

# Menu Design of Digital Photo Frame for Older Users

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**Abstract.** The advancement of image technology has escalated the development of digital camera devices and shifted the way people view and store photos. Touch screen digital photo frame, as a marginal product with the digitalization, also becomes commonly and widely accepted. With the senior citizens on the rapid increase that structurally changed with the aging society, unignorable attentions should be paid to methods for more friendly and user-centered design of digital devices for improving elder users' experience. This study set out to examine elders' performance and preferences for menu design of digital photo frame. Research data was collected from 24 subjects using the paper prototyping method. Results of this study show the preference toward exhaustive but not burden display, habitually perceivable message structure, and slightly magnified size for both the display and icons. This study concludes with the suggestions to future research and design practices of digital photo frame.

**Keywords:** Menu design, Icon design, Digital photo frame, Paper prototype, Gerontology.

## 1 Introduction

Information and communication technology is of crucial importance for daily life in the modern era. It affects living convenience and contentment, and contributes to one's perception on their living quality. For the elderly population in specific, ICT has been considered as powerful to facilitate and improve their feelings of connectedness with their families and the society as well (Davies & Nolan, 2006). Taking photowork (Kirk, Sellen, Rother, & Wood, 2006) as an example, the flow of photograph capture, storage and display has been significantly engaged with digital devices (Choi, Lee, & Koo, 2010). However, while a large number of related works focused on innovations of image technology (Apted, Kay, & Quigley, 2006; De Voegt, et al., 2010; Frohlich, Kuchinsky, Pering, Don, & Ariss, 2002), research on the needs and experiences of the users is not exhaustive.

On the other hand, in response to the current structure change in global population, the world in general and developed countries in specific have been predicted to suffer rapid aging problems in the near future. Additionally, value of families and family bond has shaped a relatively unique social connectedness between senior citizens and their offspring in asian countries. The needs to enrich and enhance the quality of life

grow along with the increasing number of aging population. In Taiwan, Council for Economic Planning and Development of Taiwan (2010) addressed the coming of aging society with the predictive ratio of senior citizenship grown up from 10.7% in 2010 to 45.6% in 2060. This projection not only suggests that gerontogocial products would be then the major merchandize for the society, but also implies emerging needs and possibilities of ICT to be involved in elder appliances in the future. In order to meet these future needs, understanding of the users now is necessarily important.

This study focuses on photograph display as a symbolic phenomenon that reflects social life of the elder people. Photo frames are usually considered to be part of the furiture or decorative objects that blend in the home environment, which serve as constant reminders of the emotional feelings and mark those significant family events. Photo frames highlight the value and importance of the static images, which is evident while the elders initiate and manage a conversation with a photograph. Consequently, it is important to provide suggestions for forthcoming designing digital product that will offer engaging content combined with an interface that seniors can easily and pleasurably use. In this vein, this study takes touch screen digital photo frame as the benchmark product to examine its usability from a set of criteria including elders' perceptions, needs, preferences and interactions with the interface.

## 2 Interface Design for Older Users

The aging of population and increasing societal reliance on computers are two prominent trends (Saunders, 2004). With the lower technology affordance elder users usually bare, the learning barrier of digital products for them is generally high due to the degeneration of sight, memory and cognitive ability (Miller, 1956; Zajicek, 2001). As a result, in design for elders, the well documented effects of aging should be taken into account carefully due to the disability and illness increased as we aged, especially in losses in vision, cognition, and motor skills (Apted, Kay, & Quigley, 2006; Morimoto et al., 2001).

Previous studies have suggested several differences on interface preferences between elder and general users. Opalinski (2001) found that senior users claimed several features of computer and digital products, including the simplicity of instruction or tutorials, less expensiveness, adaptability, and ease of repairing. Studies regarding touch technologies advocate the intuitiveness and ease of operations for elder and novice users to directly manipulate virtual objects in natural ways (Albinsson & Zhai, 2003; Apted et al., 2006; Jin, Plocher, & Kiff, 2007; Shneiderman, 1991). On the other hand, control mechanism and interface have also been of enthusiastic discussion in related research works. Sears (1991) believed that user performance and preference will be influenced by the size of keyboards, and the larger size leads to better performance (Sears, Revis, Swatski, Crittenden & Shneiderman, 1993). A key or icon designed to be touched easily will attribute to low error rates for novice users. For elder users who are not familiar with the digital products, a similar design with clear and immediate reacting icon may decrease the anxiety and change their attitudes to more positive views on the products. Regarding the controlling accuracy, Hall, Cunningham, Roache, and Cox (1988) claimed that icon of 26mm per side results in highest accuracy on touch screen panel. Recent studies on mobile technologies indicated that older users preferred larger icons

(20 mm) in contrast to younger participants in the research on physical interaction with PDAs (Pease & Pease, 2001; Siek, Rogers, and Connelly, 2005). It is noticeable that in spite of the general preferences reflected by varied user groups, user performances are, on the other hand, greatly influenced and interfered by the format of the digital products and the major tasks they perform with the products. For elder users who work on capturing, archiving, searching, browsing, sharing and framing (Frohlich, Kuchinsky, Pering, Don, & Ariss, 2002; Kirk, Sellen, Rother, & Wood, 2006; Rodden & Wood, 2003), to design and develop suitable and efficient user interface still call for empirical and specific research efforts.

In sum, this study sought to testify the optimal icon size of digital photo frame for elder users based on their preferences. Specific user features such as degenerating sights, memory and cognitive abilities are taken into design considerations when developing the prototypes to cope with the general limitations and individual differences reported above.

### 3 Experiment Design

#### 3.1 Subjects and Instruments

According to the purposes of study, 24 elder users ranged from 55 to 75 years old who had experiences with digital products are recruited by judgment sampling and pearl growing techniques (Narayanan, Bailey, Tendulkar & Daley, 2002). The sample of 24 users is proportioned to user gender and age.

This study adopts Liddle's (1996) paper prototyping technique in the experiment. The experimenter manipulates the paper prototype in response to the elder users' immediate feedback. User preferences toward the physically functional attributes including display size, icon size and numbers are measured and analyzed to inform the design of the digital photo frame.

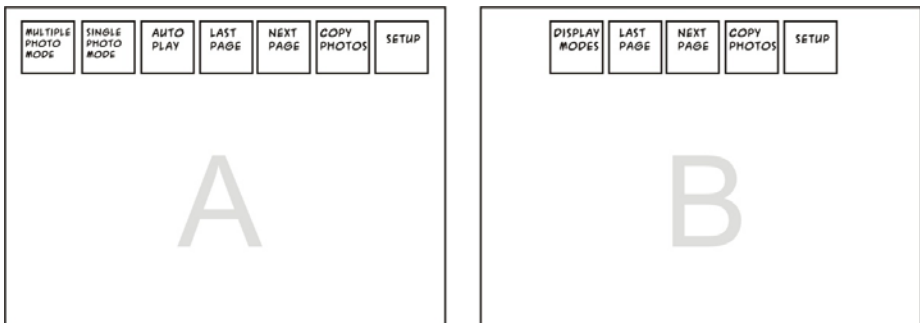


Fig. 1. Design A and Design B

Two designed layouts are tested in the experiment. The sizes of both displays are 17.78cm x 12.70cm as shown in Figure 1, while Design A is distinguished from Design B in the number of icons. There are seven icons in Design A: multiple photo mode, single photo mode, auto play, last page, next page, copy photos from memory

card, and setup. Five icons in Design B are display modes, last page, next page, copy photos from memory card, and setup. Design A adopts flat menu by presenting 3 peculiar functional icons for display on the first-level. Design B adopts cascading menu design by dispensing functional icons to secondary levels.

### 3.2 Procedures

All participants are required to fill out the questionnaire in which personal background, experiences and computer literacy are inquired. The researcher gives an instruction of the paper prototype of photo frame, and the following tasks users will be undertaking. Second, with the instruction given ahead, every single user is assigned to conduct four tasks of copying, deleting, searching and displaying with the paper prototype during the experiment. The order of the tasks is pre-determined according to user proportion in order to leverage order effects.

Copy: Copy the photos from memory card.

Delete: Delete the appointed photo.

Search: Find the appointed photo.

Display: Set photos play automatically.

Thirdly, every participant is then interviewed individually for their preference over different layouts and functions. By the size of the display and the number of icons, this study composed 6 sets of experimental panels. Users are asked to rank the six sets and three different icon sizes respectively during the interview. Lastly, every participant is asked to sort the substantial icons and arrange selected icons freely on assigned paper photo frame which sized 17.78cm x 12.70cm.

There are two researchers accompanied the subjects constantly in each experiment. One sits behind the paper prototype of digital photo frame to interact with the participants. The other monitors the experiment in the observation room with one-way mirror and records users' reaction time and logs by digital camera. User reaction time refers to the time of completing each task after the given task instruction. It is measured and recorded in this study to note the reaction process of each participant to understand work efficiency of operating the prototype.

## 4 Results

The participants of this study are 24 elders aged from 55 to 75 ( $M = 63.38$ ,  $SD = 6.52$ ) in the northern part of Taiwan. Male and female participants are of equal number. According to their experiences of digital camera, male and female groups were then divided into two sub-groups of 6 for each. The participants are asked to evaluate their self abilities to use digital products. Most of the participants regard their abilities as lower than the general average.

Of each assignment for both Design A and B, mean reaction time (RT) was recorded. Specifically, participants reacted faster with Design A than with B over the tasks of deleting ( $M = 77.75$  sec  $<$  104.5 sec) and displaying ( $M = 3.63$  sec  $<$  13.63 sec) photos. Based on the observation logs, most of the participants failed the tasks of deleting photos while they reflected difficulty to recall, recognize and manipulate the menu.

After operating the paper prototype with assigned tasks, the participants were asked to choose which design they preferred most from Design A and B. Of the 24 participants, 5 persons reported a general preference of Design B, despite that much time was spent in deleting the appointed photo and setting photos play automatically.

Table 1 shows participants' preferences for the size of display and the numbers of icon. Design 6 was the most satisfied interface design and the Design 1 was the least satisfied design. The result showed the participants preferred larger size of digital photo frame since the average scores from Design 3 to 6 were all higher than the average. It is notable that mean of Design 2 was higher than Design 1, and so did the comparison between Design 3 and 4, and between Design 5 and 6. The results suggested that under the same display size, elder users preferred more icons on the menu, which is also identical when 19/24 of the users like Design A more than Design B.

**Table 1.** User Preference for Display Size and Icon Numbers

Design	1	2	3	4	5	6
Size of the Display	S	S	M	M	L	L
Number of Icons	5	7	5	7	5	7
M	2.25	2.38	3.46	4.29	3.88	4.75
SD	1.72	1.31	1.25	1.36	1.42	1.64

Note. N=24. Scores (1-6) were transformed from the ranking results.

The ranking result of the preferred icon sizes was transformed into weighted scores. While the participants ranked the three sizes of the icon, the most preferred one gets 3 points and the least preferred one gets 1 point. According to the result, the medium size (2 cm x 2 cm) is most liked by elder users ( $M=2.62$ ,  $SD=0.49$ ), followed by the large size of 3 cm x 3 cm ( $M=1.96$ ,  $SD=0.80$ ), and the small size (1 cm x 1 cm) was considered least preferred ( $M=1.42$ ,  $SD=0.65$ ).

## 5 Discussions

The results of this preliminary study supported the questions of older people's preference for digital photo frame. In general, Design A with more keys was generally perceived as easier to manipulate for its flat presentation of all functions. This result was corresponded to the recommended DoF (degree of freedom) of input devices cause efficient operation (Miller, 1956; Nakata, 1998) since Design A was designed with 7 keys. According to the participants in this study, Design B with only 5 keys looked simple before they interact with, however, after the experiment they found insufficient information provided on Design B that made them confused and therefore resulted in spending more time to search to complete assigned tasks. It was common that participants experienced failures of recall, recognition and manipulation during the task of deleting photos in which most error occurred by researchers' observation. Likewise, it was notable that elder users made fewer mistakes while operating the interface with more function keys; instead, more mistakes were made by interacting with fewer icons, which echoed Sears's previous studies (1991; 1993). To sum up, the sufficiency of recognition significantly impacted elder users' preference. In addition,

the result of this research indicated that the elders preferred medium key size (2 cm x 2 cm) which was quite close to the research of Siek et al. (2005). They claimed that elders preferred larger icons in comparison with the younger participants because it was easier to see the details.

As shown in Figure 1, visualizing with self-related images led to higher evaluations for the incremental products (Dahl and Hoeffler, 2004). This research supported the result that the experience of digital camera will probably have influence on the preferred layout of digital photo frame in this study. Moreover, the participants in this study experienced the utilizing process with the designed paper prototype. It is speculated here that the intuitive operation might help the participants learn from the experiments thereby changed their initial experience. Consequently, it can be inferred that for the participants without experience of using digital camera, the arranged layouts were identical to the paper prototype designed in this study was influenced by the experience built up during the experiments. This was relevant to the research of Hoeffler and Ariely (1999) that the initial experience was shown to influence the participants' preference.

Although the senior generation, 55-75 years old in this study, has reported different needs and preferences from other age groups, generally they were not conservative to use digital photo frames. The results have shown that exhaustive interfaces, flat menu structures and moderate key size were favored even with more searching time, which were evident for the recognizable design of gerontological interface. Larger samples with different age groups of elders could be taken into consideration in the future studies to reveal more preferable and specific needs. And the user testing with the genuine product of digital photo frame is also suggested for empirical studies if possible to confirm the effects of computer anxiety over the elder users. While the majority of the current digital photo frames is of similar size, it is suggested by this study that alternative sizes of the display should be taken into consideration for the use of different target users. Also, the customized menu for elder users to manage and arrange is preferable for the panel design of digital photo frames.

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