

Understanding the User Model of the Elderly People While Using Mobile Phones

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Abstract

This paper tried to understand the problems encountered by the elderly while using mobile phones through their user models. The purpose was to show the different dimensions of the discrepancies between user and designers models regarding mobile phones. Protocol analysis, structural hinting, and coaching methods were applied in the usability test. The results showed the different levels of operational problems of mobile phones, including physical, perceptual, functional, and conceptual. The problematic scripts of mobile operation, therefore, can be systematically categorized. Finally, conceptual misunderstanding of mobile phones should receive more attentions than the physical features of mobile phones.

1 Introduction

In modern society, people living longer have gradually changed the demographics of the population, and elderly people have become a large group in society as well as essential users of mobile phones. As modern communication has been drastically improved by the advantages of mobile phones, it is very often to see they cannot even operate the basic functions. Mobiles companies and phone designers tend to focus on teenagers, and at the time mistakenly categorize elderly people into the entry-level group that only requires basic functions in hope that without modifications entry-level mobiles can fulfill their need. This study explored the user model of the elderly people to understand their real needs when using mobile phones in order to reveal the problematic thoughts regarding senior mobile consumers.

1.1 The problem

Most literatures discussed the usability of electronic devices for elderly users in terms of decline of physical performance and a slower reaction time. The improved physical features of these devices increased the operation performance of elderly users a great deal, and our understanding of their physical ergonomics. With the progress and diversity of electronic products, large size screens and handwritten devices enabled elderly users operate cell-phones effectively.

In 2001, NTT DoCoMo Inc., the biggest Japanese telecommunication company, interviewed 300 male and female cell/PHS phone users in their sixties to understand mobile phones being increasingly popular among the elderly. This survey reported nearly 70% considered mobile phones essential for enjoying their lives. Interestingly, they indicated that mobile phones should be easier to use. As mobile phones incorporate more functions, the elderly found themselves unable to keep up with technological advances. Their comments regarding mobile phone development primarily required single function units for calls only and enhanced operational ease for mail and other additional functions.

While bigger buttons made navigation easier, older users actually faced a more complex problem in terms of understanding how mobile services were structured. When the forms of mobile phones are getting more stylish, it's a problem if you cannot perceive the correct operations of the interface, such as where the button is for dialing. Similarly, the complex hierarchy of a phone's menus increases the difficulty to navigate through a phone's functions as memory declines, since it places a high demand on remembering a sequence of actions (Goldamn, 2002).

1.2 The assumption

These phenomena seemed to suggest a diversity of problems occurred when the elderly operated mobile phones. Operational misusability of elderly users did not only result from physiological performance but also cognitive misunderstanding. Most research has been done in the physical ergonomics of elderly welfare and usability of user interface, but there is still limited research of cognitive ergonomics of elderly users with mobile phones. The design of mobile phones, therefore, remains unsatisfactory.

We speculated their operational misusability resulted from both physiological performance and importantly cognitive misunderstanding. Applying the mental model proposed by Johnson-Laird (1989) and Norman (1990), we hypothesized the mismatch between the user's and designer's mental models causes the hindrances of using mobile phones. The inability of elderly people to understand the fundamental concepts in mobile phones and the deterioration in cognitive capacities to operation further exacerbated the situation.

The purpose of this study was to establish a primary model, comprising a set of characteristics of the cognitive process through which elderly users utilize mobile phones. Through the models, we can understand more about the discrepancies of mental models between designers and the elderly.

2 Methodology

A usability test surveying the operations of mobile phones with the participation of elderly people was applied to observe their cognitive processes and frustration occurrences. According to the characteristics of senior citizen and our experimental experience, the final method was composed of protocol analysis, structural hinting, and coaching method in order to maximum both the quality and the quantity of our experimental data, Figure 1.

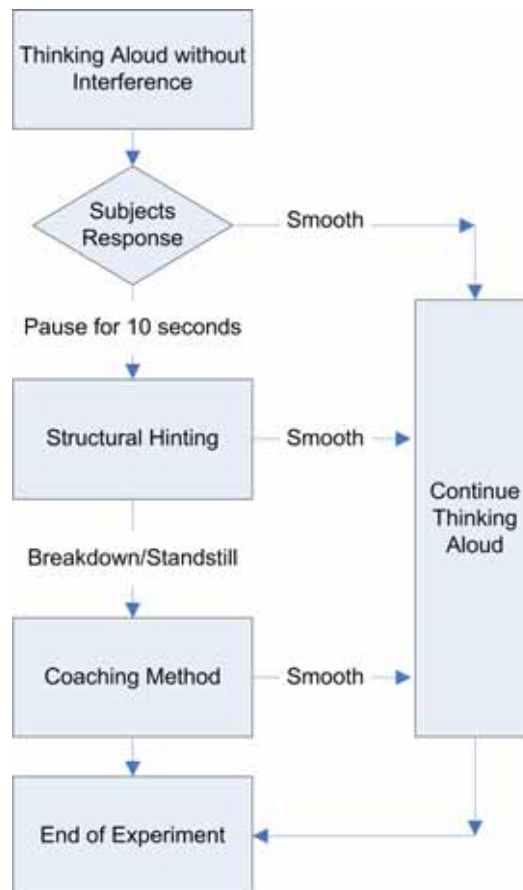


Figure 1: The procedure of experiment

Protocol analysis was originally proposed by Ericsson & Simon (1993) to explore the human problem-solving process. In recent years, it has been broadly applied in usability test in human-computer interface (HCI) studies (Carroll & Mack, 1985). Subjects were required to speak out their thoughts while operating the target devices. Experimenters analyzed the utterances of their thinking aloud, protocol, to research the cognitive process. Nielsen(1993) indicated that protocol analysis was the qualitative method of usability test aiming at examining the operational problems and cognitive misunderstanding. The richness of protocol was valuable to the understanding of HCI (Staggers & Norcio, 1993).

Structural hinting was applied in the process of protocol experiments to encourage subjects to verbally express their thinking processes when the elderly encountered operational problems and paused for 10 seconds. The hinting was not to direct the subjects' reaction but to guide them to solve the problem by proposing appropriate questions related to HCI. If the experimental process still encountered a breakdown or a standstill, coaching method was then applied (Nielsen, 1993). The experimenter would provide the correct procedures to the subjects, and listened to their responses. The procedure of the experiment was established.

The situation determining a standstill were incorrect operations for a long time and expressing of frustration, and that of a breakdown was pause for a long time and giving up. The structures of hinting questions and coaching steps were based on Norman's execution-evaluation cycle (1990). If proceeding smoothly after questions or coaching, the experimental process continued with protocol analysis.

The tasks for the experiment were calling using the address book, replying the missed call, and calling an answered call again. They were the most fundamental functions of mobiles and the most essential one as well. As a result, several similar mobile phones from dominant brands were selected, including NOKIA, Sony Ericsson, ALCATEL, and Motorola.

In most literatures, elderly means an individual who will be age 60 or older by the end of the month. In reality, the definition is relatively ill-defined since it does not include the performance of physical, physiological, and psychological functions. Subjects of this study ranged from 50 to 75 and have the experience of using mobile phones for 1 to 5 years. With a total number of 39, each subject provided a video recording of the operational process and a concurrent protocol.

3 Results

The results were presented as problematic scripts, including the detailed operational procedure, situations and discussions. Among them, common problems of mobile phones for elderly were found. Based on Norman's conceptual model, we found that the problematic scripts could be categorized into four different levels that imply a cognitive process in which a stimulus of mobile phone goes from the external world to the internal world of the elderly and vice versa.

The four cognitive levels were physical, perceptual, functional, and conceptual. The physical referred to the physical attributes of the mobile phones, including shapes, colors, textures, and sizes. The perceptual referred to the visual-spatial relationships of the appearance of the mobile phone, including arrangements of buttons and the mapping between screens and buttons.



Figure 2: The keypad of Sony Ericsson-Z200

The functional relates to functional references mapped between visio-spatial features/relationships on the mobile and the meanings and functions they represented. For example, the center square of the keypad of Sony Ericsson-Z200

represents four-directional selection and confirmation buttons, Figure 2. The conceptual represented the various functions of mobile phones, their concepts, operational procedures and the service they can provide, for example, SMS message, MMS message.

The problematic scripts of operational processes were represented by these four levels and their inter-linked relationships. The physical and perceptual levels reveal the external physical problems of mobile phone design, while the functional and conceptual levels revealed the internal cognitive misunderstanding of the elderly users about the mobile phone. These four levels were the discrepancies between user and designer models and generated usability problems while the elderly operated mobile phone. The conceptual model for understanding the user model of the elderly people while using mobile phones was produced, Figure 3.

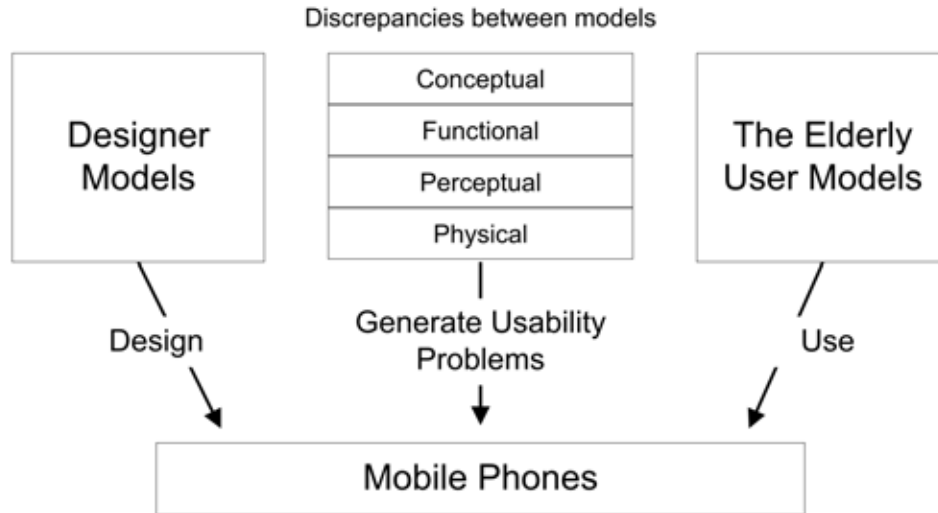


Figure 3: The discrepancies between models

In terms of abovementioned model, the problems found in the operational processes of mobile phone could be systematically categorized into a table, Table 1. The most interesting result was conceptual misunderstanding created many problems and frustration for the elderly. Some fundamental concepts applied in the design of mobile phones alienated the elderly users who were not familiar with these ideas, for example the hierarchical menu. Some problems crossed two levels. For example, a soft key without a label created a perceptual confusion, and the its mapping with changeable displayed functions also did. However, soft key and hierarchy were commonly applied in the entry-level mobile phones that were proposed to be used by senior citizen.

Table 1: Systematic organization of the operational problems of mobile phones

Physical	Perceptual	Functional	Conceptual
<ul style="list-style-type: none"> ■ Small Button Size ■ Small Display Font Size ■ Short Distance between Buttons 	<ul style="list-style-type: none"> ■ The Operational Directions of Buttons ■ The Buttons without Labels 	<ul style="list-style-type: none"> ■ Soft Keys (one key representing multiple functions according to the display) ■ Comprehension of the Icons 	<ul style="list-style-type: none"> ■ Using the Mental Model of a Traditional Phone ■ Hierarchical Structure of the menu ■ Automatic Wizards ■ The Meaning of Missed Call

4 Conclusions

For most consumers, designers, and market persons, the problems of mobile phones for the elderly were mostly physical and external. Therefore, we could found the mobile phone for the elderly were equipped with extra large

keys, a wider size, but similar underlying functions. Our results indicated that for elderly mobile phone users, even with more than one year experiences, misconception of basic operations and functions still existed. Therefore, the discrepancies between the users and design models hindered senior citizen to use mobile phones pleasantly.

The physical and perceptual problems were easy to perceive and correct in terms of mobile design, while the functional and conceptual were not. Given the situation that designers cannot use soft keys and hierarchical menus in their mobile design, what kind of mobile could be produced. If with some initial learning about these concepts, to what extent we can apply these concepts. With the emphasis shifted to functional and conceptual problems, more possibility regarding to the mobile phone design emerged. Therefore, more usability problems of mobile phones could be reduced for the elderly.

In conclusion, this study provided a method to observe the elderly while using mobile phones. The primitive results are as follows. First, many operational problems occurred due to cognitive aspects of ergonomics. Second, not age but the familiarity with underlying concepts of mobile phones represented the meaning of "elderly" users of mobile phone. Third, the results of this study provided realistic scenarios to abridge the gap between the users and designer mental models. The functional and conceptual aspects of mobile design should be the focus on understanding the user model of the elderly people while using mobile phones.

The future study will be focusing on how to facilitate the learning process when elderly people use mobile phones in the hope that the current technology of communication could benefit elderly people more with our better understanding of their user models of mobile phones.

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