Culture-adapted User Interface Design Method for Mobile Phone: Correlation between User Knowledge and Icon

Chen Yumiao
Zhejiang University
Hangzhou, China
Chenyumiao123@163.com

Xu Jiang
Southeast University
Nanjing, China

Yang Zhongliang
Zhejiang University
Hangzhou, China

***Abstract*—This study is to explore the design process regarding how interface designers in China deal with the user interface design styles pertinent to the mobile phone, and investigates correlation between user knowledge and icon of mobile phone. An experiment was conducted to examine the usability and user's satisfaction of the designed mobile phone UI. Sixteen Chinese participants in China participated in this study. User knowledge eliciting and interface usability testing were conducted to study correlation between user knowledge and icon. Results indicate that culture-adapted user interface design method for mobile phone can help designers to develop appropriate user interface for Chinese users.**

Keywords- user interface design; mobile phone; user knowledge; icon

I. INTRODUCTION

Interest in the influence of culture on the design of user interfaces has grown as the world market has become more globalized. For software, translating all the text items, such as commands, help, and prompts, is basic and necessary for localization, but text translation is not the only translation issue. Other issues like date, time, number formats, symbols, colors, and functionality are also important [1]. It is concluded that culturally determined usability problems converge in the understanding of representations the meanings of which are rooted in culturally specific contexts [2]. Culture can affect the usability of user interfaces [3]. Usability is a cultural phenomenon, and it depends on the symbols, beliefs, practices and social relationships that govern human activity in a given time and place [4]. People from different cultures are different in their perceptions, cognition, thinking styles, and values. Thus, it is important to thoroughly understand different cultural traits in designing computer interfaces for international users, rather than simply translating language [1].

User interface studies with culture, cognitive and implicit viewpoints are mostly involve interaction in a desktop environment. And mobile phones are being rapidly disseminated through diverse cultural areas.

As of March 2010, the Chinese mobile phone users have reached 778.7 million [5]. For those reasons, cultural accommodations need to be taken into consideration in mobile phone UI design.

The purpose of this study is to explore the design process regarding how interface designers in China deal with the user interface design styles pertinent to the mobile phone. A brief review of the literature related with culture, interface design and usability is followed by the methodology used in the pilot study.

II. CULTURAL DIFFERENCES AND IMPLICATIONS FOR USER INTERFACES

Culture can be viewed as "shared patterns of behavior" [6]. A cultural environment is be able to provide an individual with an emotional space in which set of beliefs, values, and behaviors can be commonly shared by all the members within the same society or ethnic group. Cultural traditions should be generally agreed upon by the majority of the members of the culture, not just by an individual alone [7].

Anthropological and psychological studies continue to suggest that cognitive style is culturally different. Particularly, Nisbett reports plausible evidence of such cultural difference, empirically supporting what has been extensively asserted in other disciplines by explaining where the culturally adapted cognitive difference comes from [8]. A central idea to his research is 'holistic versus analytic thought'. Holistic thought engages in context-dependent and holistic perceptual processes by attending to the relationship between a focal object and the field, and through a tendency of explaining and predicting events based on such relationships. On the other hand, analytic thought engages in context-independent and analytic processes by focusing on a salient object independently from the context in which it is embedded. It has a tendency to focus on attributes of the object and assign it to categories, using rules about the categories.

The term "culturability" has been suggested by Barber and Badre (1998) by combining the words culture and usability. They developed a systematic usability method by inspecting hundreds of Web sites to identify specific culture and genre design elements by using 'cultural markers' such as religion, language, customs, colour, metaphors, icons and flags to facilitate user performance [9].

Choong and Salvendy (1998) investigated the effects of cultural differences on computer performance of Chinese and American users and the design of appropriate interfaces for Chinese users. An experiment was conducted with 30 American and 30 Chinese subjects. The subjects performed recognition tasks using different presentation modes. Results indicate that for the American subjects there were advantages to alphanumeric and combined modes, compared to the pictorial mode. in terms of performance time and errors. For

978-1-4244-7974-0/10/$26.00 ©2010 IEEE

Chinese subjects, there were advantages to pictorial and combined modes, compared with alphanumeric mode; their initial error rate also was lower using a combined mode than when using an alphanumeric one [10].

Thus, it is concluded that culturally determined usability problems converge in the understanding of representations the meanings of which are rooted in culturally specific contexts. And culture discrepancies are important factors that designers should take into account while designing the user interfaces for the different backgrounds people.

III. CULTURE-ADAPTED DESIGN METHOD FOR MOBILE PHONE USER INTERFACE

Here, culture-adapted design method for mobile phone user interface is presented. The method is consisted of seven steps, such as understand the design goal, elicit user knowledge in GUI design, evaluation of the user knowledge, design GUI according the knowledge, construct user interface prototypes, conduct interface usability testing and refine. Figure 1 gives an introduction of the method.

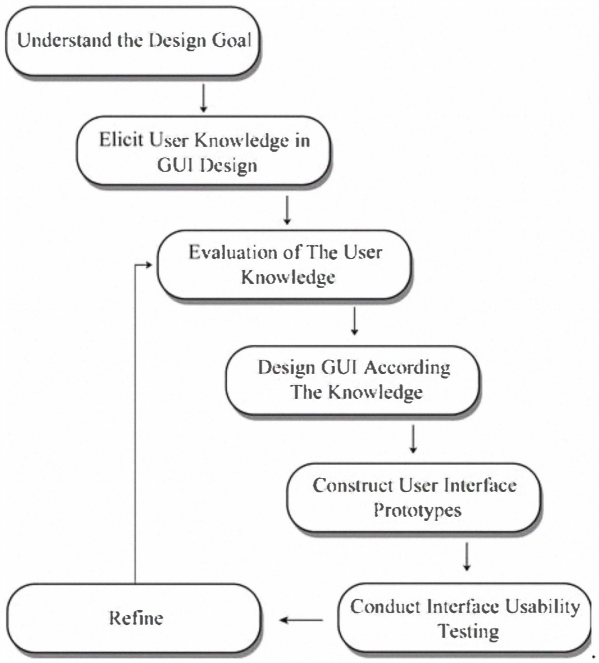

Figure 1. Culture-adapted design method for mobile phone user interface.

IV. THE PILOT STUDY

In this section we will apply the culture-adapted design process for mobile phone UI to design an icon of game. And in the interface usability testing step we will test the result of UI design and the whole design process. This unique design process may include seven stages described as follows:

A. Understand the Design Goal

Interface designers will need to fully understand the goal of the product or the user interface design in order to generate suitable design concepts. To do this, the interface designer needs to understand three design issues, i.e., the user of the GUI, the function of the GUI, and the use environment of the GUI. In this experiment we frame the design goal as "Design an icon of game in mobile phone for Chinese 20-25years old users".

B. Elicit user knowledge in GUI design

The literature and experience on requirements engineering claims that gathering good user data is difficult. And according to Teeravarunyou and Sato (2001) the first problem that we found in the method itself is that user data can lead to misinterpretation of user needs. Many methods focus on one sided interpretations by researchers or users [11].

We developed the user's knowledge via her/his memory and cognition habit of the game. First, ask the user to recall the scene of a game and write down her/his own feeling and memory about the game. Then, express it by words or graphic. Lastly, coordinate the result of user expression on the game. In the pilot study, participations (group A) are asked to recall the scene of a game and draw it on a paper. Five males and five females participations (mean age=22, SD=1.3) were randomly involved in the experiment in a laboratory. The entire experiment took approximately 20 minutes. Table 1 is the result of the user knowledge of a game.

TABLE I. RESULTS OF EXPRESSION OF THE USERS' KNOWLEDGE TO THE GAME

User	Expression of The Game	User	Expression of The Game
1	Fly a kite	6	Poker
2	Crystal ball	7	Magic cube
3	Catch a butterfly	8	Joystick
4	Fishing	9	Billiards
5	Snooker	10	Paper airplanes

C. Evaluation of the user knowledge

In this step we will evaluate the users' knowledge about the game which users generated in their memory that can represent the properties of the game. The test consists of 3 items (1, matching score to memory; 2, degree of cognition coordination; 3, degree of satisfaction) with answers measured along a scale of 1–5 to the user knowledge of the game. The evaluators' satisfaction is presented in Table 2 based on the Likert scale (1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree). Participations are group A.

TABLE II. RESULTS OF EVALUATION OF THE USERS' KNOWLEDGE

Expression of The Game	Mean of Item 1	Mean of Item 2	Mean of Item 3
Fly a kite	3.1	3.3	3.3
Crystal ball	3.4	3.3	3.6
Catch a butterfly	3.0	3.1	3.0

Fishing	3.1	3.2	3.5
Snooker	3.6	3.5	3.7
Poker	3.8	3.5	3.3
Magic cube	3.3	3.1	3.2
Joystick	4.1	3.8	3.5
Billiards	4.2	4.2	3.7
Paper airplanes	3.0	3.1	3.0

On the basis of the result, we can conclude that users have the highest evaluation to "billiards". And we use "billiards" as the property of the icon of game. So that it can best represent the objected user's property.

D. Design GUI according to the knowledge

Once an interface designer understands the client's design specifications and the user's requirements, s/he will start conducting the user interface design. In this step we will design icon via the user's expression of game. In last step, we have taken the conclusion that "billiards" is the best property of the game in users' memory and cognition. According to the character of "billiards", we asked five interface designers to design the game icon of a mobile phone. Figure 2 gives the result of the design.

Figure 2. GUI design according users'knowledge about the game.

E. Construct user Interface Prototypes

We will construct the user interface prototype with the design made in last step for testing purpose. If there is time for constructing user interface prototypes, two types of prototypes can be made during the design process, i.e., low-fidelity prototype and high-fidelity prototype. Fig. 3 shows the low-fidelity prototype to be used for design discussions. Fig. 4 illustrates high-fidelity computer simulation prototype to be used for usability testing to help acquire information regarding user preference and performance.

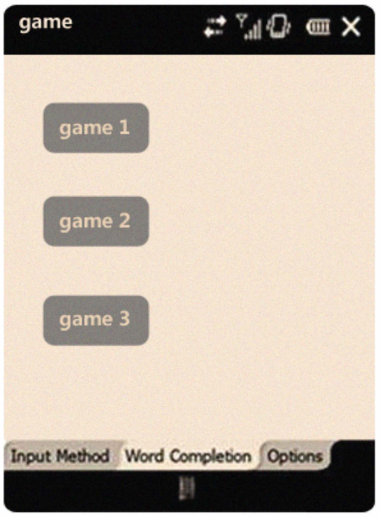

Figure 3. . Low-fidelity prototype of the game.

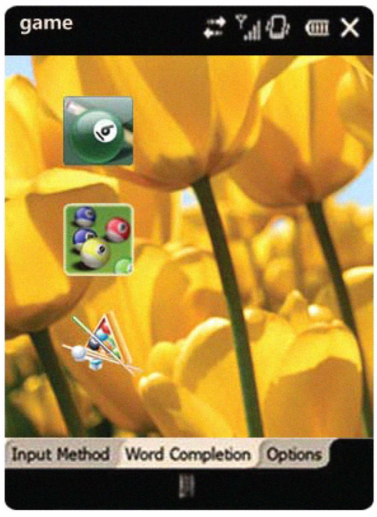

Figure 4. . High-fidelity prototype of the game.

F. Conduct Interface Usability Testing

It is one step of the whole design progress and usability testing to the design method. The International Standards Organization (ISO) defines usability as the effectiveness, efficiency, and satisfaction with which specified users can achieve specified goals in particular environments (ISO DIS 92411-11). Four males and two females participations (group B, every one is different from group A. mean age=22.5, SD=1.2) were asked to use the user interface prototype that was constructed in last step and fulfill the Likert scale (1, strongly dissatisfaction; 2, dissatisfaction; 3, neutral; 4, satisfaction; 5, strongly satisfaction). The test consists of 2 items (1, degree of icon's identification; 2, satisfaction of icon's aesthetics). Two items results of the questionnaires are then analyzed to verify which icon users consider as the best. And users' commentaries and advices to those icons are also

collected to help designers to improve the icons. The result of the testing is given in Table 3.

TABLE III. RESULTS OF EVALUATION OF THE USERS' KNOWLEDGE

Expression of The Game	Mean of Item 1	Mean of Item 2	Mean of 2 Items
Game 1	4.8	4.1	4.45
Game 2	4.1	4.2	4.15
Game 3	3.7	4.1	3.9

According to the testing result (table 3), users can make an easy reorganization and be satisfied with the icon tabbed as game 1. The icon tabbed as game 1 is expressed with a billiard and a pole. Because it represents both object and action of billiard, it is easily identified by the users in the experiment.

G. Refine

The last step of the method is design refine. In this step interface designers modify and consummate the UI design base on the usability testing and users' feedback.

V. CONCLUSION

In this paper we develop a culture-adapted user interface design method for mobile phone. And in the light of the method we make a pilot UI design and usability testing. According to the whole design process it is proved that designers can well do culture-adapted user interface design for Chinese users with the method. The characterization of icon developed from users' memory to the sense of the icon can be in accordance with users' cognition. The icon developed by the method is easily identified and innovational. It can prevent a designer's subjective concept to construct GUI and then the difficulty of user's cognition to the icon.

At present, the method is direct against the GUI design process, and does not involve the part of interaction. And in the pilot design, because of consideration of the simplicity, we did not design the whole UI and UI prototypes for the mobile phone. So we will utilize the method in our design process and consummate it in the future.

ACKNOWLEDGMENT

This research was supported by Guangdong Province Ministry of education university-industry cooperation projects(2009B090300246, 2009B090300041).

REFERENCES

[1] P. P. Raua, Y. Choong, G. Salvendy. A cross cultural study on knowledge representation and structure in human computer interfaces. International Journal of Industrial Ergonomics 34 (2004) 117−129.

[2] P. Bourges-Waldegg, S. A.R. Scrivener. Meaning, the central issue in cross-cultural HCI design. Interacting with Computers 9 (1998) 287-309

[3] S. Wallace, H. Yu. The Effect of Culture on Usability: Comparing the Perceptions and Performance of Taiwanese and North American MP3 Player Users. Journal of usability studies. Vol.4, issue 3, May 2009, pp.136-146

[4] P. Fraternali, M. Tisi, "Identifying Cultural Markers for Web Application Design Targeted to a Multi-Cultural Audience," The Eighth International Conference on Web Engineering (ICWE 08), IEEE Press, Jul. 2008, pp. 231-239.

[5] Ministry of Industry and Information Technology of the People's Republic of China, http://www.miit.gov.cn/n11293472/n11293832/n11293907/n11368277/13258331.html

[6] M. Mead, Coming of Age in Samoa. Modern Library, New York (1953)

[7] C. Chen, C. Tsai, Designing User Interfaces for Mobile Entertaining Devices with Cross-Cultural Considerations, Usability and Internationalization, Part I, HCII 2007, LNCS 4559, pp. 37–46, 2007.

[8] R. E. Nisbett, The Geography of Thought: How Asians and Westerners Think Differently...and Why, New York: Free Press, 2004.

[9] W. Barber, A. Badre. Culturability: The merging of culture and usability. Human Factors and the Web, 1998.

[10] Y. Choong, G. Salvendy, Design of icons for use by Chinese in mainland China, Interacting with Computers 9 (1998) 417-430

[11] S. Teeravarunyou, K. Sato, Object-Mediated user knowledge elicitation method, The proceeding of the 5th Asian International Design Research Conference, Seoul, Korea, October 2001.