

Initial Investigation on More Elderly-friendly Gesture Technology of Viewing Photos on Smart Phone

Ming-Hong Wang

Department of Visual Communication Design, Southern Taiwan University of Science and Technology, Tainan, Taiwan.

Chih-Yuan Cheng

Institute of Financial & Economic Law, Southern Taiwan University of Science and Technology, Tainan, Taiwan.

Chian-Fan Liou*

Department of Visual Communication Design, Southern Taiwan University of Science and Technology, Tainan, Taiwan.

Corresponding author. Tel.: +886 6 2533131#7301; Fax: +886 6 3010020

E-mail: sss103103@stust.edu.tw

ABSTRACT: As the population of aged people grows, the use of smart phone device is also growing in the elderly age group. Through study and research, we try to discuss a more elderly-friendly operation way of smart phone to reduce their frustration and improve their willingness of using a smart phone. This study starts from the gestures applied on the smart phone for viewing photos. Through the comparison between new and old gesture design, we can verify the design performance. Lastly, a conclusion is decided through the discussion with the product design professionals. In terms of new gesture development, the data shows that Gesture B is more user-friendly to the elderly than the traditional gesture. Through final interviews with the professionals and documentary comparison, 5 points indicate that Gesture B has better advantage for the elderly users than the traditional setting: 1. The interface is designed based on higher instinct, 2. Less fingers involved operating the phone, 3. The control bar is more obvious, 4. The reminder in images or texts is bigger, 5. Minimizes inadequacy of cognitive difficulty. On the other side, the user-unfriendly design elements are as follows: 1. Lacks past experience to refer to for operation. 2. A big change from traditional device setting. 3. Lacks visual clues or functions are hidden, 4. Unable to tell symbols and operation goals, 5. Two finger operation at the same time, 6. Confusion between the body reaction and cognitive operation.

1 INTRODUCTION

As the wireless internet is more popular and common, the development of smart phone is more advanced compared to the simple function of the traditional phones. The development of smart phone development has been more mature and diverse in functions, including photography, internet, GPS, social media and streaming media etc. It is even designed to control TV, washing machine, monitors and all types of home appliances. As the public relies on smart phone for longer usage, it has become a necessity on everyone's daily life. Information has developed and transmitted quickly, compared to the elderly, the teenagers and children usually adapts and learns quicker. Therefore, the elderly people are called "digital immigrants", which means they are the disadvantaged group who face more challenges to become digital users (H.-J. Lai, 2016), such computers and smart phones in their real life. There are more and more aged people who show willingness or are forced to learn to use smart phones. Although many users show that they have difficulties or have no ideas how to use them, the

number and rate of smart phone users and usage is growing fast every year. From the research in 2017, we know that the users in the group over age of 60 has a highest growth rate (Y.-C. Chen and C.-H. Kuo, 2019).

According to the statistics of national development committee, about 89.9% of the people at the age between 60 and 64 use smart phones, whereas 63.2% of the age above 65. From the situation the daily internet communication and social media usage is close to 80% of their time and still fast growing (H.-J. Lai, 2022). Many researches indicated that using a new technology is a challenge for the aged people. Compared to traditional computers, smart device has a touch interface for easier and intuitive operation. It is a very popular device with diverse APP available, which makes it more attractive for the elderly to learn and use (H.-J. Lai, 2016; H.-J. Lai, 2018). Undeniably as the technology evolves, smart phones are designed to be smaller, lighter with more and more additional functions and hidden interfaces and buttons. For most aged people, it is a big challenge for them to learn all about these functions (S.-W. Chang & K.-K. Lee, 2002). As they age, their vision, hearing, physical and mental conditions all go down hill with

a dramatic change in physical function, especially bad in vision, body control and cognitive operation. (P.-C. Yeh et al., 2020). If they encounter frustrations, fading memories and reduced attentions, the overloading of new knowledge, lack of guidance and teaching, anxiety and insufficient confidence will lead the aged people to give up early learning a new technology. Therefore, designing an easier and user-friendly method to reduce the elderly's frustrations is an important direction for helping them mentally and physically. (Cristiano, A. et al., 2022; Park, K.-H. et al., 2008; C.-Y. Hu, & L.-C. Chen, 2013).

Until the end of 2050, the WHO estimates the population of the aged people is going to exceed 2 billion. The Population Reference Bureau in the US also pointed out in 2011 that the population of the people over 65 years old is going to be 2.5 times of that of young children under 4 years old in 2050 (H.-H. Ho et al., 2020; T.-H. Chiu et al., 2014). As the aged people's population grows, plus the smart phone touch interface is more user-friendly than traditional computers, the documents quoted in this article also pointed out that the population and usage time of aged people using smart phones will continue to grow in the future. After they learn to use smart phones, their satisfaction for life, social life and family connections will improve better. How to make it easier for aged people to learn to use smart phones, reduce their frustration and loading of learning a new technology is an important direction for efforts. In the past, most documentaries undertook the studies towards the setting, styles, colors, texts and font sizes of digital interface, with very little information about the improvement on gestures of operating a smart phone for aged people. Gestures are a powerful and natural tool for communications between people.

However, if it requires a complicate gesture or operation on the interface, due to their degenerated physical condition, it is going to be a difficult challenge for the elderly people. The scholar T.-L. Wong (2010) brought up the idea that the difficulty to use a touch interface must be reduced in order to facilitate the use for the aged people, and yet she didn't mention which operation is most suitable (T.-L. Wong, 2010). Trewin et al. pointed out that although it is easy to operate physically, it is rather challenging and difficult for the elderly people to visually and cognitively operate it. Therefore how to study on gestures and interfaces to facilitate the elderly people to use is an important and primary design mission that has been rarely studied. The documents mentioned above talking about gestures and operations also stated that a clear control bar without repetitive clicking is more intuitive to the elderly people. However, the people who can use two fingers to control the screen are only 50% of total. There is nearly none of them who can

accomplish 3 finger operation on the touch screen (S Trewin, et al., 2013; N.-T. Wang, & C.-M. Cheng, 2015). Hence, from the document mentioned above, we can find the possibility and direction of design that reduces operational difficulty and provides the elderly with a more user friendly smart phone. This is the purpose of this research and test.

The key part of this research is on the gesture, which is through Focus Group to find out the improvement on difficult gesture. At the end of research, we found out that the regular functions, such as photo zoom in and zoom out is rather difficult for the elderly to operate, which is also a high frequency of use. This responds to the research content of C.-Y. Hu, & L.-C. Chen: the multiple touch using two fingers and the expanding and closing of two fingers to view pictures done by the people who did the tests. The middle aged or older people might have to spend more time to complete the image viewing action. Those basic operation actions that seem not difficult for regular users could be difficult for the aged people. This also causes the frustrations and retreat during the use (C.-Y. Hu, & L.-C. Chen, 2013).

From the past research, we can see the biggest purpose for aged people to use a smart phone is to have a social life and to communicate with their family. Therefore there is a high usage rate for them on social media websites, and communication software. The social media tool usage rate in Taiwan is as high as 97%, which means only 3 people out of 100 have never used social media. The social function, like sharing photos and activities on Facebook is also very popular to the middle aged or older people. The age group over 65 years old also are a growing user group (T.-H. Tsai, 2014). This is also a healthy support and connection to the world for the elderly living alone in the remote areas or with disabilities. In Taiwan, the research in the past also indicated that the elderly people not only had interests in learning Facebook, but also Line, especially using the stickers on Line. They love using stickers, taking photos and they hope they can make their own "Morning Greeting" stickers based on the smart phone practice lessons for the elderly in the past (H.-J. Lai, 2016; H.-J. Lai, 2022). It is common to see that the elderly people use a lot of pictures, photo sharing and viewing just as much as typing texts. If we can make this operation more user-friendly or simple, it will help the elderly view images and transmit them more effortlessly on the internet.

2 METHOD

This research is divided in 4 parts: Stage 1. We use Focus Group to find out the difficult gesture that is not easy for the elderly. Stage 2: We develop the

new gestures and do some adjustments, focusing on the gesture of only using 1 finger. Stage 3 is going to do a Usability Test to compare the difference between traditional gestures and new gestures. Stage 4 is going to analyze and discuss the comparison between the interviews with the designer and the documents.

2.1 Discuss the gestures that are difficult for the elderly.

This study took 5 best selling smart phone brands in Taiwan, HTC, Samsung, Sony, Apple, ASUS for samples to locate 5 people who received the test. The people who are over 60 years old and have had experience using over 1 year are the testers. They will engage into the basic operation of the 5 brands of smart phones for about 30 minutes. Through interviews and observations, we can find the rather difficult gestures for the elderly. We found out that the rather difficult gestures for the elderly operating smart phones on the market are zoom in and zoom out the photos using two fingers at the same time, as shown in Figure 1 (Gesture A). This stage also corresponds to the mentioning in the past documents: The higher number of fingers involved at the same time, the more difficult it is for the elderly regardless if they are cognitively or physically coordinate.

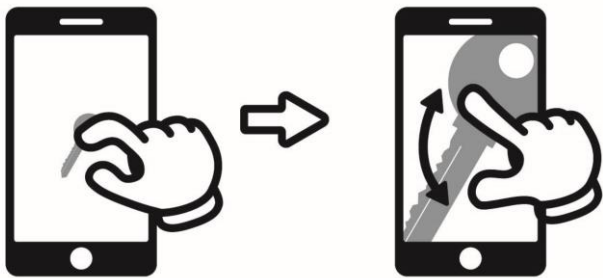


Figure 1. Gesture A: Traditional Gesture using 2 fingers to zoom in and zoom out (two fingers holding the screen at the same time to drag the image around).

2.2 Development and design of gestures

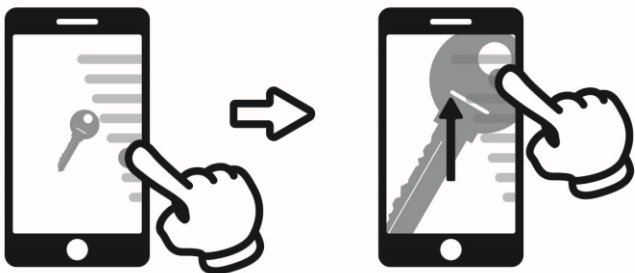


Figure 2. Gesture B: The figure on the right shows the control bar on the scale, which can be done by 1 single finger. When the finger swipe up, the image zooms in, if down, it zooms out.

The research team and product designers discuss then develop gestures. Based on the two finger operation on traditional smart phones for zoom in and zoom out, this can be improved for more user-friendly to the elderly. Through different collections

and creations of ideas, we invited 10 elderly people for test. In the end, we concluded two operation methods as below, and they are both one single finger touch operation, which improves the traditional two finger operation. They are shown respectively as Figure 2 (Gesture B) and Figure 3 (Gesture C):

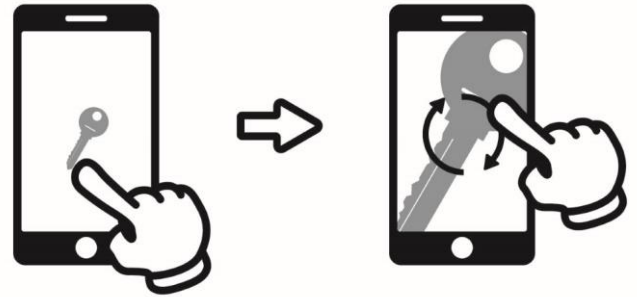


Figure 3. Gesture C: Through spinning of image, one can use one single finger to spin the image clockwise to zoom in the photo or spin anti-clockwise to zoom out the photo.

2.3 Assessment on the usability of new and old gestures

Through 5 indexes of usability assessments in the research: Learnability, Efficiency, Memorability, Errors, Satisfaction, we collect data feedback using 5-Point Likert Scale over 30 people at 55 years old or above who received the test. When the test starts, the researcher will explain different operations of gestures that have an effect on zooming in and out the image. We asked the testers to undertake this operation and answer the questions after completing the action. The data assessed through 5 indexes will be collected. The highest score is 5 and the lowest is 1.

- (a.) Learnability: Easy, simple, convenient and fast for learning.
- (b.) Efficiency: After learning and practice, it is easy to understand with efficiency.
- (c.) Memorability: After a period of time, it is not difficult to forget.
- (d.) Errors: Minimize the operation mistakes that users make.
- (e.) Satisfaction: Satisfaction level towards the whole operation experience.

3 ANALYSES AND DISCUSSION

There are three different groups for gesture testing on viewing images on smart phones. They all used fingers to zoom in and zoom out photos. The gestures are as follows:

- Gesture A: Traditional Gesture (Two fingers pressed the monitor at the same time and drag the picture around).
- Gesture B: New Gesture (Single finger to press on the right control bar to move up and down).

- Gesture C: New Gesture (Single finger to press on the central block to clockwise or anticlockwise).

At this stage, we used Independent Sample T-Test to compare between two new gestures B, C and traditional gesture A. We tried to find out a better solution for traditional gesture from the two newly developed gestures. After the analyses, the result is shown as Table 1 (A & B) and Table 2 (A & C) :

Table 1. Usability of Gesture A and B using T-test (*P-value <0.05)

	a. Learnability	b. Efficiency	c. Memorability	d. Errors	e. Satisfaction
	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)
A	3.80 (±0.41)	3.43 (±0.63)	3.40 (±0.50)	3.37 (±0.67)	3.13 (±0.73)
B	4.40 (±0.67)	4.30 (±0.65)	4.00 (±0.64)	4.30 (±0.47)	4.70 (±0.47)
P	0.000*	0.000*	0.000*	0.000*	0.000*

Table 1: Through the comparison between Gesture A and Gesture B using T-test for usability over 5 items, Gesture B in the new design all have a higher score than Gesture A in the traditional design in all the 5 items. It means Gesture B has better learnability, Efficiency, memorability, less error, and higher satisfaction for the elderly people to view images by zoom in and zoom out. Overall, it has better values.

Table 2. Usability for Gesture A and Gesture C using T-test (*P-value <0.05)

	a. Learnability	b. Efficiency	c. Memorability	d. Errors	e. Satisfaction
	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)
A	3.80 (±0.41)	3.43 (±0.63)	3.40 (±0.50)	3.37 (±0.67)	3.13 (±0.73)
C	3.30 (±0.65)	3.50 (±0.51)	3.80 (±0.76)	3.20 (±0.41)	3.80 (±0.76)
P	0.001*	0.652	0.020*	0.249	0.001*

Table 2: Through the comparison between Gesture A and Gesture C in Table using T-test over 5 items in usability, Gesture C in the new design is more difficult to learn than Gesture A in the traditional design with a obvious difference. However, in the aspect memorability, Gesture C has better performance than Gesture A with a significant difference. In the aspects Efficiency and error, there is no significant difference between Gesture A and C. Therefore, there is no need to discuss them in these two aspects.

To compare and analyze the comparison results of usability above, new Gesture B (Single finger pressing on the right control bar to move up and down to zoom in and out the image) is a more successful design. Lastly, this research assessed the result by consulting with the product designers for the data.

Through interviews, it discussed why there is a difference in usability between Gesture B and Gesture C for the elderly. To summarize the opinions of product designers, they are as follows: New Gesture C conducts clockwise and anticlockwise movement to zoom in and out images. Although this removes the difficulty for 2 finger operation simultaneously, it is still insufficient for instinct action. Also it is not acknowledged as a reflex action. Normally “spinning” is recognized as a skill to move or spin the picture, not to zoom in and zoom out the picture. Although the instructions and explanations have been given to the users before operation, due to a longer time to initiate the cognition, this design is not considered better than traditional gesture A by significance. As for the success of Gesture B, the designer also points out that the control bar on the side might block the image on the screen. This operation elements are similar to the volume control on the panel bar in traditional TV setting. Although they have different purposes and functions, the control bar movement on the scale is a instinctive and direct reminder for the elderly. This enables the elderly to pull the bar naturally. On the other hand, it also has a more positive feedback on the result. In the future design, this traditional habitual recognition might be transplanted to the touch panel devices as a way for the elderly to learn and adapt to.

4 4CONCLUSION AND ADVICE

This article has studied the more difficult action” two fingers pressing the screen to view the image by zooming in and out “with a further approach to improve it to single finger touch. As last, two user operation modes are selected for usability test. Through T-test, the comparison between traditional and new gestures can be done. Finally we can get a conclusion from the designer through the interviews. The whole process includes problem finding, design solving, quantitative tests, qualitative discussions and conclusions.

The less finger operation is used to lower the difficulty of operation. Among all the newly developed gestures, Gesture B is more successful. The main reason is. “the control bar for operation is intuitive and similar to the traditional TV cognitive operation. The failure reason for gesture C is “The operation lacks instinctive action and it doesn’t have an obvious control panel.” There are things in common between the study results and past study documents. The user-friendly features for the elderly in the control panel are: (1) the more intuitive touch panel design, (2) less finger operation involved, (3) easy to see control bar, (4) the image or text reminder are bigger in fonts, (5) reduce the inadequacy due to cognition change (T.-L. Wong, 2010; S Trewin, et al., 2013; N.-T. Wang, & C.-M. Cheng, 2015; P.-C.

Yeh et al., 2020). On the contrary, for the elderly to operate the smart phones, the unfriendly operation gestures include: (1) new operation without experience to refer to, (2) a significant different arrangement from the traditional control panel, (3) lacks visual clues or the functions are hidden, (4) unable to identify symbols and operation goal, (5) two finger operation at the same time, (6) difference between body reaction and cognition (C.-Y. Hu, & L.-C. Chen, 2013; T.-H. Chiu et al., 2014; P.-C. Yeh et al., 2020).

Lastly, as the population of aged people grow and the smart devices develop swiftly, this design area has a high economic value and thus is worth more studies. Plenty of similar area-related researches have been done to discuss the smart device use for the elderly, which keeps them active in the medical platform, social platform, communication software. This lifestyle will have a positive impact on their mental health. As long as the threshold bar is lowered for the elderly to enter the digital world, it will have a positive help to the overall social development. This research only discussed gesture design and assessment on image viewing for the start. It's advised to use more interviews and experiments in the future to improve the design for more diverse and accurate content.

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