User Experience Study on the Telecare System Menu Design With Handheld Devices

Che Liang-Yuan and Chen Chien-Hsiung

Department of Design, National Taiwan University of Science and Technology, No.43, Keelung Rd., Sec. 4, Da'an Dist., Taipei City 10607, Taiwan

ABSTRACT

Telecare systems for handheld devices can support people who need medical help through technology to get help faster. This study aims to investigate the user experience of the user interface design of teleconsultation and care system for mobile devices. In the previous phase of the study, participants believed that the telecare system should have a clear message structure and function list, and reduce visual interference on the page to improve search efficiency. In particular, the functions of the "Hot Experts, Finding Experts, and Personal Records" section need to be clearly delineated. Therefore, this research design and the experimental project will focus on the layout and menu types. The authors will investigate the user's requirement for menu functions and the usability of the user interface of the system. The primary research method is a two-factor mixed experiment with purposeful sampling. A total of 20 participants were invited to participate in the user interface viewing test. After simulating all the typical tasks, users will fill out the SUS, NASA-TLX, and subjective preference questionnaires. The researcher will conduct a semi-structured interview at the end. The research finally found that the usability of the handheld device of telecare system is better in the hierarchical menu. Also, due to the screen size limitation, it takes more physical demand and effort in full menu with text, resulting in a low usability evaluation. In addition, moderate use of icons in hierarchical menu can be interesting for users. Improper use can easily cause information interference. At the end of this study, it is recommended to incorporate other visual design elements for further exploration in the future.

Keywords: Telecare systems, Handheld device, Menu design, Interactive design

INTRODUCTION

Since the beginning of the epidemic, medical care in various countries has entered the stage of digitalization and technological transformation. Today, we have gradually entered the Internet of Medical Things (IoMT) era (Vishnu et al., 2020). How to provide real-time, more professional, and more accurate medical services is an urgent issue to be solved. Due to the change in communication behaviour between caregivers and patients caused by the epidemic, enhancing the user experience through the relevant interface is very important (Koonin et al., 2020). When users first encounter a user interface, its ease of use and preference determines whether they will continue to use the

application in the future. In handheld devices, menus are an essential tool to help users navigate and operate. The use of menus is now widely used in all screen sizes. Because of the limitation of each screen size, how to design the menu is also very important. Generally speaking, the content of menu design includes pictures, text, layout, visual information, and screen size. Vander-donckt et al. (2019) also classified and discussed the graphic design of the menu in 8 dimensions. However, exploring the impact of visual design, such as text, icons, and colours, on usability is still the mainstream research.

Menu structure generally refers to functional grouping or sorting, such as menu type, hierarchy or structure, length, order, and appropriateness of messages. Wang et al. (2004) systematically organized and discussed the menu structure. And the literature believes that hierarchical menus are better than full menus. It is known that menus composed of different design elements and structures will have other cognitive loads on users.

If the system provides the right amount of helpful information, it will give users a good service experience. Too much or too complex information may cause users to overlook it or generate negative feedback. There are many telecare systems in the app market, but there has yet to be a design guideline for a telecare menu system. This study aims to provide an apparent reference for menu designers to design a more reasonable menu through the above design elements.

Jiang and Chen (2022) mentioned many menu types. In this study, two category menu types were chosen to help understand how the degree of collapsibility affects usability:

(1) **Full menu:** The titles and content items are all visible.
(2) **Hierarchical menu:** Users can see the group title, and the user can see the drop-down menu after touching it.

The purpose of this study is to explore the usability of the telecare system. In the previous phase of the study, most participants mentioned that the telecare system should have a clear information structure and function list, reducing visual interference on the page to improve search efficiency. Therefore, among the visual design elements of this study, only two layout types are used to investigate users' subjective preferences.

(1) **Text:** The user interface design mainly consists of text content.
(2) **Text and icons:** The user interface design mainly consists of text content and icons.

METHOD

This research study is to understand the usability and subjective preference of layout type and menu type on the user interface of handheld device telecare system. A two-factor mixed experimental design was carried out through layout type 2 (within group) x menu type 2 (between group). The sample design of the research is based on the results of past interviews and research. It lists four primary functions of the system, including "Hot Experts, Finding
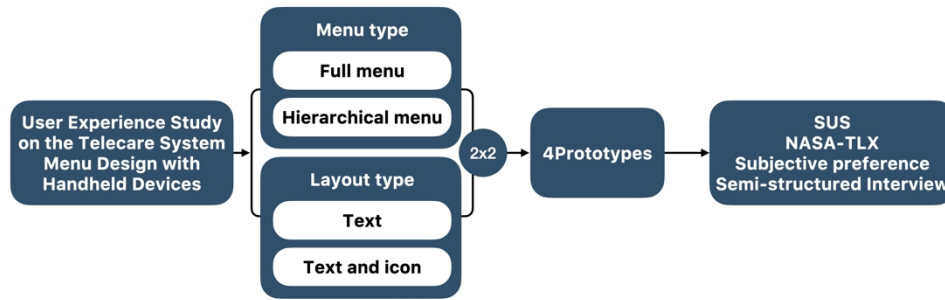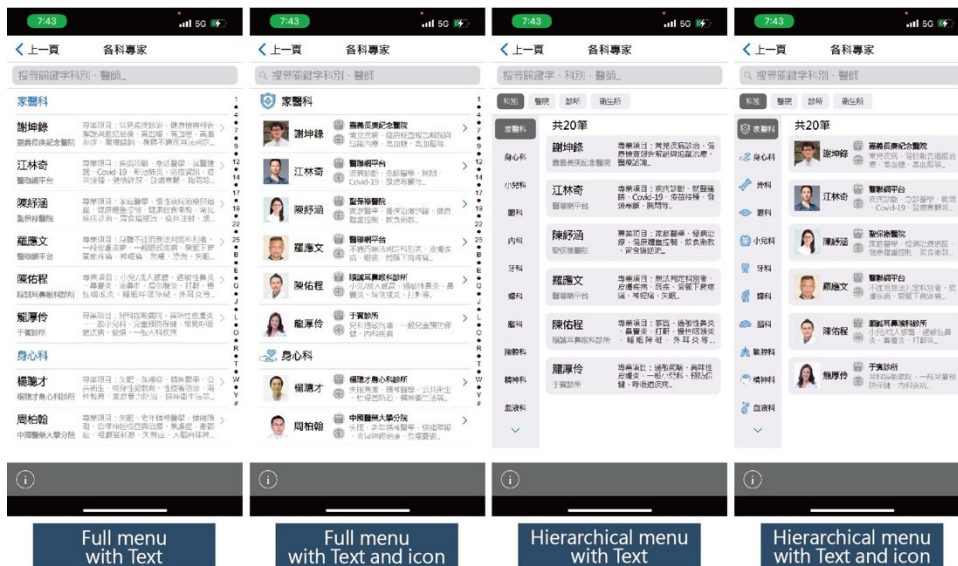
Figure 1: Research structure.

Figure 2: Experimental materials: Finding experts.

Experts, Personal Records, and Settings." A total of four prototype interfaces were designed (see Figure 1 & 2).

Before the formal experiment begins, the participants will first listen to the researchers explain the steps of the research process. After completing the viewing test process of the first interface design, fill in the SUS (Brooke, 1996), NASA-TLX (Hart & Staveland, 1988) and subjective preference scales in sequence. Then go through the second process and fill out the second questionnaire. After the experiments are completed, a background questionnaire is filled out. Researchers will ask participants to conduct a process of recall and semi-structured interviews.

RESULTS AND DISCUSSIONS

A total of 20 participants (10 males and 10 females) were invited to conduct experiments in this study. The participants were aged 20–35 years. There

were 16 participants with telecare experience and 4 without the experience. The experimental data were analyzed by two-way ANOVA with SPSS.

In the summary table of the SUS two-factor ANOVA analysis (Table 1), it was found that there was a significant difference in the menu type (F(1,18)= 37.179, $p =0.000^*$ < 0.05; $\eta^2 =0.674$); there was no significant difference in the layout type (F(1,18)= 0; $p =0.623$ > 0.05 ;$\eta^2 =.014$). There was a significant interaction between menu type and layout type (F(1,18)= 11.728, $p =0.003^*$ < 0.05; $\eta^2 =0.395$).The averages from high to low are layered Hierarchical menu with Text (M = 86.0) > Hierarchical menu with Text and icon (M = 79.25) > Full menu with Text and icon (M = 71.25) > Full menu with Text (M = 57.5) (Figure 3).

It can be found in the interview that the participants think that the full menu is an old-school design method. Finding content may take time, and the search efficiency is poor. Consistent with the research results of Wang et al. (2004), most participants think that the hierarchical menu is more usable, and they can see the information they need at a glance when searching for keywords. On the "Finding Experts" page, some participants mentioned that the introduction of expert information is also displayed on this page. Therefore, in the hierarchical menu, the text will be more useful than text and icons. On the "Personal Records" page, some participants also mentioned that adding text and icons would make the interface more interesting. The layout type with text-only feels less emotional.

In the summary table of the NASA-TLX Physical Demand two-factor ANOVA analysis (Table 2), it can be seen that the participants think that there is a significant difference in the menu type (F(1,18)= 6.000, p

Table 1. Two-way ANOVA summary table for SUS.

	Source	SS	df	MS	F	P	η^2
SUS	Menu Type	3330.625	1	3330.625	37.179	.000*	.674
	Layout Type	122.500	1	122.500	0.250	.623	.014
	Menu Type x Layout Type	1050.62	1	1050.625	11.728	.003*	.395

$^*p<.05$
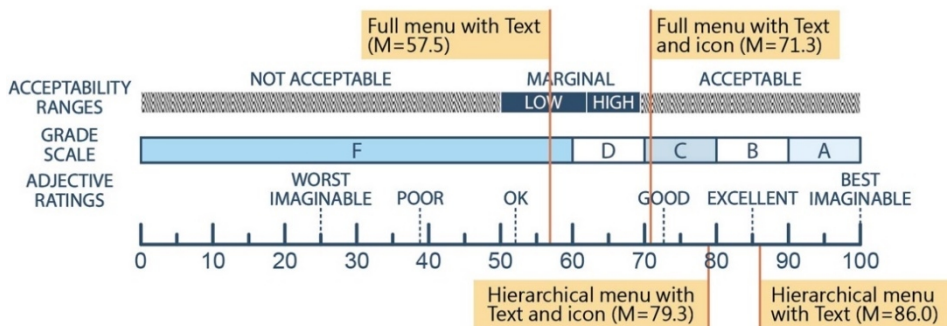
Figure 3: SUS scores.

Table 2. Two-way ANOVA summary table for NASA-TLX.

	Source	SS	df	MS	F	P	η^2
NASA-TLX	Menu Type	4.900	1	4.900	6.000	.025[*]	.250
Physical	Layout Type	.000	1	.000	.000	1.000	.000
Demand	Menu Type x Layout Type	6.400	1	6.400	7.837	.012[*]	.303
NASA-TLX	Menu Type	2.025	1	2.025	.906	.354	.048
Effort	Layout Type	.225	1	.225	.094	.763	.005
	Menu Type x Layout Type	13.225	1	13.225	5.914	.026[*]	.247

[*]$p<.05$

$=0.025^*<0.05$; $\eta^2=.250$). Layout types were no significantly different ($F(1,18)=0.000$, $p=1.000>0.05$; $\eta^2=0.000$). There was a significant interaction between menu type and layout type ($F(1,18)=7.837$, $p=0.012^*<0.05$; $\eta^2=.303$). The averages from high to low are Full menu with Text (M = 3.4)> Hierarchical menu with Text and icons (M = 2.7)> Full menu with Text and icons (M = 2.6)> Hierarchical menu with Text (M = 1.9).

From the interviews with the participants, it can also be found that the participants generally believe it takes much physical effort to complete the selection of simple texts, and it takes more time to find the information they need. Also, because of the size limitation of the mobile phone interface design, it will give users a poor impression. Moreover, the participants mentioned that a hierarchical menu with text and icons might produce too much visual stimulation due to the interference of menus and icons. Users are easily burdened and unable to find the critical information they need at one time. Most participants think the full menu with text and icons will not cause too much information interference. They only need to slide down to view the required information.

In the summary table of the NASA-TLX Effort two-factor ANOVA analysis (Table 2), it can be seen that there is no significant difference in the menu style ($F(1,18)=0.906$, $p=0.354>0.05$; $\eta^2=0.048$); layout type were not significantly different ($F(1,18)=0.094$, $p=0.763>0.05$; $\eta^2=0.005$). There was a significant interaction between menu type and layout type ($F(1,18)=5.914$, $p=0.026^*<0.05$; $\eta^2=0.247$). The averages from high to low are Full menu with Text (M = 3.8)> Hierarchical menu with Text and icon (M = 3.2)> Full menu with Text and icon (M = 2.5)> Hierarchical menu with Text (M = 2.2).

In the interview, the participants believed that on the "Find an Expert" page, the "Full menu with Text" needs more time to concentrate on understanding the content. In addition, the "Hierarchical menu with Text and icon" may take more time to understand due to a large amount of information. On the "Personal Records" page, the participants also mentioned that because of privacy concerns, "Full menu with Text" requires more effort to check the information, which may cause trouble to poor eyesight or the elderly.

In the summary table of the NASA-TLX two-factor ANOVA analysis (Table 3), it can be seen that there are significant differences in the menu

Table 3. Two-way ANOVA summary table for subjective preference.

	Source	SS	df	MS	F	P	η^2
Subjective	Menu Type	13.225	1	13.225	17.966	.000[*]	.500
Preference	Layout Type	.225	1	.225	.096	.760	.005
	Menu Type x Layout Type	.025	1	.025	.034	.856	.002

[*]*p<.05*
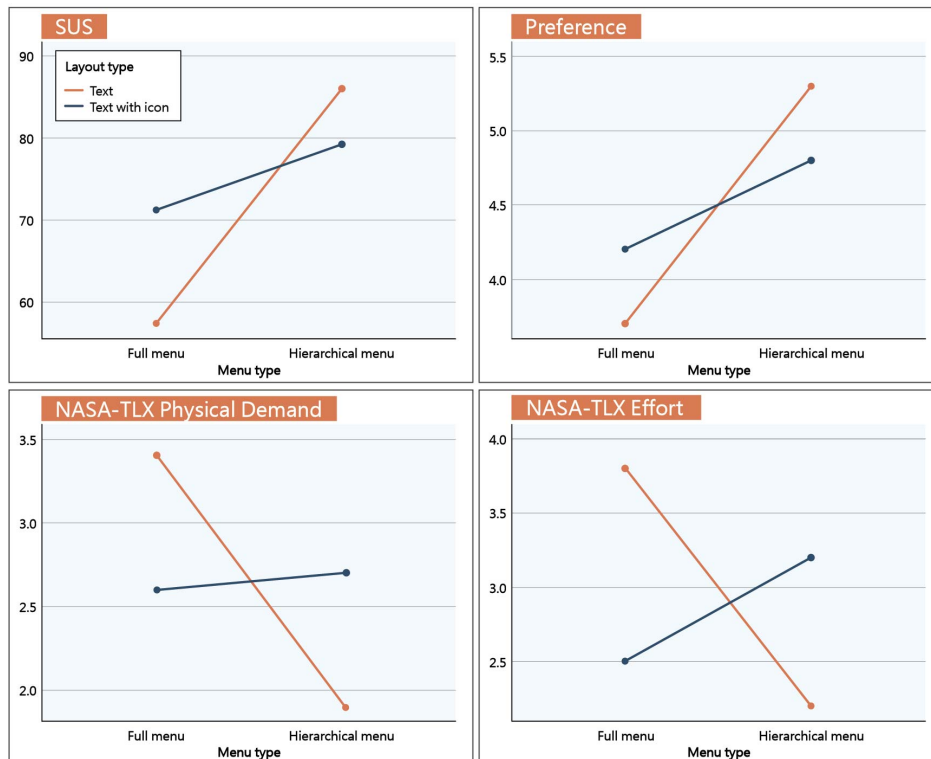
Figure 4: Interaction plot.

style (F(1,18)= 17.966, p =0.000[*] < 0.05; η^2 =0.500). Layout type were not significantly different (F(1,18)=0.096, p =0.760 > 0.05; η^2 =0.005). There was no significant interaction between menu style and layout style (F(1,18)=0.034, p =0.856 > 0.05; η^2 =0.002). The averages from high to low are Hierarchical menu with Text (M = 5.7)> Hierarchical menu with Text and icon (M = 5.6)> Full menu with Text and icon (M = 4.6) = Full menu with Text (M = 4.6).

In the semi-structured interviews, the participants mentioned that the "Hierarchical menu with Text" felt cleaner, fresher, and more usable. Secondly, in "Hierarchical menu with Text and icons", participants also mentioned that icons would have a more positive and interesting feel in the interface design. Compared to "Full menu with text and icons", "Full menu

with text" was the least preferred interface by the participants, which was generally considered to be old-fashioned and inefficient.

CONCLUSION

In this study, four user interface designs were conduct to help understand the influence of interface design and menu type on the usability of telecare systems and users' subjective preferences. Finally, it was found that the hierarchical menu was more usable than the full menu in the interface design of the telecare system for handheld devices. Because of the limitation of the screen size of the handheld device, the full menu with text requires more physical demand and effort and may result in a lower user evaluation. When finding experts, users preferred a "hierarchical menu with text" interface design. The main reason is that the introduction of each specialist includes the doctor's specialty, the name of the medical institution, etc., and the icon may cause visual interference. The second preference was for the "hierarchical menu with text and icon" because the appropriate use of icons can make the interface feel lively and interesting.

Summarizing the interview results, it was found that the icons in the hierarchical menu could be of interest to users because of the size of the handheld screen. However, it still needs to be configured appropriately to avoid excessive information interference. This study also found that the participants expected different experiences from the application for different stages of information needs. It is suggested that other visual design factors, user's background, and information involvement level can be incorporated for more in-depth study in the future.

ACKNOWLEDGMENT

REFERENCES

Hart, S. G. & Staveland, L. E. 1988. Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. Advances in psychology. Elsevier.

Jiang, L. & Chen, Y.-H. 2022. Menu Design on Small Display User Interfaces: Measuring the Influence of Menu Type, Number of Preview Items, and Menu Breadth on Navigation Efficiency. International Journal of Human–Computer Interaction, 38, 631–645.

Koonin, L. M., Hoots, B., Tsang, C. A., Leroy, Z., FarriS, K., Jolly, B., Antall, P., McCabe, B., Zelis, C. B. & Tong, I. 2020. Trends in the use of telehealth during the emergence of the COVID-19 pandemic—United States, January–March 2020. Morbidity and Mortality Weekly Report, 69, 1595.

Vanderdonckt, J., Bouzit, S., Calvary, G. & Chêne, D. 2019. Exploring a design space of graphical adaptive menus: normal vs. small screens. ACM Transactions on Interactive Intelligent Systems (TiiS), 10, 1–40.

Vishnu, S., Ramson, S. J. & Jegan, R. Internet of medical things (IoMT)-An overview. 2020 5th international conference on devices, circuits and systems (ICDCS), 2020. IEEE, 101–104.

Wang, A.-H., Lai, Y.-Y. & Sun, C.-T. 2004. Effect of PDA scrolling- and hierarchy-menu design on users' operating performance. Displays, 25, 109–114.