

The Effects of the Transparency of the Guiding Diagrams on the Phone Interface for the Elderly

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Abstract. This study aims to explore the elderly users' preference for the transparency of the guiding diagrams in the phone interface and their use of the interface. In the one-to-one interview and the questionnaire survey, the subjects compared the guiding diagrams of two levels of transparency, and the statistical software was adopted to analyze and process the data obtained from the questionnaire. According to the results of the statistical analysis of the interviews and questionnaire survey involving 20 elderly people, there is no significant difference in the preference for transparency among the elderly users, and the effects of the transparency of guiding diagrams on the use of the phone are insignificant. The findings can provide reference for phone interface designers in the process of interface design.

Keywords: Touch screen · Elderly · Assisting diagrams · Transparency

1 Introduction

As the proportion of the elderly people in the developed countries becomes larger, old people have become an indispensable group in the consumer market. According to the 2012 UN report on aging population, the aging rate of the developed countries has climbed from 12% in 1950 to 33% in 2050. Additionally, the investigation report of The International Data Corporation shows that there had been a year-on-year increase of 85% in the sales volume of cell phones by the first quarter of 2011, but the growth rate was merely 11% among the elderly. According to the above data, the sales volume and smart phones and the number of the elderly have increased, but corresponding growth has not been found in the elderly people's use of smart phones.

As has been revealed in the literatures about interface design, interface design and guiding diagram are two main factors which influence the experience of the users; however, many manufacturers pay relatively less attention to the design for specific groups because only by quickly delivering products to consumers can they make profits from the sale. At present, most products are aimed at young consumers, but manufacturers neglect the fact that it is the elderly who have great impact on the future trend of the whole market. Because of physiological decline, vision is the part which is the most sensitive to physical change. Therefore, this study adopted the interview approach and the questionnaire survey to probe into the effects of the presentation of guiding diagrams on the elderly users. The purpose of this study is to explore the effects of the guiding

diagrams in the phone interface on the elderly users as well as the difference in the preference for guiding diagrams and the use of the interface; moreover, the possible reasons for the difference were discussed to offer some reference for the design of phone interface.

2 Relevant Studies

To date, there have been a large number of studies on the phone interface for the elderly, but the quantity of the studies on the operating gesture and on the transparency of assisting diagrams is rather small. Despite this, it is still useful to get acquainted with the features of the elderly and the design factors of phone interface with the help of the previous studies. In consideration of the topic of this study, the literature review was divided into three parts: the experimental exploration into phone interface, the design guidelines, and the visual decline and feelings of the elderly.

Some studies involved an experiment on the elderly people's use of cell phones. In the experiment by Rock Leung, 18 elderly subjects aged over 65 and young subjects aged between 20 and 37 were asked to recognize a series of phone diagrams. The results of the experiment indicated that the elderly were outperformed by the young in the recognition and understanding of diagrams. Besides, the diagrams with written illustration were more helpful for the elderly than the young. Similar studies have also been done on the computer interface. In the experiment by Min-Ju Liao, 12 elderly and young subjects were asked to express their views on complexity. The results showed that more colorful or complex diagrams had greater effects on the elderly than on the young.

Other studies investigated the elderly users' feelings about the computer interface. By conducting a survey on 300 elderly subjects who had never used the computer, Tracy L. Mitzner tried to achieve some insights into the improvement of the computer interface. The results showed that the factor which had the greatest influence on the intentional use of the elderly resided in the experience of using technological products and in the openness to fresh things. Therefore, Tracy L. Mitzner suggested helping the elderly to develop positive use experience and enhance their use of interface through appropriate training. The study most relevant to this study is the one by Silvana Maria Affonso de Lara in 2015, where the acceptance and use of the website interaction aids of 313 subjects (44% of them were elderly) were explored. The findings showed that the website interaction aids indeed promoted the interaction between the elderly and websites and between the young and websites.

Some studies focused on the guidelines for interface design. With emphasis on the buttons in the phone interface, Qin Gao invited 40 elderly and young subjects to participate in the experiment. After analyzing the size of button, gesture and the gap between buttons, he proposed a series of design guidelines. Jeff Johnson also offered some guidelines for interface design to create better visual effects for the elderly. As visual decline affects the cognition of the elderly in the use of smart phones, attention must be paid to the following aspects in the initial stage of interface design: (1) use a pure background color; (2) pay attention to blue, green and yellow and other similar colors; (3) use different color zones to distinguish the link which is being used from the ones which

have not been used; (4) don't base differentiation on color alone; (5) use highly contrastive colors; (6) enable users to make adjustment and comparison.

The studies on the interface for the elderly focused on the visual decline and feelings of the elderly. Color is an essential factor which influences visual and interface design. For individuals and groups, the feeling about the same color is subjective, and the difference in the feeling about colors may be attributed to ethnic group, culture, age and even personal experience. Due to physiological influence, the elderly would have a weak ability to distinguish colors. As they age, they show more preference for red and green but less preference for blue (Dittmar 2001). The visual effects on the elderly include (1) uncomfortable about dazzling, (2) declining visibility and (3) weaker sensitivity to blue light. As one grows older, his lens would gradually become yellow, which will result in weaker sensitivity to blue, purple and green. To help the elderly see these colors clearly, stimulus is needed (Nguyen-Tri 2004). Visual decline would affect the cognitive ability of the elderly in the use of smart phones.

3 Experimental Design

After the above literature review, we have had a deeper understanding of the development of human computer interaction (HCI). Nonetheless, few studies on the transparency of guiding diagrams have ever been done so far. For that reason, emphasis was placed on the transparency of guiding diagrams in the experiment of this study. By asking the elderly subjects to compare the guiding diagrams of two levels of transparency, we tried to find out the needs of the elderly.

To get acquainted with elderly people's preference for the transparency of guiding diagrams, we conducted a pre-test, where 10 phone users aged over 50 were interviewed. Specifically, 4 of them preferred to transparent diagrams while 6 were more interested in opaque ones. In consideration of this study and others on the visual decline of the elderly, we proposed the following hypotheses: (H1) The elderly prefer to opaque guiding diagrams; (H2) The transparency of guiding diagrams has effects on using cell phones to browse websites; (H3) The elderly pay more attention to the transparency of guiding diagrams than other design factors when buying a cell phone.

3.1 Experimental Design

The subjects of this study were 23 smart phone users aged over 50, including 8 males and 15 females. Two subjects were removed for not having used a cell phone, and one for being aged below 50. Therefore, there were 20 qualified subjects in this study. The average age of the subjects was 60.2, and the average time of using smart phones was 4.35 years. To exclude possible variance, all the subjects were right-handed.

3.2 Experimental Site

The subjects of this study received the interview and filled the paper questionnaire in the quiet rooms of the Department of Volunteer Work at National Cheng Kung University Hospital.

3.3 Experimental Method

To get acquainted with the interviewee's opinion on certain object through dialogue, the interviewer has face-to-face communication with the interviewee, with the former attempting to know the thoughts and feelings of the latter. In this study, the authors interviewed the subjects aged over 55 in the Department of Volunteer Work at National Cheng Kung University Hospital, so as to know the subjects' views on the existing phone interface. Additionally, a questionnaire survey was conducted in this study. As an approach of collecting information, questionnaire survey is often adopted to measure personal behavior and attitude. With questionnaire, we can summarize and analyze the thoughts of several people and get to the essence of problems. The Likert scale, ranged from "1" to "5", was adopted to design the questionnaire and explore the elderly subjects' preference for guiding diagrams of different levels of transparency and the use of interface.

3.4 Experimental Method

In this study, the one-to-one interview and the questionnaire survey were adopted to obtain qualitative and quantitative data. To ensure that the subjects had a full understanding of the experiment, the research fellows interpreted the meaning of the guiding diagrams; then, the subjects were shown the guiding diagrams of two levels of transparency on a cell phone for a comparison (as is shown in Fig. 1). After that, the subjects expressed their views on the existing phone interface in the interview and filled in the questionnaire. Finally, the data obtained from the interview and the questionnaire survey were analyzed.



Fig. 1.

3.5 Questionnaire

The questionnaire consists of three parts. Part 1 comprises 3 items, which aims to get the subjects' opinions on the transparency. Part 2 and Part 3 focus on the comparison between opaque and transparent guiding diagrams. The 5-point Likert scale was applied to measure the preference of the subjects. The details of the questionnaire are shown in Figs. 2 and 3.



Fig. 2.

Example

1. Do you pay attention to the colors of the guiding diagrams on both sides?
2. Do you pay attention to the design of the guiding diagrams on both sides?
3. Do you pay attention to the transparency of the guiding diagrams on both sides?
4. Do you think the guiding diagrams on both sides are easy to recognize?
5. Do you think the guiding diagrams on both sides cannot be distinguished from the background?



Fig. 3.

6. Were you allowed to select the colors for guiding diagrams, what colors would you choose?
7. Which one do you prefer, Design A or Design B?

4 Research Results and Conclusion

The paired sample T test was adopted to test the hypotheses about the two levels of transparency, and the ANOVA was used to detect the difference in the attention to the color, form and transparenre of guiding diagrams among the subjects (Tables 1 and 2).

Table 1. Numbers of years of smart phone usage

Numbers of years of smart phone usage	Numbers of sample
1 ~ 3	10
4 ~ 6	4
7 ~ 9	4
More than 10	2
Total	20

Table 2. Age

Age	Numbers of sample
50 or less	1
50 ~ 55	6
56 ~ 60	4
61 ~ 65	5
66 ~ 70	2
More than 70	2
Total	20

Table 3.

Paired sample T test		
	Variable 1	Variable 2
Mean	3.15	3.45
Variance	1.923684211	0.892105263
Sample	20	20
Pearson's product-moment correlation coefficient	0.066291127	
Degree of freedom	19	
P value (one tail)	0.209695686	
P value (two tail)	0.419391372	

4.1 Discussion on the Preference for the Transparency of Guiding Diagrams

The questionnaire item “I think I would like to use the website with such a guiding diagram” was taken for the paired sample T test. According to the result of the test, there was no statistical significance when the significant level was 5% (p-value = 0.209695686). This indicated that the elderly didn't show special preference for the transparency of guiding diagrams.

4.2 Discussion on the Use of Interface According to Transparency of Guiding Diagrams

The items about the use of transparency in the questionnaire were used for the paired sample T test to explore the effects of transparency on the use of the interface among the elderly. The result showed that there was no statistical significance when the significant level was 5% ($p\text{-value} = 0.370536326$). This demonstrated that there is no difference in the use of guiding diagrams of two levels of transparency (Table 4).

Table 4.

Paired sample T test		
	Variable 1	Variable 2
Mean	3.25	3.35
Variance	1.460526316	1.50263158
Sample	20	20
Pearson's product-moment correlation coefficient	0.399685113	
Degree of freedom	19	
P value (one tail)	0.370536326	
P value (two tail)	0.741072652	

4.3 Discussion on the Attention to the Transparency of Guiding Diagrams

Finally, the items about the design of guiding diagrams in the questionnaire were used for the analysis of variance to explore the difference in the attention to these factors (the color, form and transparency of guiding diagrams) among elderly users. According to the result, there was no statistical significance when the significant level was 5%. This showed that there was no difference in the attention to the color, form or transparency of guiding diagrams. Also, it revealed that the elderly don't attach particular importance to guiding diagrams and that they wouldn't pay too much attention to the transparency of guiding diagrams when buying a cell phone (as is shown in Table 3) (Table 5).

Table 5. ANOVA

ANOVA						
Source	<i>SS</i>	<i>DF</i>	<i>MS</i>	<i>F</i>	<i>P-Value</i>	<i>Critical</i>
Between	4.9	2	2.45	1.97385159	0.14830271	3.158842719
Within	70.75	57	1.24122807			
Total	75.65	59				

5 Conclusion

Despite the increasing aging around the world, most elderly people still find it difficult to use the existing phone interface. As far as the transparency of guiding diagrams is concerned, this study shows that there is no significant difference in the attitude towards

the transparency of guiding diagrams among the elderly and that the elderly don't pay special attention to the transparency. We assumed that the elderly would prefer to opaque guiding diagrams because of visual decline, but the investigation showed what was different from the assumption. For the elderly, the visual decline makes it more difficult to notice the difference in transparency. According to the follow-up interview, the elderly pay more attention to the contrast between guiding diagrams and background than guiding diagrams. Therefore, the designers of guiding diagrams should attach greater importance to the relationship between background and guiding diagrams. Because of the limitation on time, this study merely focuses on transparency in the experiment. It is hoped that future studies will probe into the contrast between background and guiding diagrams.

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