An Ergonomics Research for Developing Senior Citizens' Mobile Devices Gesture Display

Shou Fang Liu, Ming Hong Wang, Ming Chyuan Lin and Tsung Sheng Huang

Abstract The advanced countries in Europe, US, and Japan start to focus on the design problems of aging society from the point of social welfare because of the global trend towards the aging society. However, there are a variety of mobile devices on smart phones and tablets showing the flashy and high-tech effect to attract the users' attention but it is confusing to the elderly for searching and judging important information. An industrial designer should know the elderly requirements, follow the principles of the universal design, be able to design suitable gestures for the interface operation of the mobile devices, and promote the value of products. This research applies the concept of ergonomic methods in building ergonomic decision evaluation system, modeling development and demonstrating the developed designs to help improve the gesture of interface operation on the mobile devices for the elderly people.

Keywords Elderly people · Smart mobile device · Interface design · Customer-oriented design

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1 Introduction

Due to the change of social population, the elderly with the improvement and completion of the medical equipments and care are becoming more and more life span. The relevant research issue of facing the elderly adaption is what many scientific experts want to understand further. Situated in the era of fast modern technology development, people often carry the smart mobile device, which has become part of the human life. Under the situation of seating in such a high-fast modern technology, the elderly are forced to use the relevant 3C technological products of intelligent interface devices. Learning through the initial observation on the popularity rate of intelligent interface devices, people can find the life-style of the elderly is beginning to be changed. Life can't be escaped from the high-technological products with the audience dependent on the smart phones. As such it will take much higher quality for users to use.

Our living societies are now in the surroundings of the high-fast technological development that need the visual and touch display to be the way of spreading messages, which instead cause a big burden for the elderly. A multiple functional mobile device has become the available spreading message equipment, the close-related product, mastering the precise information instantly and releasing information at any time in the modern life, etc., so it's become the most important service content item of the current modern technological products.

Cuhaman [1] thought that the users' interface composed of the interaction of software and hardware among the products is grouped into three categories: hardware operation, touch operation and software operation. The common interface of hardware operation is called content interface operation including the traditional controller, the control panel of the display, and the position of the content product for users to operate. The touch interface operation of the touch panel combined with the software and hardware users' interface that allows users to use fingers to operate. The soft interface operation toward the development of diagrams is called diagram interface operation, which enhances the users' comprehension to make the operation easy. Primarily finding from the author's past relevant research, the operation of the smart device interface, for which people's demand will produce a different-level change when the age is growing.

The young aged people, with better physical status than the medium-high aged people, are good at mastering the technological products either familiarity with operation or the speed of reaction to the interface operation. The study has shown the elderly are unable to retain the attention for a long time, which might cause some problems, especially for the task of the prompt and continuous scan, the elderly will feel so tired [2]. They are likely to be absent-minded, for the trivial details, lowering the ability of gaining information [3, 4].

Their abilities become lowering when they focus on two complicated tasks at the same time [5, 6]. No matter how the old people are, their attention can be distributed to employ at the same time. For example, when driving, their attention will be distributed; only when facing more complicated tasks is the elderly attention

weaker than those of the young. The study has shown the distribution of attention can decline with the age increasing. It is an essential issue for the future toward the aging society that the elderly should be more intuition and efficiency for the operation of the smart interface device product. The modern high technological products have developed more and more advanced functions, and all brands promote the smart mobile interface products, which can be all kinds, and they emphasize their own value of products correspondent with the environment, safety, equipment efficiency, and the introduction of all kinds of novel entertaining functions.

For the color of words on the interface, the organism of the product feedback, the way of the screen display and illumination, the size of floating windows, and gestures, they are forced to learn different ways of operation when using every different product of brands. Besides, they have to try many times because of different gestures and will cause the learning patience exhausted or give up directly and turn to their family or friends for help. The author has primarily united the most common types of smart-phones in the market based on the observation from the above list of the most common gesture operations involving motion, rotation, and contraction, etc. Human-Computer Interface or called Human-Computer Interaction, HCI, is focusing on the ideal users' interface design, showing that the machinery interface is the main interactive role [7]. Usability evaluation includes five sector indexes and is stated as follows:

1. Learnability: be easy to learn and quick to respond.
2. Efficiency: be capable to use and quick to reach.
3. Memorability: be easy to memorize and operate.
4. Inaccuracy: lower error rate.
5. Satisfaction: be comfortable in use and operation.

2 Method

2.1 Previous Studies

In the previous studies, the examiners operated 5 most common products of smart-phones that are obtained from the market, and recorded their gesture operation. The experiment investigated the examiners' operation of smart-phone products to find which gesture operation for the elderly can't be used easily. These statistical data derived from the experiment will be the core of the study. In this experiment, five designers who have over six years of practice experience were asked to take the way of hand-drafting to identify the difficulty that the elderly feel when using smart-phones. It is expected to analyze through the current gesture operation to find a more suitable way for the elderly.

The result of the final research evaluated the experimental solutions and the simulated gestures of innovative designs with the way of traditional operation to compare interactively with the gesture of the innovative design. Note that the Traditional Gesture is illustrated in Figs. 1, 2 and 3. As to new Gesture, they are illustrated in Figs. 4 and 5.

Fig. 1 Zoom in gesture (shrink)

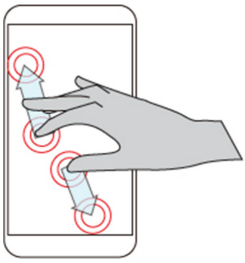

Fig. 2 Zoom out gesture (enlarge)

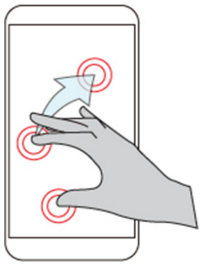

Fig. 3 Rotate gesture

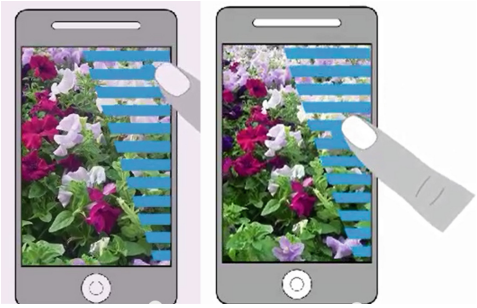

Fig. 4 Zoom in (slide down) and Zoom out (slide up) gesture

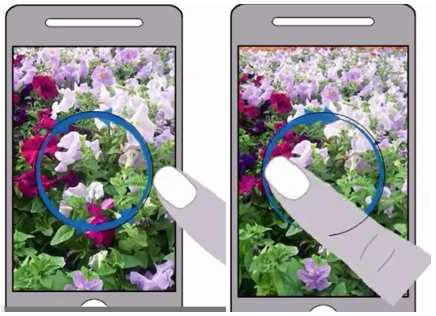

Fig. 5 Zoom in (reverse clock circle) and Zoom out (clock circle) gesture

The study establishes the way of the innovative gesture control. According to the outcome of the focus group, the way of the innovative gesture operation is better than the way of multi-fingered gestures for the elderly. Thus, it can prove the innovative-designed gesture operation is much better than the way of the traditional operation. In the items of the use assessment, efficiency, memory and satisfaction all can achieve the good condition.

From the analysis of the study, the medium-high aged people can take the one touch gesture operation as the way to operate smartphones. The outcome from the research is helpful for the advanced development in the touch device operation of mobile devices for the elderly. Based on Wang's [8] research outcome, it is noted that the best gesture operation of the smart mobile device interface is use the one touch operation for the elderly.

2.2 Focus Grouping

This study focused on over 55 years old people for the smart-phones of hand-touched operation through the review of references, the survey of questionnaires, and the experimental simulated operation. To provide the suitable hand-touched operational interface materials with the elderly, the research increased the elderly' touch feedback of the screen texture design, and evaluated with learning, efficiency, memory, the error rate, convenience, vision, and the whole satisfaction. Note that the standard of the scores are based on a Likert Scale (1 = very awful; 2 = bad; 3 = no opinion; 4 = good; 5 = very good). The comfortable degrees of fingers and eyes are the way to testify the gesture operation.

2.3 Subjects

The tested subjects who involved in the experiment are 10 people aged over 55. To conduct the test, the research arranged 15 min of operation in order to explore the

elderly's requirement for the way of the smart mobile interface device. The tested subjects have at least one-year experience of using smart-phones. The research presented 4 different touch product samples and explored which is most suitable for the elderly to use comfortably.

2.4 Process

This experiment uses the same type smartphone, the type and brand of the smart-phone is HTC M7. Focus the issue of "interface materials" and "the comfortable degree of vision" to be the research exploration. Explore the variable comparison of smart mobile touch interface devices and the comfortable degree of the visual browse to represent all kinds of variations for users' feelings after the usage.

- Step 1: First, ask the examinees to use the smartphone without attaching any materials, with 5 min.
- Step 2: Put the interface materials of the No.1 to the No.4 attached to the smart-phones respectively, and each of the interface material for using 5 min. Figures 6, 7, 8 and 9 illustrated the respective surface materials for the 4

Fig. 6 No.1 Bright surface material

Fig. 7 No.2 Matte surface material

Fig. 8 No.3 Rigidity surface material

Fig. 9 No.4 Anti-blue surface material

samples. The examinees browse the specific pictures of the study with different interface materials, and use the three gesture operations: motion, rotation, and contraction. The above three gestures are the most employment that the research derived from the past research references and the current observation.

- Step 3: After finishing the experiment of No.1 to No.4, the research evaluated the questionnaires of the experiment. Table 1 illustrated the results for the four samples based on the seven evaluation items.
- Step 4: The above experimental steps proceed with a continuous process, and it can just be seen as the procedure of the whole experiment. Based on the experimental data of smart-phones, the data with the interface materials and without the interface materials are forwarded to the ANOVA analysis to observe if there is any obvious difference, and explore which materials are suitable for the elderly.

Table 1 Mean and S.D. in different gesture mode

			Learnability	Efficiency	Memorability	Errors	Convenience	Visual	Satisfaction
Material samples	No1.	Number	10	10	10	10	10	10	10
		Mean	3.0	3.4	3.0	3.8	3.4	1.8	3.8
		S.D	0.9	0.5	0.9	1.0	0.5	0.4	0.4
	No2.	Number	10	10	10	10	10	10	10
		Mean	4.8	4.6	5.0	4.0	4.0	4.8	4.4
		S.D	0.4	0.5	0.0	0.9	0.0	0.4	0.5
	No3.	Number	10	10	10	10	10	10	10
		Mean	3.6	4.4	4.0	4.4	4.0	2.6	4.0
		S.D	0.5	0.5	0.9	0.5	0.0	0.5	0.0
	No4.	Number	10	10	10	10	10	10	10
		Mean	3.2	2.8	2.8	2.8	2.8	2.4	3.2
		S.D	0.4	0.7	0.7	0.7	0.7	0.8	0.4

3 Result

Facing the coming of the aging society, the relevant touch interfaces of technological products are developing rapidly. The users are eager for the requirement of the simple interface operation. However, we can't exactly know the elderly' feelings for the new coming touch technology and the interface from the current references. It is expected that through the experiment of smart-phones and the operative observation, the results can help induce and analyze the elderly for the requirement of the operation of smart-phones and develop the design principles of the smart mobile relevant interface product as a reference for the related design for the future elderly.

3.1 The Comparative Analysis of Each Material

We can clearly see that the No.1 (glare), the No.2 (anti-glare) and the No.3 (reinforced glass) are the common materials for the elderly to use. From the evaluation of usage chart illustrated in Table 1, learning, efficiency, memory, the error rate, vision, and the whole satisfy, all achieve significance ($P < 0.05$).

4 Conclusion

From the analysis of the study, we can understand that based on the previous study, getting the innovative gesture model for the users aged over 55, using the one touch gesture as the way of operating smartphones, connected with the interface materials of mobile devices can be helpful for the elderly to operate the touch device interface. In this period of the experiment, getting the statistic data as the reference of expanding samples in the future is still unable to represent the population for the current experimental result. This study will continue to explore deeply, hoping to analyze the more suitable experimental proof for the elderly to operate and making the interface materials of smartphones much more comfortable for the elderly to use. In the future, the direction of the study will further focus on the analysis of exercise for the tiring of hands muscle, the exercise way of every finger' joint, and the innovative design model of eyes tracking.

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