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On the influencing factors of dictionary app interface design for the elders

Wen-Te Chang[a], Chan-Li Lin[b], Kuo-Chen Huang[c], Ching-Chang Chuang[c]

[a]*Dept. of Arts and Design, National Taipei University of Education, Taiwan, ROC*
[b]*Cultural and Creative Industries Management, National Taipei University of Education, Taiwan, ROC*
[c]*Dept. of Product Design, Ming-Chuan University, Taiwan ROC*

Abstract

English learning is becoming one of the popular movements towards the Globalization. In recent years especially, more people use smartphones to learn English. However, it was found in the current market that most dictionary apps were designed for the younger generation and neglected the needs of the elderly. The issue of memory over-load turned out to be the critical problem of the usability for the elderly, due to the complex menu structures. Thus this study is meant to explore a suitable menu structure for the senior user, and provide suggestions for the relative researches.
The study results are:

1. Gender: There is no significant between male and female in the operating performance.
2. Menu structure: the performance of the hybrid structure is superior to the linear structure.
3. Display mode: There is no significant between the horizontal and vertical display modes in operating performance.
4. Task Complexity: A positive ratio between task complexity and menu topological structure was revealed, the harder the task complexity, the better performance of mixed structure can be expected.

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Keywords: Dictionary app; Menu structure; Gender; Task complexity; The elderly people

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1. Introduction

Smart phone Apps are developing rapidly and context-dependently. Taking digital dictionary as an example, it has been installed in most Taiwanese' smart phones. The majority has implemented digital English dictionary that include functions such as input interface, audio, and image, and only a few App interfaces designed for the elder people. This new type of App interface representation has been extremely effective, moving well beyond people's current experience. Layouts and topological structures have developed rapidly, an App interface design without the elderly user experience test and evaluation may affect the interactive effectiveness and quality of an interface, and consequently, addressing interface design issues prior to evaluation of a system is crucial.

2. Method

2.1. Participants

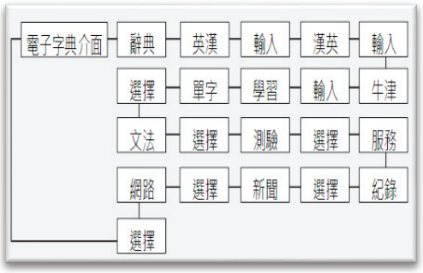
Fifty-one participants (24 females and 26 males) aged between 60~70, all passed the standard visual test and had previous 3C product experience were invited to have the hypertext browsing tests. Participants were randomly assigned to each one of the between-subject factors (gender and topological structure) experimental variable conditions. All participants were paid US $10 per hour for their participation.

2.2. Menu structure

Figure1 shows the layout design (Fig. 1a) and links structure (Fig. 1b) of the linear topological web page design. The linear topological Web page design featured each node in a fixed linear sequence. Each individual Web page could be accessed by clicking on "forward" and "backward" buttons at the bottom of the pages, which caused the next or previous page to be displayed. The linear version links were based on one parent node for every two child nodes, resulting in 37 nodes with 36 links.

Figure2 shows the layout design (Fig. 2a) and links structure (Fig. 2b) of the mixed topological web page design. The mixed topological Web page design allowed each page to be accessed by clicking on its name in the text table at the bottom of the main Web page. The pages were based on 37 nodes with all cross-referenced links to connect every Web page.

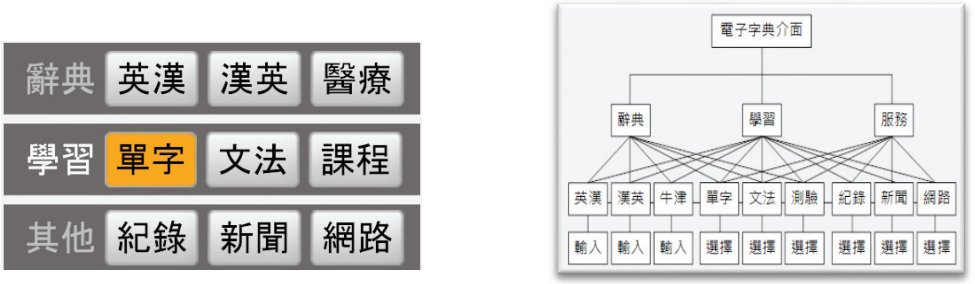
a



b

Fig. 1. The linear topological menu design. (a) Layout of interface design; (b) Linear type of links structure.

a. b.



a b

Fig. 2. The mixed topological menu design. (a) Layout of interface design; (b) Mixed type of links structure.

a b

Fig. 3. The Display mode. (a) Horizontal mode; (b) Vertical mode.

2.3. Display mode

FIgure3 shows the display mode, horizontal (Fig. 3a) and vertical (Fig. 3b).

2.4. Task complexity

Two tasks for each of the task type (easy, medium, and hard) were developed, resulting in 6 tasks in all (Table1). The specific task types were as follows:

- Easy: to travel through a single-linear of 4 linking nodes and find a specific page that provided answer to the given questions.
- Medium: the task was to travel through two targeted layers that amount of 8 linking nodes and find two specific pages that provided answers to the given questions.
- hard: the task was to travel through three targeted layers that amount of 12 linking nodes and find three specific pages that provided answers to the given questions.

Table 1. Types and levels of task design.

No.	level	Task	Nodes	Layers
1 2	easy	Single-layer	4	1
3 4	medium	Two-layer	8	2
5 6	hard	Three-layer	12	3

2.5. Procedure and facility

A multimedia room was used as the experiment site because it enabled reduced noise from the outside environment. A smart phone, Samsung GALAXY Note II, size 151.1 x 80.5 x 9.4 mm with 5.5" screen display/ weight 180 g, was used for digital dictionary app tests.

The nature of the experiment and the task specifications were first briefly explained to each participant, and following this introduction, the participants were given 15 minutes to learn how to interact with the user interface. More time was given for participants who felt they needed further practice. The learning and practice session ended when participants had completed three randomly assigned practice tasks, one single-, one double-, and one triple-layered task. Instructions for these three tasks were given in writing on separate cards; participants took one card at a time and completed the task assigned on it before continuing with the task assigned by the next card; this continued until all three tasks were completed. Once the practice session ended, the experiment formally began after a 15-minute rest. Three tasks comprising the formal test were similarly given to participants on separate cards, and participants completed the task on one card before looking at the next. Each of the three tasks was thus taken randomly to avoid any carry-over effect. For both the practice and experimental trials, participants were instructed as follows: "Click on/off using the mouse to activate the interface, and the test will formally commence and be recorded. Your operation time is taken to reflect the effectiveness of the interface assigned to you, so please pay careful attention while performing the requested procedures. After reading and memorizing the tasks, please try to complete the tasks as quickly as possible." The full experiment lasted approximately 1 h for each participant.

2.6. Experimental design & analysis

A mixed-factor 2×2×2×3 MANOVA experimental design was adopted in this study. The independent variables were gender, hyperlink topology (linear and mixed), mode (horizontal and vertical) and task type (easy, medium, and hard). The dependent variables were the mean time of locating specific nodes. Within-subject design was used for the variable of mode and task type, and between-subject design was adopted for the two factors of gender and topology. There were 12 tasks in all, *2* tasks for each of the 3 task type with repetition of the 2mode (2×3×2=12). To avoid the learning effect and various starting nodes of each task, the tasks were arranged using a Latin square, and each task started from first front page of Web page.

Web searching performance was measured by the time spent searching; starting when the task began and ending when the participants found the correct answer and answered on the task cards. Each answer was confirmed by the research staff before the next task was given. Additions to the MANOVA analysis of all the three variables, post hoc comparisons were processed to identify the simple effects among the factors. The statistical analyses were carried out using the Statistical Package for the Social Sciences (IBM SPSS Statistic Inc., Chicago, IL, USA, Version 20).

3. Results

3.1. Overall results

As Table2 displays, the MANOVA analysis of collected experimental data are summarized. As the analysis results indicated, the variables of topological structure ($F_{(1, 46)}$=22.65, p<.001), task type ($F_{(3, 92)}$=331.07, p<.001), but gender ($F_{(1, 46)}$=.97, p>.05) and mode ($F_{(1, 92)}$=2.28, p>.05). As the main effect analysis indicated, mixed structure is superior to the linear topological structure. On the task type analysis of efficiency, the comparing order of time spending on the three types of task is easy<medium <hard.

Table 2. Summary of MANOVA analysis.

	Variables	Type III Sum of Squares	df.	Mean Square	F	Sig.
Between-subject	Gender (A)	703.93	1	703.93	.79	.37
	Topology (B)	20124.74	1	20124.74	22.65	.00
	A×B	19.37	1	19.37	.02	.88
	S(AB)	40868.95	46	888.45		
Within-subject	Mode (C)	727.58	1	727.58	2.28	.13
	A×C	251.99	1	251.99	.79	.37
	B×C	282.70	1	282.70	.88	.35
	A×B×C	154.08	1	154.08	.48	.49
	S(C)	14627.92	46	317.99		
	Task type (D)	89712.86	2	89712.86	331.07	.00
	A×D	402.38	2	402.38	1.48	.22
	B×D	5395.65	2	5395.65	19.91	.00
	A×B×D	6.75	2	6.75	.02	.87
	S(D)	12464.79	92	270.97		
	C×D	9.82	2	9.82	.05	.81
	A×C×D	235.41	2	235.41	1.33	.25
	B×C×D	176.33	2	176.33	.99	.32
	A×B×C×D	2.87	2	2.87	.01	.89
	S(CD)	8144.04	92	177.04		

3.2. Interactive effect

There were one significant two-way interactions, topological structure and task type ($F_{(2, 92)}$=19.91, p<.001) found. However, it was noted that the two-way interactions of gender×topology ($F_{(1, 46)}$=.02, p>.05), gender×mode ($F_{(1, 46)}$=.79, p>.05), gender×task type ($F_{(2, 92)}$=1.48, p>.05), topology×mode ($F_{(1, 46)}$=.88, p>.05), task type×mode ($F_{(2, 92)}$=.05, p>.05), either the three-way and four-way interactions among factors were not significant (see Table2).

4. Discussion

4.1. Main effect

a) Gender: The main effect of gender is not significant. This is not consistent with the previous study that claim male have better performance than the female on wayfinding tests [2, 5]. A possible reason is that previous studies did not include the age effect. Note that the present did not include the younger subjects, a comparison between the young and elderly groups remained to be testified on the future research.

b) Menu topological structure. The main effect of topological structure is significant. Mixed is superior to the linear structure, and supported by previous study [1].
c) Mode: The main effect between horizontal and vertical mode is not significant. As the smart phone can shift the display mode between horizontal and vertical mode depending on users' needs, a good interface design shall prevent the mode effect to insure the consistency quality [6].
d) Task complexity: The main effect of task complexity is significant, and supported by previous studies [3, 4].

4.2. Interaction between task complexity and topological structure

Although the experiment data indicated that the main effect on the topological structure was significant, it was found that the interaction between task complexity and topological structure was significant. The post hoc comparison revealed that, the time spend on task complexity is: hard> medium> easy. In addition, a positive ratio between task complexity and menu topological structure was revealed, the harder the task complexity, the better performance of mixed structure than linear structure can be expected. A possible reason is that mixed structure design successfully integrated the merits of hierarchical and network structure that overcomes the difference of task complexity.

5. Conclusion

This study adopted topological structures in the practice of dictionary app user-interface design. The research results indicate that, depending on the nature of the task complexity, each type of topology has unique design features that can facilitate users' performance. It was found that mixed topological structure is superior to the linear and a positive interactive ratio was noted, the difference between mixed and linear will increase when the task complexity raise. These findings suggest that mixed structure is the fittest interface layout for the elderly citizens' smart phone app.

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