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Gesture Interaction Preference of Healthy App for Elderly Users

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ABSTRACT

Objective: The social issue of ageing is becoming increasingly prominent, consumption for the elderly is forming a larger market and health issues are becoming more important, therefore using smartphones to address health issues will become an effective measure. By combining the psychological and physiological characteristics of older users, we study the gesture interaction preferences of older people in the health app domain, and thus aim to develop an exclusive gesture interaction system for older users.

Methodology: Firstly, we summarised the existing gestures and27 alternative gestures from the existing health apps, and then used a questionnaire to obtain the gesture interaction preferences of elderly users when using health apps. The results were that older people used "back", "OK", "cancel", "move", "delete", "return to home", "call out multitasking", "zoom in and out", "rotate". "The best gestures for the commands with inconsistent gestures are "click", "click", "click ", "Single finger press and drag", "Long press on target point to delete", "Click on Home", "Long Press the Home button", "two fingers open and close" and "two fingers rotate".

Conclusion: This study has been conducted to find out the preferences of the elderly in the health app domain regarding the gesture interactions corresponding to the nine types of operations, and to provide a better experience for the elderly users.

Keywords: Touchscreen gesture preference, Health app, Older users, Human-computer interaction

INTRODUCTION

As the number of older people increases, the social issue of ageing is becoming increasingly prominent, while a larger market is forming for health consumption aimed at older people. According to surveys, in the smart device market, more and more middle-aged and older people are choosing to use mobile devices such as smartphones or tablets (Ai Rui Consulting Group, 2014). However, even with the intention of learning how to use smart devices, most middle-aged and older people still find it difficult to quickly accept the new technology that smart devices bring and often feel uncomfortable and anxious in using them (Turner, 2008). With the continuous development of information technology, human-computer interaction has gradually shifted from buttons and knobs to a way that is closer to normal communication. Gesture interaction has attracted much attention with its natural, effective

and friendly characteristics, and many studies are now proving the usability problems of gestures in supporting the elderly (Salman et al., 2019; Cáliz et al., 2016). By studying the gesture interaction of elderly users, we can solve the difficulties when using smart devices, and apply them in more scenarios to truly realize smart old age care. With the "Healthy China 2030" goal put forward, the big health industry will develop more vigorously, and self-health management will become increasingly important. However, although there are many types of health apps, they lack consideration of the needs of the elderly. Today, 28% of the elderly are skilled Master the use of mobile phones, but they are quite different from young people in terms of usage habits and physical and psychological needs, and face many problems in human-computer interaction.

Current domestic and international research related to interactive gestures for older people focuses on two aspects: first, empirical studies in different perspectives to confirm the characteristics and advantages of older people when using touch screen mobile phones, for example, Leah Findlater et al (2013) compared the efficiency of older and younger people in touch screen operations, although older people were much slower than younger people, but proved that touch screen narrowed the performance gap relative to desktop and Gao et al. (2015) investigated the usability of four touchscreen gestures (click, move, zoom, rotate) among older and younger users, experimenting with the results that older people prefer click and younger users prefer convenient, fun and fast operation, and proposing a set of guidelines for the design of touchscreen user interfaces. The second is to propose guidelines or laws for interaction design by studying the physical and mental cognitive characteristics and performance experiments of the middle-aged and elderly. For example, Stößel (2009) proposed the importance of familiarity in the design of touch screen gestures for the elderly through a comparative study of gestural interaction with the elderly. Zhao and Men (2016) analyse the operation patterns, finger structure, finger dexterity and frequency of use of touch screen mobile phones by the elderly from an ergonomic perspective, and propose that the design of smart touch screen mobile phones based on the elderly needs to be more scientific and reasonable to make it simpler and more comfortable to be used.

Overall, the above research presents principles of touchscreen gesture design in demonstrating the importance of gesture interaction for older people, and analyses the differences between older and younger users and gesture preferences under a variety of touchscreen gestures. The current study does not focus on gesture preferences in a particular domain, so this study starts with the health domain scenario, first analysing the user characteristics of older people, then summarising the touch screen operations and gesture types based on existing health apps and interviews, and then investigating the gesture preferences of older people through a questionnaire survey to come up with a touch screen gesture system that is suitable for older people.

CHARACTERISTICS OF ELDERLY USERS

The defined age of old age is changing, and this study takes middle-aged and elderly people over 50 years old as the research object. At this stage, the physiology and psychology of the elderly will change. The following mainly analyzes the characteristics of the elderly from these two aspects.

Physiological Characteristics

As the elderly age, the main physiological symptoms are a decline in sensory functions and reduced mobility, such as reduced vision, reduced hearing sensitivity, slowed mobility or a variety of pain and discomfort caused by other diseases. The deterioration of the physiological systems of the elderly is accompanied by a decrease in the accuracy of movements and slower reaction times.

The main dimensions related to gestural interaction are motor function, haptics, and cognition, with motor performance characteristics including slowed reaction and poor finger dexterity; haptic performance characteristics including dry and inelastic skin, tactile insensitivity to pressure on the skin, and finger-end epilepsy; and cognitive performance characteristics including severe decline in short-term memory, better retention of long-term memory, and reduced learning ability.

According to Mi-randa A. Farage, the following points can be summarised: motor function can be improved by reducing the difficulty of finger manipulation, avoiding incoherent movement design, and not having too long intervals between manipulations; haptic can be improved by enhancing feedback stimulation and differentiating significantly; cognitive can be improved by using symbols of older people's experience, being easy to learn, and interacting consistently (Farage et al., 2012).

Psychological Characteristics

After retirement, the range of activities of older people is significantly reduced compared to their working life, and the centre of activity changes from the workplace to the home community, socialising mainly with family and neighbours. Due to the influence of physiological characteristics, such as the decline of memory and thinking ability, the elderly are less able to learn new things, less able to adapt to society and the environment, and also easily develop a sense of inferiority. Therefore, the design of mobile phone interfaces should give emotional care to the elderly and design gestures according to their behavioural habits, following design principles related to matching, ease of use, guidance, fault tolerance, standardisation and feedback (Xiuhua et al., 2015), effectively solve the elderly's fear of mobile phones, think with scientific thinking and methods, and effectively improve the life happiness of the elderly.

CASE STUDIES

Wu et al. (2016) put forward the principles of gesture design and its kinds of alternative gestures when studying the touch screen gestures of the elderly,

Table 1. Alternative gestures corresponding to the nine operations.

Orders	Gesture I	Gesture 2	Gesture 3
Back	Click 	Swipe from the left edge of the screen to the right edge 	Single finger right stroke 
Determination	Click 	One-finger tick 	Single finger downstroke 
Cancellation	Click 	Single finger painting "×" 	Single finger upstroke 
Mobile	Press and drag with one finger 	Two-finger press on target, then drag 	Click and long click, then click 
Delete	 Long press on target + tap to delete	 Slide the target bar left + tap to delete	 Right slide target bar + tap to delete
Back to main page	 Four fingers open and squeezed together	 Five fingers open and squeezed together	 Click the Home button
Call out multitasking	 Five fingers open and squeezed together	 Four-finger downstroke on screen	 Long press on the Home button
Zoom in/out	 Two fingers open and closed	 Five fingers open and closed	 One finger points and the other finger strokes up and down
Rotation	 Two-finger rotation of both hands	 One finger points and the other finger spins	 Two-finger rotation

which laid some foundation for their research on the gesture interaction preferences of elderly users in health apps. On the basis of the previous research, combined with the actual research, the alternative gesture types corresponding to each type of operation under the health app application scenario were analyzed and derived, as shown in Table 1.

Through a short interview and market health app research, from the interview, we know that the elderly mainly focus on four modules in health: health knowledge reading, health file recording, health information viewing and health behaviour assessment. In this paper, we have researched several health apps with high download numbers, such as Miao Health, Dingxiang Doctor and Mint Health. Through the actual operation of these apps, we have analysed the characteristics of their centralised gesture operations such

Table 2. Basic information on elderly users.

Variables	Category	Quantity/person	Percentage/%
Gender	Male	50	46.3
	Female	58	53.7
Age	50-60 years old	54	50.0
	61-70 years	29	26.9
	71-80 years	16	14.8
	81 and above	9	8.3
Average monthly income	Up to and including 1000	3	2.8
	1000-3000 (including 3000)	27	25.0
	3000-5000 (including 5000)	45	41.7
	5000 or more	33	30.6

as open, close, rotate, delete and return, and found that for the "select" operation corresponding to "click" gesture, "browse up and down" operation corresponds to "single point down slide" gesture, these gesture design has become the industry standard, but also found that the nine basic operation gestures These include: 1) back, 2) OK, 3) cancel, 4) move, 5) delete, 6) return to home, 7) call out multitasking, 8) zoom in and out, and 9) rotate.

Participants

The criteria for participants in this study were: 1) Seniors over 50, 2) experience of using a health app, 3) consent to be interviewed anonymously and to be recorded.

Questionnaire Research

The questionnaire is divided into two parts: the first part is the basic information, including the user's age group, education level and other information; the second part is the interaction gesture preference of the elderly when using the health app, including nine kinds of operations, each operation corresponds to an alternative scheme, mainly from the four dimensions of ease of learning, efficiency, memorability, satisfaction to compare and filter the best usability gesture scheme. The subjective attitudes of elderly users were evaluated using a 1–5 Likert scale, mainly through both online and offline distribution. 108 questionnaires were collected and the basic profile of elderly users is shown in Table 2.

Results

The experimental data were processed and analysed using SPSS software. Table 3 shows some of the intercepted data.

Specifically, for the 'Back' operation, there were significant differences ($P<0.01$) in efficiency, memorability and overall score, with the usability level of one click being significantly better than that of one swipe from the left edge to the right edge of the screen and one finger right swipe. For the 'OK' operation, there was a highly significant difference ($P<0.01$) in ease of learning, satisfaction, efficiency, memorability and overall score, with click being

Table 3. "Return" dimension and total score ANOVA results.

Operation	Gestures	Gestural evaluation dimensions									
		Ease of learning		Satisfaction		Efficient		Memorability		Total points	
		Average value	Da	Average value	Da	Average value	Da	Average value	Da	Average value	Da
Back	1	−0.266	A	0.468	A	1.087	B	1.029	B	0.423	C
	2	−0.065	A	0.231	A	−0.686	A	−0.610	A	−0.284	A
	3	−0.089	A	0.516	A	−0.498	A	−0.505	A	−0.023	B
F		0.733		1.921		100.578***		28.699***		19.630***	

significantly better than one-finger tick and one-finger down. For the 'Cancel' operation, there was a highly significant difference (P< 0.01) in ease of learning, satisfaction, efficiency, memorability and overall score, with click being significantly more usable overall than one-finger 'x' and one-finger up. For the Move operation, there was a highly significant difference (P<0.05) in ease of learning, satisfaction, efficiency, memorability and overall score, with the overall usability level of single-finger press and drag significantly better than two-finger press and drag and click and long press and then click on the target location. For the 'Delete' operation, the three operations differed significantly (P<0.01) only in terms of efficiency. For the 'back to home' operation, there were significant differences (P<0.05) in ease of learning, satisfaction, efficiency and overall scores, with the 'home' click being significantly better than the four-finger open pinch and the five-finger open pinch in terms of overall usability. Five-finger open pinch. For the 'call out multitasking' operation, there was a highly significant difference (P<0.01) in satisfaction, efficiency and overall score, with long presses on the home key significantly outperforming five-finger open pinch and four-finger downward swipes on the screen. For the 'zoom' operation, there was a highly significant difference (P<0.01) in ease of learning, satisfaction, memorability and overall score, with two-finger open being significantly more usable than five-finger open and one finger tapping and one finger swiping up and down. For the 'rotate' operation, there were highly significant differences (P< 0.05) in satisfaction, efficiency and overall score, with two-finger rotate being significantly more usable than two-finger turn and one-finger tap-hold, one-finger rotate.

DISCUSSION

The experimental study found that the gestures suitable for the elderly were mainly one-click and one-finger patterns, while some faster and more vivid interaction methods (e.g. four-finger up-call multi-tasking) did not show advantages among the middle-aged and elderly subjects due to the complexity of the gestures themselves. Therefore, in the design of gestures for the middle-aged and elderly, higher attention should be paid to the simplicity and efficiency of the gestures, and correspondingly, less attention should be paid to the metaphorical and fun aspects of the gestures.

The best gesture for return is option 1: "Click the 'back' button". Although "one-finger right swipe" is more in line with everyday cognitive schemas,

it is more metaphorical and for young users, the one-finger right swipe is undoubtedly the most convenient gesture. However, for older people, due to their reduced motor skills, the choice of gesture is more efficient in order to avoid misuse.

The best gesture action for the OK action is option 1: "click". As the OK command is a more frequently used command on the touch screen, users are influenced by their subconscious experiences when using it. Although 'one-finger draw' and 'one-finger swipe' are more natural gestures, they are often used without the aid of a pop-up box, making them more difficult for older people to use without textual cues and with a higher degree of metaphor. This may be due to the reduced accuracy of motor functions in the middle-aged and elderly.

The best gesture for cancellation was option 1: "Click the 'Cancel' button". Although the more metaphorical "one-finger stroke ×" and "click up" were easier to learn, the "click" gesture scored much higher in terms of efficiency than the other options. Again, this suggests that efficiency is an important aspect of gesture design for the middle-aged and elderly due to their reduced motor function.

For mobile actions, the best gesture was Option 1: "Press and drag with one finger". Option 1 scored higher than the other options in terms of satisfaction, efficiency and memorability, while the three options differed less in terms of ease of learning. Compared to the 'two-finger press and drag' option, the 'one-finger press and drag' option has an additional long press response time, but due to physiological changes in the middle-aged and elderly, finger dexterity is poor and the process is slower, making the two-finger drag much less efficient. The efficiency of two-finger dragging is much lower than that of single-finger dragging. Therefore, the advantages of two-finger dragging are not as obvious.

For the delete operation, the best gesture action when option 1: "long press on the target point to delete". Subjects generally use Android phones, and long presses to delete will generally result in a prompt that has confirmed whether or not the deletion has taken place, which is designed to be fault-tolerant and suitable for older people. For "right swipe target bar tap to delete" and "left swipe target bar tap to delete", where right swipe is more efficient and smoother, the drawback of this gesture is that there are no visual prompts, leading to a lot of possible confusion during use.

The best gestures for returning to the home page and for calling out to multitasking are option 3: "Click on the Home key" and "Press and hold the Home key". There is little difference in terms of ease of learning, satisfaction and memorability, but in terms of efficiency, "Click Home" or "Press and hold Home" are far more effective than the other options. Multi-finger swipes are less efficient, but the fun aspect of the operation can improve the experience in another way. However, fun is not an important factor in the design of gestures for older people who are not skilled in their own use.

The best gestures for zooming and rotating are: "two-finger open" and "two-finger rotate", respectively. Although two-handed gestures are proposed to improve efficiency, the lack of synergy between two-handed

movements makes one-handed gestures more usable than two-handed gestures in terms of overall usability.

In a study of gesture preferences on health app touchscreen phones, older adults operated "back", "OK", "cancel", "move ", "delete", "return to home", "call out multitasking", "zoom in and out", "rotate". The best gestures for the commands with inconsistent gestures are "click", "click", "click", "Single finger press and drag", "Long press on target point to delete", "Click on Home" , "long press on Home", "two fingers open and close", "two fingers rotate". Therefore, in the gesture design, priority is given to gestures that are more preferred by older users.

CONCLUSION

With the advent of ageing, the elderly population is gradually expanding, and the contradictions caused by their physiological and psychological changes and rapid social development have led to an unsatisfactory human-computer interaction experience for the elderly, with problems such as misuse, confusion and accuracy seriously affecting user experience, for example: (1) many gestures have metaphorical and unguided nature, making it difficult for users to discover them, and elderly users generally use gestures they are familiar with to operate in This is in line with their own cognitive habits, so gesture design must give users guidance and feedback. (2) At present, gesture operation has not formed a unified standard, and often requires different gestures for the same task, which brings confusion to users. The occurrence of these problems reflects the inadequacy of gesture interaction, which brings convenience to the user while also bringing frustration to the experience. As a natural form of human-computer interaction, gesture interaction has low learning costs and is more in line with human lifestyles, so gesture interaction has great potential in the elderly market (Zhang et al., 2017). Designing according to the needs and behavioural habits of the elderly and following the above design principles in the design process will greatly improve the user experience of the elderly and increase their level of security, social motivation, happiness and self-confidence, and will no longer This will no longer be considered as a marginal user group.

This paper is limited by the limited scope of the study, such as the lack of data and the relatively homogeneous geographical location of the respondents, and more extensive and representative studies could be conducted in the future.

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