Explore Elder Users' Reading Behaviors with Online Newspaper

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Abstract. This study aimed to explore elder users' reading behavior with online newspaper. The average age of twelve elder users is 68.67 years old. They were required to find news in the UDN online newspaper on the touch screen and enlarge or shrink the news pages to the appropriate size. The results showed that elder users didn't know how to flip the pages to read other news, and they spent more time looking for the zoom in and zoom out icons comparatively. They sometimes misunderstood the meanings of other function icons. Our findings suggest that it could put instructions on the UDN online newspaper interface to show how to use the function icons, helping elder users reading news and enlarge or shrink pages easily. The function of zoom in and zoom out could replace with using two fingers to pinch the pages, just like using touchpad or smart phone. In addition, the function icons position should be consistent, elder user will not be confused when they enter into the detailed news.

Keywords: Elder users, Touch screen, Online Newspaper.

1 Introduction

According to the report of international labor force in 2004 by Executive Yuan in Taiwan, by the definition of the elders as population who aged over 65 years old, Taiwan has become an aging society since 1993, and the elder proportion increased rapidly. In the end of June 2013, the elderly people population is about 2.64 million, 11.5% of the total population. The rate suggested a significantly higher aging speed compared to other developing countries around the world (Ministry of the Interior, 2013). On the other hand, along with the technological and societal development, elderly people were gradually accustomed to and trained to use IT products in their daily life activities such as entertaining, socializing, and learning. Their needs have also gained attention economically from the governmental and industrial sectors. While most elderly people facing functional degradation, these problems make them challenging to use technology products (Greenberg, 2012; Lee, Chen, & Hewitt, 2011). The obstacles of using technology could be resulted from internal and external factors. Psychological factors are also common barriers that make elderly people did not want to learn and use computer information technology (Lee, Chen, & Hewitt, 2011).

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Recently, the technology of touch screen has been widely used in many IT equipments, such as ATM machines, MRT, train ticketing system, ibon, FamiPort, Taipei bicycle rental system. The direct manipulating interface of touch screen provided an intuitive connection between people and machines, which also allowed good hand-eye coordination that can quickly interact without having practice. However, size of the touch screen could be problematic for elderly people considering theier physical conditions such as muscle fatigue (Taveira, & Choi, 2009).

Reading is one of the common activities of elderly people to obtain daily life information and news. Newspaper with high accessibility in specific supported elder people's needs to remained connected to the society (Chiou, 2009). UDN as the major newspaper publishers in Taiwan offered the original printed newspapers in digital forms for users to read daily news online. Many public libraries adopted this sytem to provide users with digital newspaper reading services. For instance, Taipei City library displays UDN online newspapers with large touch screen, and has gained remarkable appraisal from the elderly users. Motivated by the aforementioned phenomenon, this study intends to explore the elder users' experiences with the UDN online newspaper. The usability of the product is assessed by user experiments and interviews to provide further suggestion for the interface and interaction design of UDN online newspaper.

1.1 Elderly People and Technology Product Designs

Factors such as physical limitations, the access to technologies, cost, and the passive attitude of using technologies could hinder users' acceptance toward technology use (Pedell, Beh, Mozuna, & Duong, 2013). Aging problems caused physical limitations, including action recession, cognitive degeneration, poor hearing and visual decline (Doyle, 2010). Elderly people took more time to explore and recognize information, and they could not recognize what appears on the screen simultaneously (Asano, Saito, Sato, Wang, Gao, & Rau, 2007). Degradation of cognition and memory capacity made elderly people cannot learn new things quickly (Zajicek, 2001). In terms of access to technology and cost, elderly people also face financial problems as well as learning opportunities, also the motives to use technology remain low since rare benefit can be expected by the elder users (Pedell etc., 2013).

Ng, Tao and Or (2013) noted that elderly people aging problem will lead to action and cognitive decline, resulting in poor performance of operational tasks, they discussed about elderly people using the touch screen, trackball and mouse as input devices. Their findings suggested that the touch screen could help elderly people overcome physical limits caused by aging, the performance time of using touch screen became shorter and more efficient, and it reduced the error rate. But the study also pointed out that the touch screen cannot entirely solve the usability problem since the manipulation of touch screen actually produced more body movements that made elderly people feel fatigue.

Previous studies in technology use suggested that the elder and younger users possessed different needs and behaviors (Charness, 2008). In a complex and long-term research data analysis, elderly people showed intra-individual, occasion-to-occasion,

they behave differently in tasks because of personal differences and internal ability (Hultsch, MacDonald, & Dixon, 2002). Individual differences of elderly people will also affect the willingness of using products. While the reading devices and products for elder users have not gained enough concern (Tsai, Ro, Chang, & Lee, 2011), for the important daily activity of reading newspaper, it is worthy of further exploration empirically.

1.2 Elderly People and Touch Screen Research

Researchers who studied problems and errors of elderly people by using a handheld touch device that they divided problems and errors into two parts: user point of view and machine design. User problems and errors include lack of experience, poor vision, hand muscle weakness, search strategies incorrect and previous experience lead to obstacles and conflicts. Machine errors include unclear icons, the font was too small, the screen sensitivity was too high or too low, the display mode were different to users' expectations and product feedback to the user was inappropriate (Bradley, Langdon & Clarkson, 2011).

Tsai, Ro, Chang, and Lee (2011) used small touch screens for elder users to read e-book. Their findings suggested that the page presentation would affect reading performance of the elderly. As the elderly people slid the pages with fingers, the page presentation of e-book on the touch screen used flip page would be better than scroll-bar page, and more intuitive for elderly people. Werner , Werner, and Oberzaucher (2012) compared experienced and inexperience computer elder users when using tablet PCs, and found that elderly people had computer experience performed better than elderly people without computer experience, but the elderly people without computer experience could use thumb and index finger to enlarged the screen intuitively. In the studies of larger touch screens, Jin, Plocher and Kiff (2007) required elderly people manipulated tasks on a 17-inch touch screen. Their study found that the larger the keys the shorter the reaction time, and elder's performance accuracy was also higher. Lepicard and Vigouroux's (2010) study also supported that elderly people used both hands to manipulate touch screen produced more errors.

The above literatures show that the elderly people who were unfamiliar with the operation of touch screens, tablet PC and smart phones, would push the icons too light or too heavy, and aroused the incorrect functions. Font size, icon size, and key size would affect the operation fluency of elderly people. And the elderly people would manipulate the touch interfaces with references to their life experiences, which suggested that the more intuitive the manipulation the more convenient for them.

2 Methods

2.1 Materials

As mentioned above, UDN online newspaper was selected as the experimental material for this study (see Figure 1). It renewed at 6:00 AM every day, and we selected UDN Daily News of October 24, 2013 as the main material for reading tasks.

A 23-inch large touch screen was selected for elderly reading and designed the tasks for searching news, adjust the page size, and reading news content.

Fig. 1. The full news page of UDN online newspaper

2.2 Participants

The participants in this study are the elderly people who were 65 years and older. Twelve participants were recruited, 6 males and 6 females, their average age was 68.67 years old. Their education level are all above senior high school, and they all have fair eyesight with glasses and no problems with the movement. All of the elderly users have not used UDN online newspaper system before.

2.3 Procedures and Tasks

In this study elderly users were required to complete the tasks by using touch screen to read UDN online newspaper. The reading tasks include finding and reading the assigned article in the newspaper without any assistance.

Task 1: Please find the assigned news article.
Task 2: Please find the zoom-in icon and enlarge the news page.
Task 3: Please find the zoom out icon and shrink the news page.
Task 4: Adjust the page to appropriate size that you can read the news comfortably.
Task 5: Please read the news article completely.

After performing the tasks and reading the news completely, the elderly users were required to answer a question about the topic of the news, the question was "what ingredient would be harmful to human health in the cooking oil that government must to check it out at once?" All of the elderly users were give the correct answer "Gossypol" to the question. In addition, we also interviewed the elderly users for using UDN online newspaper on the touch screen, and record the opinions of them.

3 Results

Table 1 shows the average completion time and frequency of errors. In task 1 elderly users spent average 85.42 seconds finding the assigned news article, and they spent average 44.17 seconds dragging the detailed news page to the specific news of the task. The frequency of errors is 0.67. In task 2, elderly users spent average 53.5 seconds finding the zoom out icon and successfully enlarge the news. The frequency of errors is 1.06. In task 3 the mean task completion time was 18.69 seconds, most elderly users knew the plus and minus icon were the symbols of enlarge or shrink the pages, but there was an elderly users push the print icon and flip icon. In task 4 elderly users had to adjust the news page to appropriate size that they could read the news comfortably. Every users required different font size, some users maximized the News page for reading. Some users responded the news text page was too large that they couldn't slightly shrink the page, and the screen was too small when they push the minus icon. It was inconvenient in use. In task 5 elderly users spent average 111.58 seconds reading the news.

Table 2 shows the first reading performance of elderly users. The results indicated that elderly users made more mistakes in task 2, the errors included pinch the page with two fingers to enlarge the news, push the flip icon, push the original size icon, push the most suitable height icon. Five elderly users were unable to successfully push the zoom in and out in icons because they didn't understand the meaning of plus or minus symbols which could enlarge and shrink the news pages. And in the task 3 and task 4, only one elderly user push the incorrect icon.

Table 1. The average completion time and frequency of errors of reading tasks

Tasks	Average completion time (seconds)	frequency of errors
Task 1: Please find the assigned news article		0.67
● Find news headline		
● Drag the news pages to detailed news content	85.42 44.17	
Task 2: Please find the zoom in icon and enlarge the news page.	68.25	1.08
Task 3: Please find the zoom out icon and shrink the news page.	28.25	0.17
Task 4: Adjust the page to appropriate size that you can read the news comfortably.	45.83	0.08
Task 5: Please read the news completely.	111.58	0

Table 2. The first reading behavior of elderly users

Tasks	The first reading behavior		Number of People	Percentage
Task 1: Please find the assigned news article	Correct	Push the flip icons	10	83%
	Error	Slide the page with two fingers and enlarge A1	2	17%
Task 2: Please find the zoom in icon and enlarge the news page.	Correct	Push the plus icon	7	60%
	Error	Pinch the page with two fingers to enlarge the news	1	8%
		Push the flip icon	1	8%
		Push the original size icon	1	8%
		Push the most suitable height	1	8%
		Just slide the page	1	8%
Task 3: Please find the zoom out icon and shrink the news page.	Correct	Push the minus icon	11	92%
	Error	Push the flip icon	1	8%
Task 4: Adjust the page to appropriate size that you can read the news comfortably.	Correct	Push the plus icon or the minus icon	11	92%
	Error	Push the original size	1	8%

More than half of the elderly users could find the zoom out and zoom in icons, the plus and minus symbols were similar to computer operation for zooming in the web pages. In addition, there are a small number of elderly users did not understand the meaning of plus and minus symbols because they seldom used computers in their daily lives.

Elderly users appreciated using UDN online newspaper system for reading because it could solve the problems of traditional newspaper. The font size could zoom in and zoom out according to their need, and their hands didn't get ink. On the other hand, touch screen was regarded as more intuitive than mouse, and it was easy to tap and pinch on the touch screen for reading. However some users said that they didn't want

to read the online newspaper because it didn't meet the reading habits and needs in daily lives such as cutting coupons, newspaper clipping, highlighting sentences.

4 Conclusion and Future Work

Elderly people didn't know how to search and select other news in the UDN online newspaper system, they stayed at the front page without entering into the detailed news. We suggested that putting instructions on the interface to help elderly users flip pages for searching more news, and how to drag pages to the news they want. And when elderly users touch the specific news, the next page will go to the news directly instead of dragging the news pages, it can also help elderly users accelerate the speed of searching news and reading fluency. The result was similar to that in Fisk et al. study, which suggest that technology products with instructions on how to use the system would make it easy to use and operate by elderly people(Fisk et al., 2004). While Craik (1986) also noted that the performance of elderly people rely mainly on the support of environments, if they recall on their own will produce errors, therefore, the design principles must contain environment support and instructions for users.

In the detailed news pages, some elderly users couldn't zoom in and zoom out the page smoothly. They didn't know the meanings of function icons such as original size, the most suitable height, the most suitable width, and magnifier icon with plus and minus symbols on it. Some elderly users had the experiences of using smart phone and touch pad, they used to pinch the screen with two fingers to enlarge the page, and change the pages with the flip gesture. They considered that the functions of zoom in and zoom out news pages could use the gesture similar to the gesture of smart phone and touch pad. The result was similar to Bradley et al. study, which noted that user problems and errors include lack of experience, search strategies incorrect and previous experience lead to obstacles and conflicts. Machine errors include unclear icons, the display mode were different to users' expectations (Bradley et al., 2011).We suggest that putting instructions beside the function icons, so that the elderly users can use the icons easily and adjust the news page to appropriate size. Change mode of the zoom in and zoom out to the mode of smart phone or other touch devices.

Furthermore, elderly users couldn't detect the function icons when they entered into detailed news page. Since the function icons are at the bottom of the page in full news pages, in the detailed news page the function icons are at the top of the page, elderly users need to find the function icons such as flip page again. In addition, some new function icons are not appear in the full news page such as the original size, the most suitable height, the most suitable width, and print, elderly users may have to learn the meanings of these new icons. The result is similar to Al-Razgan et al. study, which suggested that the smart phones main navigation instructions must appear in the "every page", extremely important functions were not disappear absolutely, common and important icons could put at the top of the screen to prevent elderly people pressing the wrong buttons (Al-Razgan et al., 2012).

We suggest that the function icons should be put at the same position in the full news pages and detailed news pages, so that elderly users won't be confused and reduce the speed of searching the function icons. Finally, more rigorous and sophisticated ways to collect experimental data would be conducted in the further investigation.

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