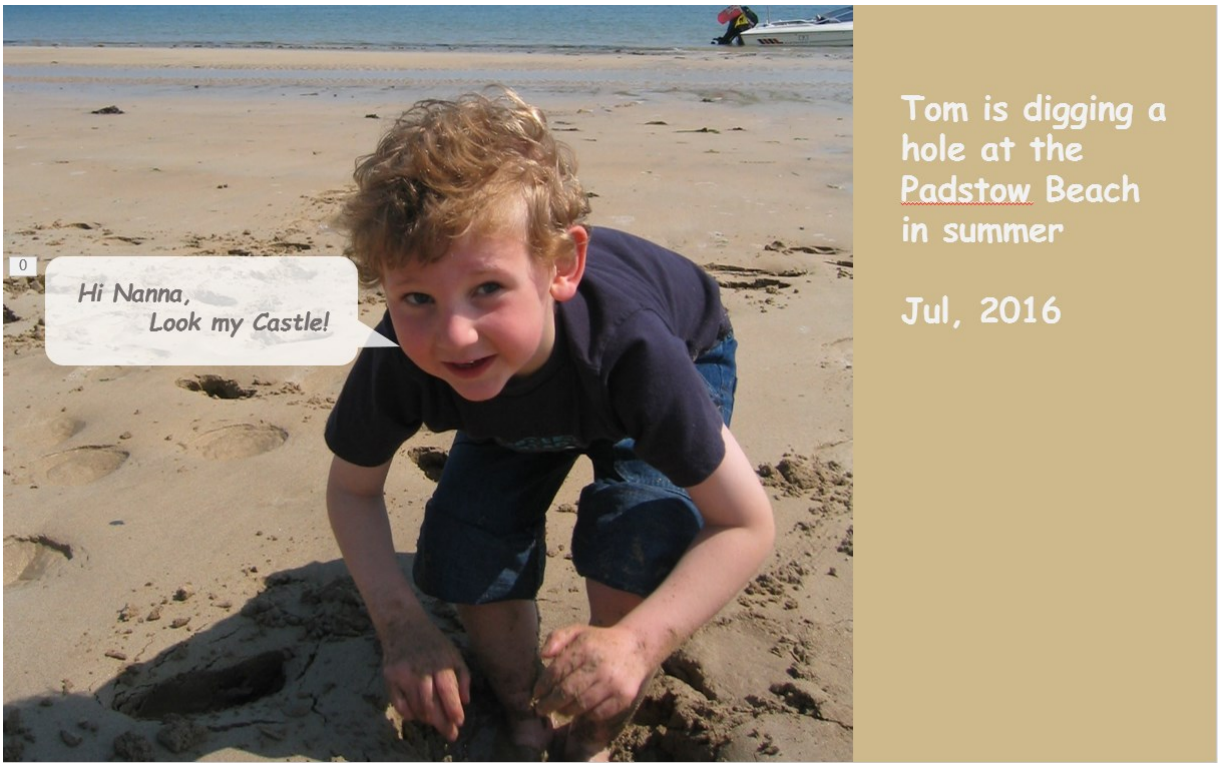

Figure 16: single photo view 1

Figure 17: single photo view 2

Dialogue

The language in the dialogue is more personal. Using a dialogue form can combine the message with the photo tightly without many distractions. At the same time, it is unnecessary to confine the "dialogue" within a dialogue. Like Figure 17, two pets have different thinking for what they are looking at. These words not only give the viewer an abundant imagination space and encourage them touch the photo, but also offer the uploader a chance to initialize an emotional communication channel within generations.

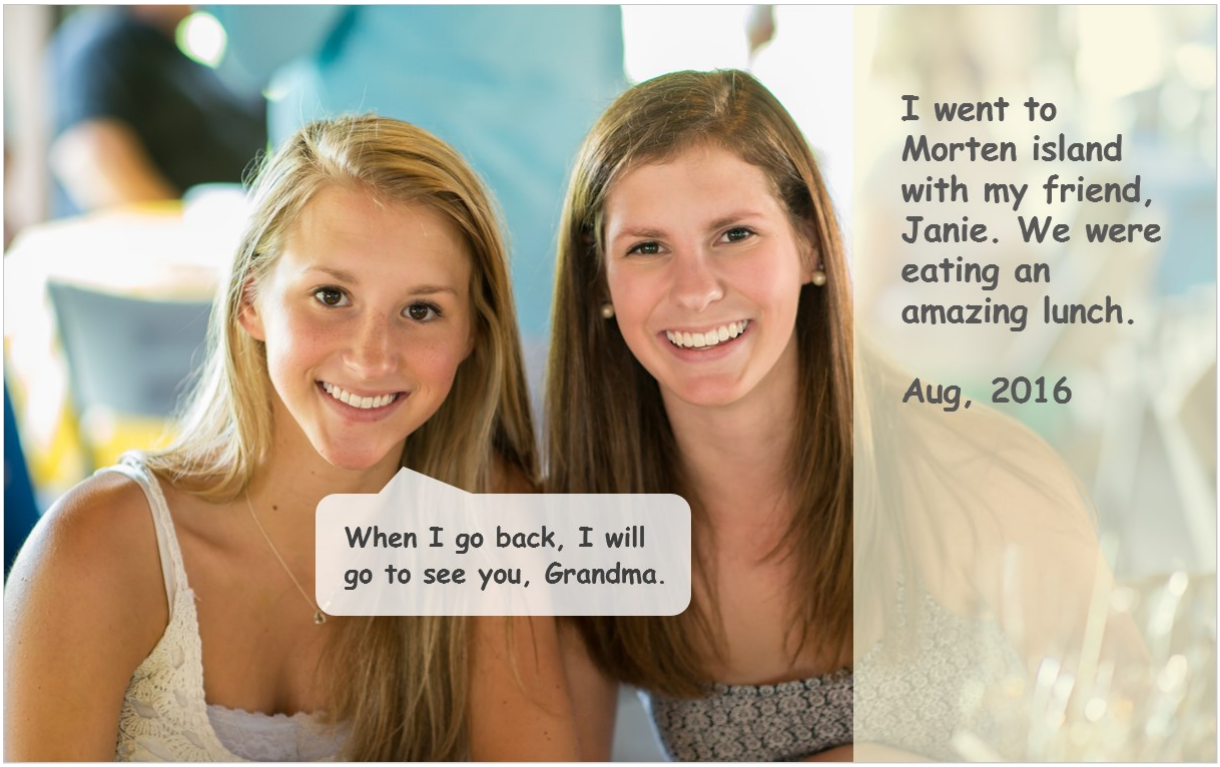

Figure 18: Single photo view 3

Slide View

The app will switch to slide view automatically when there is no interaction within certain minutes. One easy way to achieve this function is to gather the data from gravity sensor or gyroscope in the device. Using these data, the program can identify whether the device has been held by someone or is placed on the table. While some devices do not have those sensors., the system can capture the time without operation, like the PC screen protector program, in order to complete the same function. Oppositely, the application will activate

single photo view automatically when the device is hold up, or new operation has been input in the system.

The modern OS, like Windows and Mac OS, has already designed many photo slides effects, and some of them are stunning. On my part, my favorite animation is the slider with an origami style on Mac OS. Thus, in this prototype, I use this effect in the demonstration. Of course, as a real product, the app should offer a range of options for users to choose.

Enhanced Thinking of You Message

In my design, the TOY message is not just a short plain text but a multimedia message (see Figure 19). A photo will be taken at the time when the users touch the photo triggering TOY message. This design can be feasible because, when users touch the photo, they must be holding or in the front of the device due to the slider view switching function.

On receivers' side, they can reply the message instantly, as the right part of Figure 6, or make a call by press the highlighted name in the message.

If the receiver reply by message, the TOY app would pop up a notification on the screen (see Figure 20) so that the senior citizens can click to see the message (Figure 21). Normally, a notification will hide by itself a few seconds later, while TOY's notification will always flow on the screen until a user has viewed that message.

In last decade, with the booming of mobile internet and smartphone, instant message app, IM, such as iMessage, WeChat, WhatsApp and Line, gradually replace the traditional provider message service because they are free and have powerful multimedia support. Consequently, Emoji, Sticker, selfie and short video have been used more and more in our chatting channel.

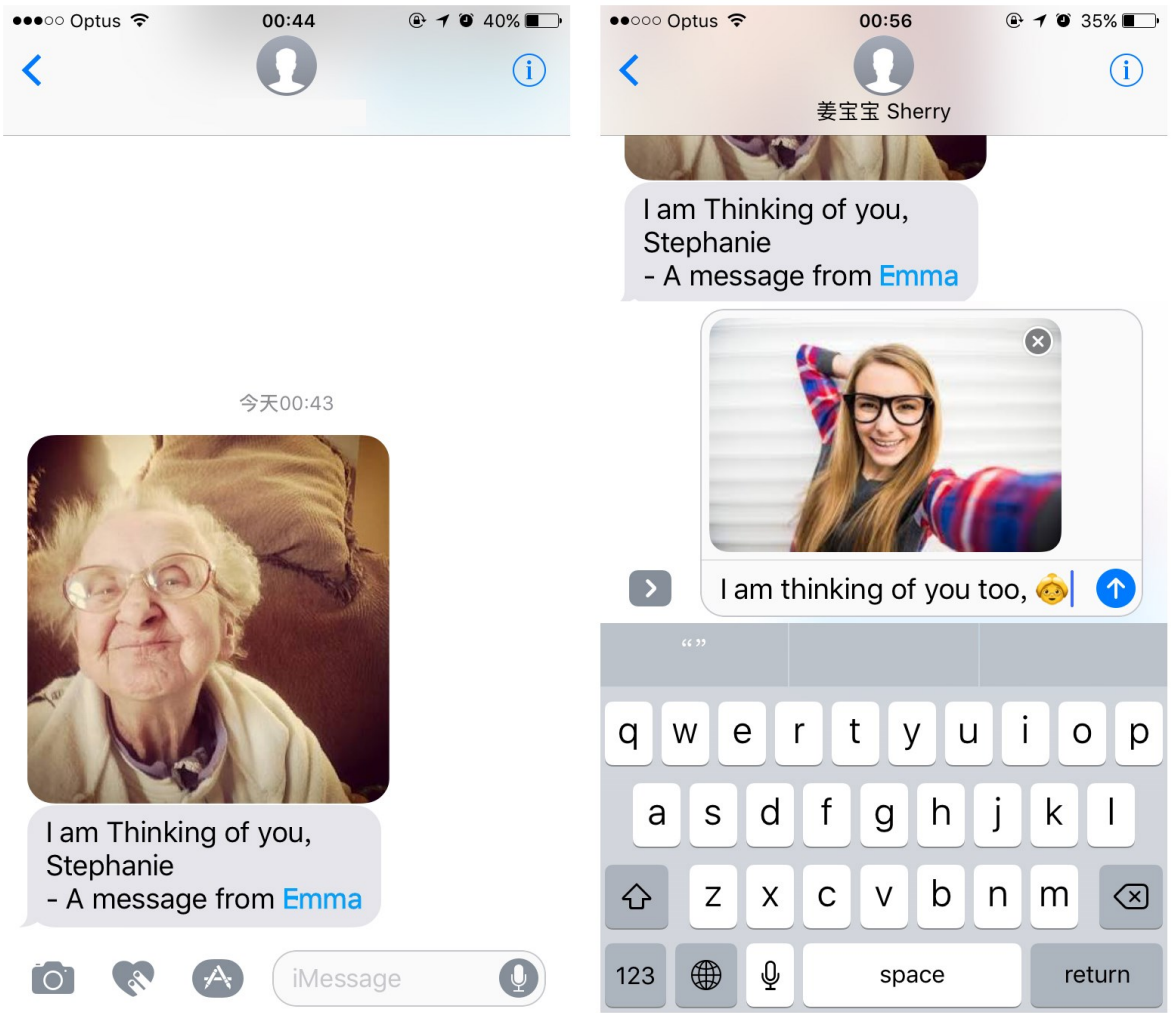

Figure 19: Left: Enhanced Thinking of You Message;
Right: User Replies the Message directly

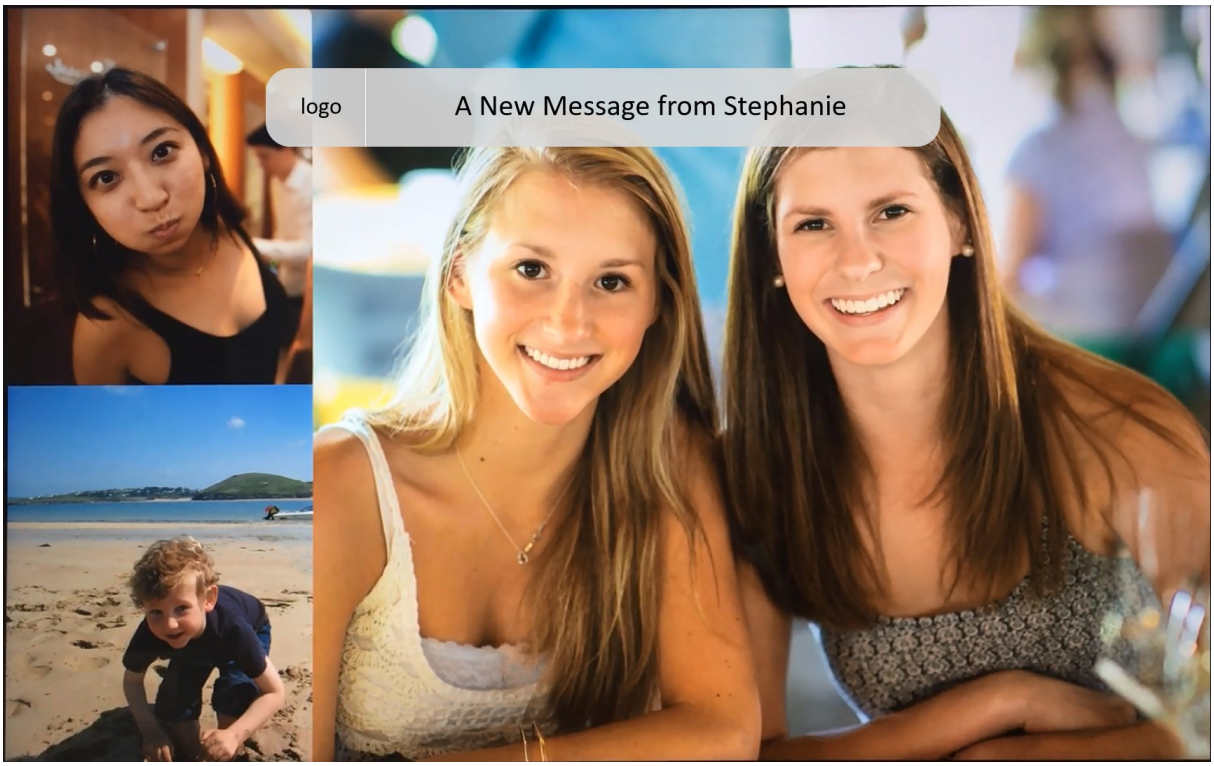

Figure 20: Quick response message notification

Figure 21: Quick response message display view

Family Photo Streaming

The photo streaming is a system level function, not a UI level. Generally speaking, different users access the family photo cloud by their own accounts. Since their TOY app will synchronize with the cloud storage and update photo albums timely, they can use upload tool to update the latest photos to the cloud so that people who have the authority to access the cloud can see the new photos on their devices.

Figure 22 demonstrates the conceptual interface of photo uploader tool on desktop and mobile respectively. In fact, I use Flickr's photo uploader interface in the prototype [2]. Demonstrating the proposal interface and its functionalities is not the aim. The difference between Flickr's desktop tool and portable tool reflects the same position to these two platforms. It is worthy of design reference.

The desktop is a universal computing platform. It works as a hub for different devices, including different smartphones, camera, and even tablet n our cases. As the most important productivity tool, a desktop can handle more sophisticated editing work such as editing the dialogue content, setting authority, and adjusting the image.

The mobile platform has an utterly distinctive convention. People who like using a phone to take a picture favour its convenience so much that it has even become a "part of the body." It is a real-time photo. Additionally, multi-selection has a bad experience on the touch-based device. The uploader on mobile only allows one photo uploading and some light-weight editing – adding story note and including GPS information.

When the cloud has been updated, the TOY will synchronize latest photos to the device. Once the user can access the new update locally, a notification will pop up (see Figure 23). This notification shares the same logic with message notification mentioned above.

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[2] Flickr upload tool: https://www.flickr.com/photos/upload/

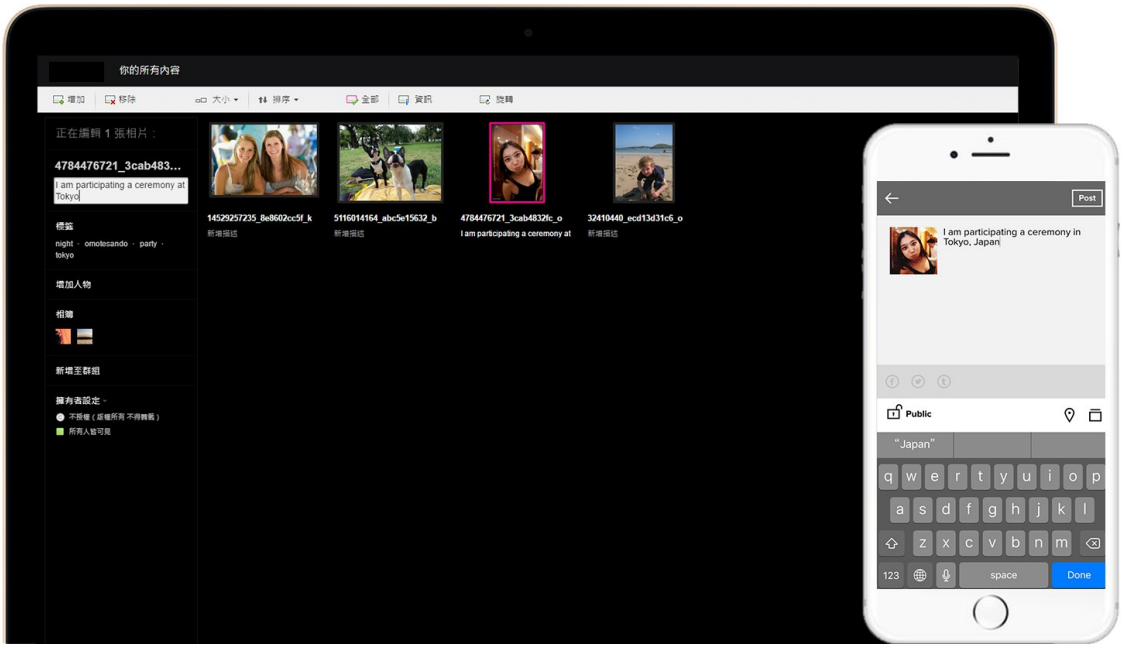

Figure 22: The uploader on desktop and mobile

Figure 23: new photo uploaded notification

c) Heuristic Evaluation and Discussion

After I finish the digital prototype, evaluation should follow up as I planned. However, since returning to Regis and restarting a similar evaluation was almost impossible, I did not conduct a formal user testing session but held serval informal interviews and discussions with my colleagues and classmates at the end of the project. That's why the following discussion focuses on the interaction and interface level.

i. Experience = device + app

Since the interaction of TOY is too simple (the only thing you can do is to touch the screen), and the data we collect is just from an unfriendly-designed tablet (the power button is a blur, the unlock page is confusing and the screen backlight was so dim at night), all the effects we wanted to see vanished in the end. We supposed to use this designed program to deliver a simple interaction solution for the aging people, but the inconvenient physical device interface made them even confused and finally led to failure.

Therefore, the ultimate user experience should combine with what kind of device and app the user uses. To deliver the best UX, we should understand the device our target users may use. And then optimize the detailed interaction basing on that.

ii. Switching between different communication tool

Since TOY is not a communication tool, users will switch to phone or SMS to complete their social connections normally. In the evaluation and previous works, no case shows users were unsatisfied with this switching or they want a super app which can have IM function as well. Therefore, I think current status is good enough. The new app, which can show the short responding message, is reaching the boundary. We shouldn't offer the reply function.

A compromise technical solution is that we can apply the open API of IM like iMessage to deliver message reply. We can integrate all message functions with the help of a third IM

app so that if aging users want to reply, TOY will jump to the IM conversation interface immediately.

iii. Genre diversity

Genre diversity is one point that the previous evaluation did not contain. All participants are female, and female contacts are more than male ones as well. That is why I can't give a rational response when one of my classmates point out this question basing on her common sense. Empirically, men have an unsociable stereotype, while TOY involves many emotional and social factors. Do they also work to men as to women? To answer this question, the work needs to recruit male participants in the future.

iv. Take photo without notice

The aim of this feature is to capture a real status of senior citizens so that their family can understand whether they are healthy or not. This starting point is good, but the side-effect cannot be ignored as well.

Without notice means that users will not know the camera is working. Their hand could cover the camera, especially when they use an iPad. Watching photos on iPad with a wide landscape is a common behaviour, which has a great possibility that one hand may cover the camera because its camera is on the left or right side when putting on a landscape. If we change to a Samsung tablet, the result will be better because its camera is on the top of the landscape.

Besides, if a user does not know the camera is taking a photo, the camera would take a bad view, which makes the photo seems ugly. A bad photo obviously has a negative user experience. In addition, the bad light condition will also lead to a terrible result.

In fact, unless old people are dressed up before taking this photo, it is difficult to hide a bad physical or mental condition despite of a strong smile.

Moreover, whether to give the user a notification or not when taking a photo should also be taken into consideration in our final design. If a good user experience is the priority, after weighing pros and cons, I prefer to providing a notice at the moment a photo has been taken.

v. Thinking of You Message

"I am thinking of you" is a strong word, and we get a positive feeling from it. This simple but emotional word can drive the receiver to make an active feedback. Although this word touches receivers deeply at the first time, this feeling may fade away after the message has been repeated hundreds of times. Since Emma tried not to use TOY, her contact did not get TOY message every day during the implementation phase, and our work went nothing. In the interview, Emma expressed that she wished she could send some words other than thinking of you. It is a point that is worthy of considering further.

A perfect TOY module should also combine with other information to surprise users. For example, if someone is on birthday, when we touch his photo, a message like "I am thinking of you, xxx. Happy Birthday" must be better than "thinking of you." Also, the weather is an interesting element. When we get a warm bless in a bad day, it could enlighten the mood.

However, the con is also obvious. Aging people have to figure out more interactions with the machine. If system provides candidate words, users would feel constraint as well because there is no candidate word can fit in their mind, making the overall satisfaction drop down. In some case, they might struggle to choose which one to send, which breaks the original simplicity. Besides, picking up a word to send inform the old people the progress, so they start waiting and expect the upcoming conversation. That is against what we discussed previously that send message without feedback because the higher expectation may lead to a more serious loneliness.

What if we remain the interface and program to generate the message? Theoretically, it is possible, but it may make the project too complicated. Moreover, a program-generated-sentence is less of a little humanity. For example, we always know which is Facebook's

system notification and which is our friend comments. Currently, the message “I am thinking of you, xxx” seems like a human word because of its simplicity. In the evaluation, we witness some contacts didn’t realize this is a system message and reply to us (they thought they reply to their parent) with surprising and exciting. The increasing complex may cause the harder to keep the humanity.

vi. Dialogue

"I want to click the dialogue to see is there any more information," a classmate said when she saw the dialogue pop up. One reason is she is a gamer. In the game, you need to click NPC's dialogue to continue. I am not sure whether the old generation would have the same reflection or not. From the cognition psychology's view, a popping-up-item can catch human's eyes, because that is a physiological response. As a result, users are easier to focus on the dialogue content.

Another concern which is worthy of discussing is that who can see the dialogue? Since we introduce the family photo streaming into TOY, it has the potential to be installed by everyone, not just the old people. Even if people who can see the photo must be your families, sometimes, the dialogue might contain private conversation with a specific family member. Figure 5 presents this scenario. Adding an authority system can solve this issue. In that way, we can decide who can see the dialogue when uploading the photo. Since the uploader's user is younger generation in most time, this kind of operation is not hard for them.

In the previous discussion, I have emphasized several times about reducing the expectation of old generation when introducing new social connection for them. If we follow the above logic, when younger people edit the dialogue content, they send a word to a particular person, which actually has aroused their expectation. They also want to know what will happen when that person sees the word. If they don't get a "TOY" response in the end, they would feel disappointed.

vii. How to handle multiple notifications

The residing notification can inform senior citizens that there are some new activities within the family so that they can check this update timely. One concern about this point is when family members make too many operations in one day, especially use phone to upload photos. The notification will take up the whole screen.

Collapsing the same type notification to make sure that there are maximum two notifications on the screen might be a good solution. However, the con is also obvious that it increases the complexity of interaction. The opposite of collapsing is also extending. Generally, users are used to clicking the notification to check the detailed information and choose to see which one first. For aging people, this design may introduce new confusion.

The other way is decreasing the size of notification bar., which means that when a notification just pops up, keep the current form first, and several minutes later, shrink it to a small block and make it float on the top of the screen. Besides, the system will also collapse the same person's notification to save space. If we do not consider the extreme situation, it can handle most scenarios theoretically.

viii. Contact reply call

Someone proposes that clicking the highlighting name to jump to the call dial interface is not clear. If there is a direct indicator given, like the following example, the learning cost can be cut down a lot.

> *"- I am thinking of you, Stephanie!*
> *– A message from Emma,* ***click to make a call****."*

Moreover, an understandable icon also an alternative way.

ix. Camera Security

My colleague states one point that “1984” has a great influence on this generation, over 70 – "The Big Brother is watching you." So they have a general concern about the camera on the tablet. In this design, we use camera to capture old people without informing. Once they realize that the camera can take pictures without their authorities, the trust will be destroyed immediately.

6. FUTURE WORKS

a) Technical Direction

i. Web App Vs Native App

In this project and previous two iterations, we all choose to build a web app as prototype. It is because web-app is easy to complete in a short time so that we can save time and focus on evaluating the idea. Also, the web is a standard which means it has the best compatible on the various platforms. As long as the device has a browser, it can run TOY.

However, during this evaluation, the dimming issue and the stability cause so many troubles that the evaluation progress has been affected a lot. So far, the idea has experienced three iterations and, I think, the main functionality has been proven. If the future work focuses on improving the user experience from a product view, I recommend to create a native app because the native app has a deep integration with system; in another word, the app accesses the low-level data of the device. As a result, native app can solve the screen backlight issue easily. An in-depth system integration offers more sophisticated experiences, for example, activating device when users hold it up, which is impossible to realize under current web framework. Meanwhile, I prefer iOS. From my experience, iPad is popular amongst old people. Since developer only needs to optimize for few devices, iOS application has a higher stability than Android's.

While a web app can run on any device with a modern browser, a smart device must set up with a smart system. A native app is able to cross multi-platform as well.

ii. Integrate TOY into a IoT context

Furthermore, with the entry of smart devices in our daily life and the development of IoT, screen, as a dominate interaction media, will take up our house. A more ambitious design concept about TOY is to integrate with system screen protector and install on TV, mobile phone, tablet, PC even a smart refrigerator. Using their screens to display photo, which replaces traditional photo frames. In that case, it could create a continuous experience and the users do not need to remember to open the app. Exploring the interaction under this context is an interesting and potential topic as well.

iii. Multimedia content

In recent years, the industry brings many surprising innovations to us: Snapchat introduces the concept of Burn after Reading; Sticker represented by Emoji create a new communication paradigm on social media; Apple promotes the emotion took by live photo; WeChat uses short video to hit Chinese users. These new form media are flowing up all over the world because in some contexts, they could carry more powerful meaning than the static photo dose. On my part, it is unnecessary for TOY to be restricted only on picture. Trying to apply these creative media may not be a bad idea. It could be a challenge to discover a suitable interaction and interface and how to compromise between context and interaction in the final design.

b) User Evaluation

This project proposes an updated version of Thinking of You, which attempts to add many features to improve the user experience. How are their performances? Due to the limited time, I can't conduct more specific evaluations to estimate them. A formal user testing can give our evidence to support the performance of each feature. Through user testing, designer will have a touch with wide range of target users. It would benefit to gain a better

understanding of them. And this understanding provides designer a confidence to push the idea into a higher level.

A social connection is a two-way activity. The current evaluation stresses the feedback of participants but Contacts are also significant users of TOY which has been neglected in the former project. Their feedback would expand our horizon and review TOY from another aspect. Improving their experience would react upon the effect TOY desires to achieve. Therefore, contacts' idea should take more weight in future researches.

c) Potential Questions

During the project, I realize that there have been many academic fields we should cover. As I mentioned, to keep the evaluation controllable, we confine each participant with maximum four contacts. Consequently, we are proving that TOY has positive effect within the close relationship of audience. However, what if the contact is not from participants' closest relationship circle, is "I'm thinking of you" still strong enough to motivate the receiver to make connection actively and timely?

Emma's psychological measurement result cannot be a consolidate proof to support the argument that TOY can improve users' social satisfaction by increasing their social connections. In fact, the total amount of Emma's social connection doesn't show a significant distinction. If we import more extended relationship into the evaluation, what would happen? Using Emma as an example, if the research includes members from her church community which has been identified as important as her biological family. Does the social connection come from them have a stronger impact than the connection between biological families? What about a connection comes from an old friend without touching since many years? Where is the boundary of this question? Those sociological questions deserve to be reflect and researched.

With the risk of no response getting higher, how to deal with the system feedback which informs users that someone has received their message and arouses a mind that a new

connection will come soon. Although I cannot answer those questions, they are worthy of being discussed and dug in the future.

7. CONCLUSION

In this paper, I discussed how social isolation affected the old group, reviewed some attempts in this field, and demonstrated the progress of evaluating Lin's work comprehensively. Although the evaluation can't allude to success, we still extracted valuable data and insights from it. The limited results enlighten me a lot regarding not only the understanding of aging population and their context but also the design of TOY. Based on what I learn from the evaluation and related literature; I complete the iterative design work and make a discussion with peers.

To sum up, there are three points deserving to share with other researchers.

Firstly, TIME is the top priority. When the research audience suffers from both physiological and cognitive issues, everything should have been standby. During the project, one participant went away because of disease exacerbation and the other one, Jo, had to quit the research because her cognition capacity retrogressing seriously. Even Emma's healthy condition becomes worse (when writing the thesis) than a few months ago. Unfortunately, this situation cannot be reversed. Therefore, when we start a similar project, time is valuable.

Secondly, although, the evaluation result is limited, all those evidences gathered from the research suggest that the "Thinking of You" using emotional short message to trigger social connection is definitely feasible idea.

Thirdly, before making a design decision, we should weigh both pros and cons carefully because, when we involve into our project, it is easy to ignore the bad side. With a new feature being adding, some unexpected issues also are introduced. How to play with those pros and cons and make compromise based on our understanding for target context is essential.

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9. APPENDIX

Appendix 1: Questionnaire

Demographics

Age

Gender M F

Marital status Married Divorced Widowed Not Married

Living alone Y N

How long have you lived at Regis? _____

Chronic medical conditions _____

_____

_____

_____

A single-item measure of social identification: Reliability, validity, and utility

Identification with Regis:

I identify (have strong ties) with Regis

do not agree at all 1 2 3 4 5 agree completely

Multiple identities

I am a member of lots of different groups.

do not agree at all 1 2 3 4 5 agree completely

I am friendly with people in lots of social groups.

do not agree at all 1 2 3 4 5 agree completely

Retained identities:

1. Since moving to Regis, I still identify (have strong ties) with the same groups I was part of before moving to Regis.

do not agree at all 1 2 3 4 5 agree completely

New identities

Since moving to Regis, I identify (have strong ties) with one or more new groups.

do not agree at all 1 2 3 4 5 agree completely

Social Groups

Sometimes we spend time with other people through being part of a group (e.g., their family, a work group, a sports club). Which groups are you a member of? [Max of 5 only]

Group 1	Group 2	Group 3	Group 4	Group 5

Of these groups, how many are very important to you? [tick]

Group 1	Group 2	Group 3	Group 4	Group 5

Social Network Diversity:

Below is a list of different kinds of people that you may or may not have contact with. For each of these people, could you indicate whether this is someone that you speak to or communicate with (in person, on the phone, or via email) at least once every 2 weeks.

If you do not have some of these relationships (for example, if you do not have grandchildren), please respond with "NA".

	No	Yes	NA
Spouse/ partner	☐	☐	☐
Children	☐	☐	☐
Grand children	☐	☐	☐
Other close family members	☐	☐	☐
Friends	☐	☐	☐
People in my local community	☐	☐	☐
Fellow volunteers (e.g., through charity or community work)	☐	☐	☐
Members of religious groups	☐	☐	☐
Members of other groups e.g., social, recreational, professional	☐	☐	☐

Think again about each of these people. Some people we don't see very much, but we are quite happy with that. Other people we would like to see more. For each of the people listed, how satisfied are you with the amount of contact you have?

Even if you indicated "NA" in the last question because you don't have a particular relationship, please indicate how satisfied you are that you don't have this relationship.

Here satisfaction means that you think have the right amount of contact; dissatisfaction means that you think you do not have the right amount of contact.

	Very dissatisfied		*Neither/ Neutral*		*Very satisfied*
Spouse/ partner	1	2	3	4	5
Children	1	2	3	4	5
Grand children	1	2	3	4	5
Other close family members	1	2	3	4	5
Friends	1	2	3	4	5
People in my local community	1	2	3	4	5
Fellow volunteers (e.g., through charity or community work)	1	2	3	4	5
Members of religious groups	1	2	3	4	5
Members of other groups e.g., social, recreational, professional	1	2	3	4	5

Loneliness

The next set of statements describe how people sometimes feel. For each one, please indicate how often you feel the way described:

	Hardly Ever	Some of the Time	Often
How often do you feel that you lack companionship?	1	2	3
How often do you feel left out?	1	2	3
How often do you feel isolated from others?	1	2	3

Mood

CES-D 8 (Van de Velde et al., 2009)

How often have you felt this way during the past week…..

	Rarely or none of the time			Most or all of the time
…. you felt depressed	1	2	3	4
…. everything you did was an effort	1	2	3	4
…. your sleep was restless	1	2	3	4
…. you were happy	1	2	3	4
…. you felt lonely	1	2	3	4
…. you enjoyed life	1	2	3	4
…. you felt sad	1	2	3	4
…. you could not get going	1	2	3	4

And the GAI-SF (Byrne & Pachana, 2011):

Please answer the following according to how you have felt in the last week

	Agree	Disagree
I worry a lot of the time	¡	¡
Little things bother me a lot	¡	¡
I think of myself as a worrier	¡	¡
I often feel nervous	¡	¡
My own thoughts often make me anxious	¡	¡

Self Esteem

1-Not very true of me
5- Very true of me

I have high self esteem	1	2	3	4	5

Perceived Control

The following statements, describe what people sometimes feel. For each, please indicate how much you agree or disagree with the statement

1- Strongly Disagree
2- Disagree
3- Neither Agree or Disagree
4- Agree
5- Strongly Agree

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I often feel that most situations are out of my control	1	2	3	4	5
Usually I feel that I have control over what is going on in my life	1	2	3	4	5
"Life is complicated; a person like me can't understand what is going on."	1	2	3	4	5

Life Satisfaction

From the world happiness survey

	Not happy at all			Very happy	
Taking all things together, how happy would you say you are	1	2	3	4	

Appendix 2: Post-Study interview outline

For Thinking of You Group Participants only:

Thank you for participating in the "Thinking of You" Application. To gain some understanding of you experience with "Thinking of You", please share your views by responding to the following open-ended questions (there are no 'right' or 'wrong' answers).

How often did you find yourself using "Thinking of You" – several times a day, every couple of days, weekly? What was the reason for this level of use?

During the trial, how did you initiate contact with nominated family and friends? Was it using the "Thinking of You" or other means? Please elaborate.

Did using "Thinking of You" improve your interaction with people? If so, how?

Did using "Thinking of You" generate other forms of social contact? If so, what forms?

How did you find interacting with "Thinking of You"? Could it be improved?

Was "Thinking of You" a good way of contacting the people you know and would you have continued to use "Thinking of You" post-trial if you had it? Why?

Appendix 3: Daily Dairy Record

Participant A's Contacts

Name	*Stage*	*Week*	*Sub*	*Original Record*						
Alison	Baseline	week1	6	1	0	2	2	0	1	0
		week2	3	0	0	1	0	1	1	0
		week3	3	0	1	1	0	0	0	1
	Implementation	week4	4	1	1	0	0	1	1	0
		week5	3	0	1	1	0	1	0	0
	Reversal	week6	2	1	0	1	0	0	0	0
		week7	4	1	1	1	0	0	1	
Tony	Baseline	week1	3	1	0	0	1	0	1	0
		week2	1	0	0	1	0	0	0	0
		week3	1	0	0	1	0	0	0	0
	Implementation	week4	1	0	1	0	0	0	0	0
		week5	1	0	0	0	0	1	0	0
	Reversal	week6	0	0	0					
		week7								
David	Baseline	week1	2	0	1	0	0	0	1	0
		week2	3	0	0	1	0	1	1	0
		week3	2	0	1	0	0	0	0	1
	Implementation	week4	3	0	1	0	0	0	2	0
		week5	4	0	1	1	0	2	0	0
	Reversal	week6	4	0	0	0	1	1	0	2
		week7	4	0	0	0	2	1	1	

Paula	Baseline	week1	1	0	0	0	0	0	1	0
		week2	0	0	0	0	0	0	0	0
		week3	0	0	0	0	0	0	0	0
	Implementation	week4	3	0	0	0	1	0	2	0
		week5	1	0	0	0	0	1	0	0
	Reversal	week6	1	0	0	0	1	0	0	0
		week7	1	0	0	0	0	1	0	

Appendix 4: Participant Interaction Record

Participant A's Interaction Record

		DATE	TIME	TARGET
WEEK1	Day1	24/06/2016	10:58:02	David
			11:01:58	Alison
			13:56:59	Alison
			14:11:55	Paula
	Day3	26/06/2016	12:20:17	David
			12:20:20	Alison
			12:20:26	Paula
			12:20:30	Tony
			21:30:11	Alison
	Day5	28/06/2016	15:15:57	Alison
			15:16:05	Paula
	Day6	29/06/2016	9:32:23	David
WEEK2	Day2	03/07/2016	12:35:11	Alison
			12:35:18	David
			12:35:22	Paula
			12:35:26	Tony
	Day5	06/07/2016	16:46:59	Alison
			16:47:05	David
			16:47:07	Paula
			16:47:23	Tony

Appendix 5: Participants Interview Result

Participant A's Last Interview Record

How often did you find yourself using "Thinking of You" – several times a day, every couple of days, weekly? What was the reason for this level of use?

I used it every few days. I used it when I wanted my family to contact me

During the trial, how did you initiate contact with nominated family and friends? Was it using the "Thinking of You" or other means? Please elaborate.

I usually used my phone to contact my family and sometimes I used the photos. It just depended on how quickly I needed to talk to them

Did using "Thinking of You" improve your interaction with people? If so, how?

No, because there are better ways to communicate with my family, for example by telephone

Did using "Thinking of You" generate other forms of social contact? If so, what forms?

No

How did you find interacting with "Thinking of You"? Could it be improved?

It was very easy to use but like I said I prefer to just call my family on the phone. It was nice to have the photos of the family in my room though. Perhaps it could be improved if there were other messages you could select rather than just the "thinking of you". I also found it difficult to switch off at night time because I can't use my right hand so I had to ask the

nurses to switch it off and on for me. It was too distracting at night time and so I always switched it off overnight

Was "Thinking of You" a good way of contacting the people you know and would you have continued to use "Thinking of You" post-trial if you had it? Why?

No, not really, I like to speak to my family.

What motivated you to touch the photos

I touched the screen whenever I wanted my family to call. Most of the time they would call me within half an hour or so.

What did you like about the app?

I liked how easy it was to use and I liked seeing the photos of my family.