Research on Optimization Design of mobile communication equipment based on analysis of elderly hand

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ABSTRACT

With the rapid development of Internet and information, The wide use of mobile communication equipment has brought great changes to people's production and life. Mobile payment, online booking and other services with mobile communication devices as the media greatly facilitate people's lives. However, due to the decline of hearing, learning ability the elderly were once considered to be "abandoned" in the Internet era. This paper takes hand as the starting point and foothold . Through observation, empirical research methods, the static measurement of hand size, shape, the dynamic measurement of hand range of motion and acceptable strength are combined to analyze the changes of hand in the elderly. Using the knowledge of ergonomics to study the characteristics and structure of the elderly hand. The research on the optimization design of the existing mobile communication equipment for aging reflects the deep humanistic care for the elderly from the perspective of design.

Keywords: Aging, Hand analysis, Mobile communication equipment, optimal design

INTRODUCTION

With the development and progress of society, human beings have entered the intelligent information age.

In the early stage, we sorted out and summarized the existing literature and data on the elderly, found the focus of the existing research on the elderly.Furthermore, the research focuses on the inconvenience of the hand characteristics of the elderly to their use of mobile communication devices.First of all, this paper uses the observation method to develop the behavior map and freeze frame photos of the elderly using mobile phones, in order to make a detailed analysis of the scene, posture, movement, especially the hand state of the elderly using mobile communication devices. Through in-depth communication with the research object through the interview method, we can visit the coupling relationship between the elderly and mobile communication devices from a more active perspective, and dig out the pain points in the use of mobile communication devices, so as to get the research results and analyze them.

Finally, based on the above experimental analysis data, this paper puts forward the aging optimization suggestions for the existing mobile communication devices, and tries to practice on the basis of the opinions.

RESEARCH BACKGROUND

According to the 19-year data of the United Nations, the world's population will reach 9.8 billion by 2050, of which the elderly population over 65 will exceed 1.5 billion, accounting for 16% of the total population Aging will become a major trend of global population development. In the information age, the rapid development of mobile communication technology makes smart phones become the key access port for the elderly and the Internet.At present, the existing mobile communication devices for the elderly in the market still stay in the big button, small screen, high volume, big font and other factors（Cui Bing.2015）. There is no detailed evaluation research on the use of the elderly, nor does the research focus on the inconvenience in the use of mobile communication devices caused by the functional changes of the elderly hands.Therefore, this paper focuses on the blank of the research on the elderly, and carries out detailed investigation and research, in order to get the research report with practical value.

Design Data of Hand Changes in the Elderly

With the growth of age, the physical and psychological aging of the elderly will inevitably lead to special needs different from other young groups(Seyed Mohammad Javad Mousavi.2013). The function of all parts of the human body will gradually decline.The shape and motor function of the hand, such as the stability and dexterity

of the hand, the pinch force of the fingers, the maximum limit of movement, the grip force of the palm will (changeYan Yafeng, Hou Huiru, Weng Changshui, Yang Jing, Yang Li, fan Qingqing, Yang Wei.2012) , these changes will affect the elderly to take and use objects, and then affect the normal life of the elderly. The skin of the hands of the elderly will become rough, which has a significant impact on the ability of the elderly to sense objects.With the aging of the elderly, the amount of exercise is gradually reduced due to the inconvenience of exercise, so the quality and quantity of muscle fiber of skeletal muscle will decrease(Liu Jian.2016) , the volume of skeletal muscle will also decrease, and the reduction of hand skeletal muscle will lead to the rapid reduction of grip strength of the elderly hand. Generally speaking, the grip strength of men aged about 40 is 43-50kg, and that of women is 27-31kg. It is not difficult to see in （Figure 3.1 "grip strength scoring standard for 60-69 year olds"）, the hand grip strength of both men and women aged 60-69 is much lower than that of 40 years old.

Unit: kg

Age	Gender	1 point	2 point	3 point	4 point	5 point
60-64	male	21.5-21.9	27.0-34.4	34.5-40.4	40.5-47.5	>47.5
60-64	female	14.9-17.1	17.2-21.4	21.5-25.5	25.6-30.4	>30.4
65-69	male	21.0-24.9	25.0-32.0	32.1-38.1	38.2-44.8	>44.8
65-69	female	13.8-16.2	16.3-20.3	20.4-24.3	24.4-29.7	>29.7

Figure 3.1 The data comes from the Internet

Coupling relationship between the elderly and mobile communication devices

In the era of mobile Internet, mobile communication equipment has become an indispensable tool in people's life. With its function gradually improved, the lifestyle of the elderly has changed a lot because of it. In the study of the coupling relationship between the elderly and mobile communication devices, this paper first uses the observation method, carefully observes and records the daily life process of five elderly people aged 60-65, and finally integrates and extracts the commonness, and draws the map of the elderly daily behavior in (figure 4.1)As can be seen from the picture, the elderly in the picture will lie in bed and use their mobile phones to check the recent news and social communication software. After a simple breakfast, they will take a walk and buy the vegetables of the day,In this scene, they will use their mobile phones for mobile payment, and then they will prepare and enjoy lunch. After lunch and lunch break, the elderly will take a rest on the sofa, use their mobile phones for entertainment or online shopping. After dinner, the elderly will go to the surrounding parks, listen to music on their mobile phones at the same time, contact their relatives and friends on their mobile phones when they get home, and then rest and sleep at the end of the day.

It is not difficult to see that there is no difference with young people, the elderly will also use mobile phones more frequently in their day. The life of the contemporary elderly is inseparable from mobile communication devices. In the use of mobile phone functions, most of the elderly will use mobile phones to watch news, shopping,

entertainment, listening to music, communication and so on.

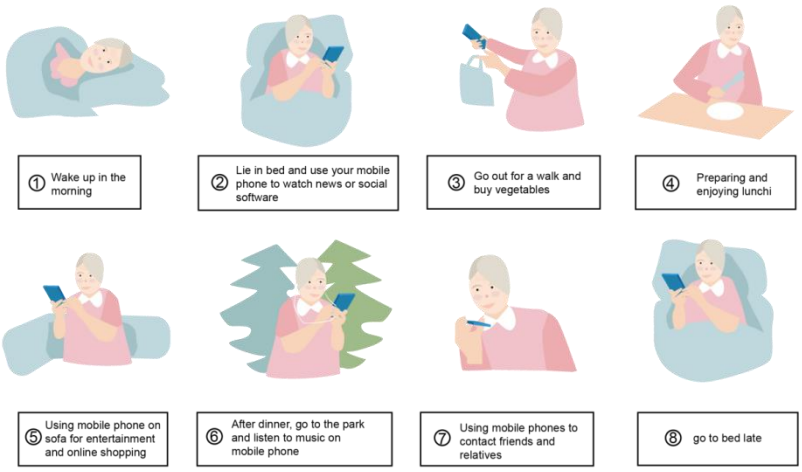

figure 4.1 The map of the elderly daily behavior

The above survey shows that there is a close relationship between the life of the contemporary elderly and mobile communication. Then, this paper will focus on what problems the elderly may have in the use of mobile communication devices? Based on the observation method and further combined with the interview method, this interview research developed a strict and standardized research process. The purpose of this study is to find out the shape of mobile phone suitable for aging.From the color, shape, material, weight, hand comfort, hand fit, screen size, mobile phone use scene, the purpose of using the mobile phone and other dimensions, the interview questionnaire was designed.

Through detailed interviews, In most cases, the elderly people's requirements for the appearance of mobile phones are still comfortable, generous and concise.In the choice of mobile phone appearance color, the elderly choose their own hobbies. On the whole, the elderly have less demand for mobile phone color than the young,most of them choose clean, simple and pure colors. Among the interviewees, men mostly choose cool colors, while women prefer gentle warm colors.

In terms of material, the mobile phone shell materials on the market are mainly plastic, metal and glass(Yan Yongdong. 2015). As far as the user experience is concerned, the appearance of the mobile phone with glass shell is glossy, fashionable and futuristic, but on the one hand, the touch of the mobile phone with glass shell is slippery, the hand grip of the elderly is weak, the mobile phone is easy to fall, and the glass shell is most likely to break under the action of external force.The visual quality of mobile phones made of metal materials is more advanced. The disadvantage is that the metal materials are easy to fall off the paint, and the production cost is the highest compared with other materials. Therefore, the unit price of mobile phones will be slightly expensive, and the mobile phones made of metal materials will be heavier

when they are the same as other materials and other parts .The interview results show that the skin of the elderly hand is rough, and the probability of the mobile phone with metal material sliding is higher than that with other materials. Mobile phones made of plastic materials have the advantages of simple manufacturing industry, low cost and high plasticity, which can meet the design of fitting the elderly hands, and the choice of colors is more diverse. The disadvantage of mobile phones made of plastic materials is that the texture of mobile phones is weak and it is easy to appear cheap. With the upgrading of materials, plastic materials with ceramic texture have appeared in the market, This shortcoming has been made up to a certain extent.

As for the weight of the mobile phone, as shown in (Figure 4.2), when the elderly use the mobile phone in different postures in different scenes, the load-bearing parts of their hands will change. In the left figure, standing hands and fingers are the main load-bearing parts. In the middle figure, sitting hands and fingers are the main load-bearing parts. In the right figure, lying hands, wrists and thumbs are the main load-bearing parts. According to the survey, the ideal weight of the mobile phone is between 140g and 170g, With the development of society, people have more and more requirements for the functions of mobile phones, and mobile phones have become more and more heavy, Long term use will cause fatigue and pain in the hands of the elderly. Mobile phones with less than ideal weight will also have the experience of weak hand pressure and poor interaction. According to the survey, 70% of the elderly hope that in the ideal weight range, the lighter the mobile phone the better.

Figure 4.2

In the use of mobile communication equipment, there will be two modes of single hand and two hands. The analysis of the two modes is also the key to optimize the aging design of mobile phones from the aspect of appearance. As shown in (Figure 4.3), the screen size of mobile phones is an important factor affecting the comfort experience of the elderly. Jobs once said that "3.5" is the best size of mobile phones ". However, with the development of technology, the screen of mobile phones has become larger and larger. Now seven inch mobile phones have appeared. The standard of dividing the data between two hands is 72mm in width, That is, the model with width greater than 72mm is more suitable for both hands operation, and the model with width less than 72mm can be operated by one hand. Seven inch single hand holding is not free to operate. It is not advisable to blindly increase screen size

and abandon the ability of single hand holding in matching the scene of elderly users. In the interview survey of the comfort of holding one hand and two hands, most elderly people said that the 6-inch screen mobile phone is more comfortable in experience.

To sum up, the authors used random sampling to screen 30 urban elderly people aged 60-65, conducted experiments on mobile phone preferences, and recorded and analyzed experimental data. The first round used color, material, shape and other weight are the same weight: 120 grams, 145 grams, 175 grams, 200 grams, 240 grams of mobile phones, so that 30 elderly people experience these five weights of mobile phones and through the hands Comfort ranked phones of different weights in four dimensions: very comfortable, more comfortable, unsympathetic and uncomfortable, and the results showed that 24 subjects thought 145 grams of mobile phones were very comfortable and 12 subjects thought 120 grams of phones were more comfortable. Eight subjects found the 175g phone uncomfortable, 23 thought the 200g phone was uncomfortable and the 30 thought the 240g phone was uncomfortable. In the second round, the author prepared the same color, shape, the material is plastic, metal, glass three mobile phones, so that 30 subjects according to the above requirements of the order, and finally 23 subjects think that plastic mobile phone is more comfortable, 25 subjects think glass mobile phone is not comfortable, 19 subjects think metal mobile phone is not comfortable.

In the second round, the author prepared three mobile phones with the same color and shape of plastic, metal, and glass, and asked 30 subjects to rank according to the same requirements as above. In the end, 23 subjects thought that plastic mobile phones were better. Comfortable, 25 subjects thought that glass mobile phones were uncomfortable, and 19 subjects thought that metal mobile phones were uncomfortable.

In the third round, the author prepared mobile phones with the same color and material and screen sizes of 4.2 inches, 5.0 inches, 5.8 inches, 6 inches and 7 inches, and asked 30 subjects to perform four-dimensional analysis of the mobile phones according to their experience comfort. In order of sorting, 21 subjects thought a 6-inch mobile phone was very comfortable, 16 subjects thought a 7-inch mobile phone was more comfortable, and 28 subjects thought a 4.2-inch mobile phone was uncomfortable.

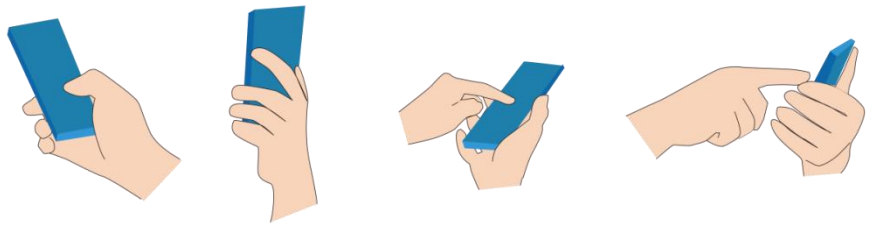

Figure 4.3

OPTIMIZATION DESIGN SCHEME

In the optimization design, combined with the above observation method and interview method and other test results, the existing mobile communication equipment is optimized for aging. As shown in(Figure 5.1), in the use of mobile phone materials, metal and glass materials are avoided, and plastic materials with stronger plasticity are selected. In order to further solve the anti-skid problem of mobile phones for the elderly, the frosted plastic shell surface is adopted, combined with the use of a small amount of silica gel, to increase the friction of mobile phones. Secondly, the design is in line with the aging ergonomics, and adopts the design of narrow in the middle and wide at both ends, so that the mobile phone fits the hand structure of the elderly better. The convex silicone design on the back of the mobile phone makes it more comfortable to fit the palm during use, increases the stress surface and reduces the burden on fingers. At the same time, the use of silicone material increases the taste of the product, and the soft touch reflects the humanistic care of the equipment to a certain extent.

CONCLUSIONS

In the aging society, the existing products for the elderly have serious problems of homogenization. In the early stage of product development, there is no in-depth research based on the audience. A large number of products for the elderly are still at the stage of solving the old people's shallow stereotypes such as dizziness and poor hearing. In the process of design and research, this paper takes the elderly hand research as the key research object, uses the standard design and research process to get the research results, and applies the results to the optimization design practice.

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