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Cognitive Considerations

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Do Existing Menu Design Guidelines Work in Chinese? *

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1. INTRODUCTION

The design of graphical user interfaces has been extensively studied in the last two decades, primarily in the United States and parts of Europe. The result has been the establishment of principles and guidelines to direct designers (Mayhew 1992). Since most interface studies have been conducted in western culture using western languages (mainly English), the existing guidelines may include culture-dependent features.

In the last few years, the importance of internationalization and localization of interfaces has been emphasized and explored by some researchers. The translation of the text contained in the interfaces, and adaptation to local formats relating to date, time, numbers and special characters has received considerable attention in most internationalization and localization efforts. However, other aspects related to culture and language have received very little or no attention. At present, a majority of Chinese language-based software interfaces have been designed as direct translations of the English originals, or utilizing icons, layout and organization based on published guidelines and English-language interfaces.

However, Chinese language and culture include an extensive collection of characteristics very distinctive from their western counterparts. For example, the iconic nature of the language may lead to different natural metaphors for computer interfaces. Hence there appears to be a definite need to investigate possible culture-dependent aspects of Chinese language computer interfaces.

In this study, some of the existing guidelines for the design of menus are challenged in their applicability to Chinese language-based interfaces.

2. CHALLENGING EXISTING GUIDELINES FOR DESIGN OF MENUS

A menu is one of the basic forms of human computer interface. It is a list of options from which a user selects a desired choice. Menu-type interfaces are widely used, as they are easy to learn and easy to use. There are specific guidelines developed for the construction of menus. Some of those guidelines may be seen as culture-independent, as, for example, the introduction of speedy navigation aids for expert users. However, many other menu design aspects seem to have a cultural element. The direct use of existing design guidelines for these aspects may result in Chinese language menus that do not fit the mental models intrinsic to Chinese population.

In this paper we will focus on three aspects of menu design:

- Orientation or flow, that is, the layout of the choices in the screen;

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- Choice ordering, that is, the sequence of the choices in the menu;
- Keyboard choice selection, that is, selection of choices in keyboard-driven menus.

Existing guidelines for *menu orientation* recommend the vertical organization of full screen menus. Due to the reading/writing orientation of English language (and most western languages), a "line-break" separates items in a list. Hence, this guidance seems natural since we write lists in a vertical orientation when using English. However, Chinese text is mostly written starting at the top right corner of the page, and proceeding in "columns" top to bottom. A natural break of the flow of the text, as in changes of paragraphs, is given by a "column-break". Therefore, a natural orientation for a list in Chinese would be horizontal.

Hypothesis 1: A horizontal orientation is better for Chinese language menus

According to design guidelines, the *choice ordering* in a menu should be alphabetical, when there is no conventional order (like in the months of the year), and no other task-related inherent order. This means that, when no intrinsic orders of choices exist, the menu should have an alphabetical order. The Chinese language is pictorial, with thousands of different characters, most of them having a complete meaning, that is, each character represents a complete word. The most common sequence in a Chinese dictionary is the number of strokes, which corresponds to the number of paintbrush strokes needed when writing the character. Therefore, it appears that the number of strokes in Chinese corresponds to an "alphabetical" order.

Hypothesis 2: Number of strokes ordering is better for Chinese language menus when no task-related intrinsic order exists

On *keyboard driven* menus, existing guidelines recommend the use of the arrow keys for menus with up to four choices and mnemonic code for longer menus or for menus of any length used frequently. Mnemonic letters, or letter codes derived from the first letter of the choice, are easy to learn and infer in English language menus, thereby providing a faster selection than number codes. However, when using a QWERTY keyboard, there is no obvious mnemonic letter code for Chinese language menus. One possibility is to use the common alphabetical representation of the sound of Chinese words, and then use the first corresponding letter.

Hypothesis 3: For keyboard-driven menus with more than four choices, mnemonic letter code derived from the sound of the Chinese word is better than a number code or a non-mnemonic letter code or arrow keys' selection.

3. METHODOLOGY

Three experiments with a total of ten experimental conditions were designed to test the hypotheses stated above. In each experimental condition, the objective was to select from a menu the name of the animal displayed in the screen. The figure of an animal appeared at the center of the screen. There were 10 choices in the menu. The text of the choices was centered in ten buttons lined either at the top of the figure or on the left side of the figure (Figure 1).

Experiment 1 was an attempt to test the optimal menu orientation for Chinese users in Chinese and English interfaces (Shih and Goonetilleke 1997). The experiment had four experimental conditions: horizontal orientation with Chinese text (called Chinese-Horizontal) and English text (English-Horizontal), and vertical orientation with Chinese text (Chinese-Vertical) and English text (English-Vertical).

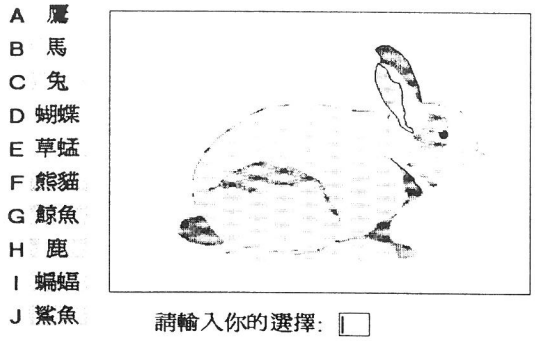

Figure 1. Example of experimental screen with vertical menu orientation

Experiment 2 was an attempt to test choice ordering for Chinese menus. The experiment had two conditions: random ordering and number of strokes' ordering. In both experiments 1 and 2, a mouse pointer was used to select the correct choice.

Experiment 3 was an attempt to test choice selection for keyboard-driven menus in Chinese. The experiment had four conditions: mnemonic letter codes derived from the sound of the Chinese words; non-mnemonic letter codes; number codes and selection by keyboard up-down arrow keys. Figure 1 shows an example of non-mnemonic letter code selection. In each experimental condition the code had to be entered (or the choice highlighted, when using arrow keys) followed by Enter key.

The experiments were coded in Visual Basic 3.0 with Microsoft Chinese Windows 3.1 environment. The experiments were run on a Pentium 90 MHz personal computer, with a multi-scan color monitor and a QWERTY keyboard.

Fifty subjects performed all ten experimental conditions in random order. All subjects were Hong Kong Chinese undergraduate students, whose first language was Chinese, having extensive training and at least 12 years of education in English. All subjects had moderate computer experience.

Prior to each experimental condition, instructions were displayed on the screen and practice trials were allowed. Subjects could control the number of practice trials, with a minimum of three. Each experimental condition comprised ten repetitions. The repetitions were presented in random order.

The dependent variables were related to choice selection time and number of errors.

4. RESULTS AND DISCUSSION

In experiment 1, the Analysis of Variance (ANOVA) for time showed a significant difference between menu orientations at the $p < 0.05$ level. Chinese-Horizontal condition had the lowest time and English-Vertical had the highest. Further analysis performed using the Student-Newman-Keuls test showed no significant differences between the Chinese-Vertical and English-Horizontal menus. This result confirms hypothesis 1, and we may say that there is sufficient evidence that horizontal orientation may be better for Chinese users.

In experiment 2, the ANOVA for time showed no significant effects at the $p < 0.05$ level. This is an indication that the order used in a Chinese dictionary does not necessarily improve

performance, even though all subjects were very familiar with the use of Chinese dictionaries. Informal interviews with subjects showed that, although they could "sense" the dictionary order of words at a glance, in many cases, they had to actually count the number of strokes to be sure. As the ordering is not "instantaneous", it seems that number of strokes' order is not as effective as the alphabetical order in other languages. Further studies are needed to confirm this finding.

No significant difference exists for the dependent variable, number of errors in experiments 1 and 2.

In experiment 3, the ANOVA showed a significant effect on time for keyboard choice selection at the $p < 0.05$ level. Arrow key selection had the best performance, followed by number code, while mnemonic letter code had the worst. A *post-hoc* Student-Newman-Keuls test showed no significant difference between arrow keys' selection and number code selection. This result is contradictory to existing guidelines for menu design. Arrow keys' selection had the best performance (comparable to number code), even with ten choices, when the guideline recommends arrow key selection for menus with up to four choices. Since the Chinese language does not render itself to immediate alphabetical mnemonic letter codes, it may be advisable to use number codes. In addition, arrow keys' selection should also be considered, even for menus with as many as ten choices (or maybe more). Although mnemonic code was expected to have fastest selection time, it was the slowest. Further study using a few volunteer subjects, showed that with extensive practice, the mnemonic letter code based on phonetics is learned and becomes the fastest. Therefore, it could still be effective for high frequency use.

There was no significant difference in the number of errors for arrow keys' selection, number code and non-mnemonic letter code. However, the number of errors for mnemonic letter code was significantly higher. This result reinforces the need of longer training for mnemonic code based on the sound of the Chinese words.

5. CONCLUSION

This study showed that, for menus deigned for Chinese users:

1. Horizontal orientation is more effective
2. Chinese dictionary order is not as effective as the equivalent alphabetic order in English
3. Mnemonic letter codes based on phonetics takes longer to learn. Arrow keys' selection or number codes have better performance for occasional users.

This study emphasizes the need of further research about culture and language-dependent aspects of existing guidelines for interface design.

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