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The Impact of Culture in Designing Web-Based Systems

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Abstract: The success of e-commerce could depend on the effectiveness of managing cultural differences of users from different parts of the world. Several HCI researchers are currently exploring many aspects of culture that can influence interface design. However, cultural studies in HCI are still very limited. To localize an interface by taking cultural factors into account must be considered with care. The paper critically reviews a large number of studies that explored the impacts of cultural elements in human information processing. The paper categorizes such studies into three major aspects: representational, cognitive, and attitudinal aspects.

Introduction

International Data Corporation (IDC), estimates that the number of Internet users in the world will be about 500 million by 2003; and 62 percent of the US population will be online by 2003 (IDC, 1999). Computer Economics Inc. reports that by 2002, non-English-speaking Internet users will be the majority (Bodeux, 2000). Currently, many HCI researchers are focusing attention on culture as a potentially influencing factor that can affect user performance and satisfaction toward an interface. The internationalization and localization concepts are frequently employed in developing cultural-based interfaces. Internationalization, commonly known as "I18N", refers to the process to eliminate the culturally specific elements such as color, text, image, and icon from an interface as much as possible. As a result, the interface can be easily adapted to use in various countries, cultures, and languages. In contrast to internationalization, localization, commonly known as "L10N", refers to the process taking culturally sensitive elements into account in software development.

Concepts of Culture

Culture is an abstract, complex and problematic term (Barber & Badre, 1998). It has been defined in various aspects. Hofstede (1991), for instance, defines culture as "software of the mind," that is, "the collective

programming of the mind which distinguishes the members of one group or category of people from another". Culture might include behavioral products, values, languages, ways of life of ancestors, art, music, shared preferences, rules, norms, attitudes, and beliefs (Segall et al., 1999). Cultural elements are transmitted, shaped, shared, and taught among people in each particular culture, thereby differentiating a culture from one another (Segall et al., 1999). Hofstede (1996) presents two layers of culture, namely, the objective layer of culture and the subjective layer of culture. The objective culture contains cultural elements, which are visible, tangible, and easy to examine and understand, such as, colors, graphics, sounds, arts, symbols, heroes, pictures, and literatures. This layer can be changed from time to time. In contrast, the subjective culture is invisible and substantially difficult to examine and understand since this cultural layer deals with beliefs, values, and behaviors such as a sense of time, personal space, a sense of group belonging, and seniority.

Impacts of Culture in Human Information Processing

The purpose of cross-cultural cognitive psychology is to understand human information processes which are influenced by cultural factors (Segall et al., 1999). These processes include perception, memorization, attention, reasoning, learning, categorization, and problem solving. Followings are discussions on a large number of existing surveys and empirical studies on cultural interface designs aiming to facilitate human information processing. Such studies are categorized into three major aspects: representational, cognitive, and attitudinal aspects.

Representational Aspects

Most of cultural issues in HCI are related to representations of interface elements such as colors, languages, icons, symbols and images. Differences in visual perception of interface representations among people from different cultures exist because they perceive things in a way that they have experienced and learned (Segall, et al., 1999). In other words, environment and culture shape humans' perceptual practices. In recent years, most of the empirical studies with regard to the design of cross-cultural interface attempt to examine the question of whether cultural diversity affects visual perceptions. Language is a major concern in representational aspects. Unquestionably, language translation seems to be difficult since languages which are the products of cultures are extremely complex. Nevertheless, it is necessary to translate software and Web sites into users' native languages since users more easily and effectively process information in their own languages than in foreign languages. Users tend to prefer to process information in their native languages rather than second languages (Nielsen & Mack, 1994; Tractinsky, 2000). To process information presented in second languages can cause users more stressful. Accuracy in meaning is the main concept of language translation. Shades of meaning in languages are different across cultures. Moreover, in some cultures such as Thailand, languages also show social status, and therefore, appropriate vocabularies must be carefully selected to use with people who have different societal status. Results from empirical studies on language translation for computer applications vary. Very recently, Tractinsky (2000) proposes a theoretical framework for the study of user interface translation. Factors in this framework include costs and benefits of vendors and users in software translation. The study categorizes components in software language translation into manipulation language, system messages, and system documentation. The major findings indicate that a fully translated interface, which contains the three components above, is the most effective approach, whereas only the manipulation language translation is the worst. However, Constantine and Lockwood (1999) state that users' expertise levels on computer systems can affect users' performance and preferences. Expert users might prefer to use English language interfaces rather than their own native language interfaces. Al-Hanaiyyan et al. (1999) investigate Kuwaiti and British students and experts evaluating translated and English interfaces. They found that student subjects preferred to use interfaces in their native languages, while expert subjects from both cultures preferred English interfaces. Barber and Badre (1998) have conducted a usability inspection on 168 Web sites originating in different countries and languages aiming at analyzing cultural elements used in Web design (e.g., colors and icons). The results indicate that there are differences in cultural element usage across cultures and genres of Web sites within each culture. Studies on cultural impacts in icon design also exist (e.g., Evers, et al. 1999; Piamonte, et al. 1999). For instance, a series of studies aiming at evaluating three sets of videophone icons and pictograms developed in Japan, the US, and England by Piamonte et al. (1999) show the effects of cultural differences in memory testing toward icon design. The studies indicate that symbols could be easily recognized and confused. In terms of metaphor design, Evers et al. (1999) attempt to explore cultural differences in perception toward metaphor design of virtual campuses. The studies conclude that users from different cultures perceive the meanings of metaphoric graphics differently. Another study, which is conducted with 111 Korean, 16 Japanese, and

22 American subjects, explores the relationship of user preferences on the simulated microwave oven interface (e.g., interface hierarchy, label, and layout) and a set of cultural characteristics (e.g., nature of human relationship, sense of space, perception, language, and sense of time) (Lee & Harada, 2000). In terms of the depth of hierarchical interface (deep/shallow) and the label of elements of the interface (verbal/graphic), the study shows that Japanese tend to prefer a deep interface structure and a verbal label, whereas Korean and American prefer shallow structure and a graphic label. However, user performance tends to have a negative relationship with user preference toward an interface.

Cognitive Aspects

Other than studies of culturally representational aspects in interface design, some culturally cognitive studies have been investigated. One study points out that relationships among cultural factors and cognitive functions are often recognized (Poortinga & Vijver, 1988). Apparently, researchers and practitioners cannot deny that human cognitive processes vary across cultures. Segall et al. (1999) also mention that basic cognitive functions of human are similar, however, by shaping with cultural experiences, human applied their preferred skills and strategies to their cognitive processes in each particular situation differently. Most of studies in culturally cognitive aspects are comparatively conducted between Chinese and American subjects. Choong and Salvendy (1998), for example, report cultural differences in visual perception perspectives on user performance between American and Chinese users in two studies. First, they explore the impacts of cultural differences with icon displays: icons with alphanumeric elements only, icons with pictorial elements only, and icons with alphanumeric and pictorial elements. The results show that Chinese users have better performance and fewer errors in using icons with pictorial elements and icons with alphanumeric and pictorial elements because Chinese language learning is related to visual processing. In contrast, American users have better performance and fewer errors in using icons with alphanumeric elements and icons with alphanumeric and pictorial elements. In another study, Choong and Salvendy (1999) explore menu interface design in relationship to differences in thinking styles between Chinese and American subjects. In the study, menu interfaces represent the concepts of knowledge representation and interface structure. Two types of knowledge representation include concrete representation and abstract representation. Two levels of interface structure include functional structure and thematic structure. The study indicates the differences in performance between Chinese and American subjects. For the Chinese users, performance increases in an interface with concrete representation and in thematic interface structure. In contrast, American subjects perform well on functional interface layout with abstract representation. The rationale behind this finding is that cognitive styles between Chinese and American are different. The study cites a study by Chiu (1972) that shows that Chinese prefer to categorize stimuli on the basis of interdependence and relationship, while American prefer to analyze stimuli based on the stimuli's functions. Nevertheless, little reliable research exists to confirm the cultural effects in menu design. A study by Shih and Goonetilleke (1997) investigating computer menu design with Chinese subjects in Hong Kong reports that user searching speed is faster in the Chinese version menu than in the English version menu. They conclude that in both Chinese version and English version menu designs horizontal oriented menus are more effective than vertical oriented menus. However, in a comparative study between Chinese and American subjects, Dong and Salvendy (1999) report that in vertical-oriented Chinese menus are more effective than horizontal ones.

Attitudinal Aspects

To measure how users perform and how they think about the system are equally important. Similar to user performance, user attitudes or judgments in experiencing the system are different across individuals, which affect how users use the system in the later time. Culture plays an important role in shaping and influencing how users think and feel toward a stimulus. People use their attitudinal framework thought by cultural groups that they belong to evaluate new stimuli (Segall et al., 1999). Researchers points out that studies on the subjective layer of culture are also necessary since feelings, values, tastes and beliefs can influence human interaction with computer technologies (Fernandes, 1995; Hoft, 1996). In cultural interface design, very few empirical studies have been explored subjective usability evaluation. Most of such studies are related to interface aesthetics. A study in attitudinal aspects by Evers and Day (1997) examine roles of cultural factors in interface acceptance among Chinese, Indonesian, and Australian. The findings confirm the differences in interface acceptance from people who have different cultural backgrounds. Chinese tend to value in the usefulness of the system rather than ease of use, while Indonesians tend to value in ease of use rather than usefulness of the system. Australians' preferences are based on their satisfactions on interface regardless of ease of use and usefulness of the system. Ever and Day suggest that Chinese tend to user a system that has useful interface, even though that interface is difficult to use. In contrast, Indonesians will not be

likely to use a system that its interface is difficult to use. Relevant to Ever and Day's study on interface acceptance across cultures, Day and Ever (1999) develop a questionnaire to assess cultural factors in computer interface acceptances. In evaluating interface design, usability and aesthetics are often debated whether which one is more important. Users attitudes and preferences toward usability and aesthetics of the system are important to interface acceptance. Both of these concepts could be influenced by cultural backgrounds of users. Usability, a core concept of HCI, refers to the characteristics of user interface that is easy to use, learn, and remember, pleasant to use and has least errors (Nielsen, 1993). Interface can be designed to reach usability concepts by understanding these factors (e.g. cultural backgrounds, ages, and computer experiences) that determine how people think and perform the system. Cultural backgrounds could also affect designers' ideas in designing interfaces. Designers develop their systems based on their assumptions, while their users perceive those systems with their own assumptions (Kaplan, 2000). Due to different thinking styles, attitudes, feelings and behaviors of users influenced by their cultures, users from different cultures might perceive usable elements or concepts differently. In Web design, for instance, most Web usability guidelines are developed with an American perspective. What Americans perceive as usable, might be not usable in other countries or cultures, and vice versa. Differences between Thai and American cultures clearly affect Web design (Noiwan & Norcio, 2000). The major differences between Thai and American Web sites are visual designs and designs of structure of information. However, no evidence that these so-called undesirable interface elements as mentioned above are also unusable among Thai users has been reported. The Thai web designers' design styles might be influenced by some certain levels of their patterns of thinking, values, and beliefs. In another study that also attempts to analyze cultural issues in Web design, Stanley and Speights (1999) report the differences in Web design found between Mexican and American radio Web sites. Mexican Web sites are considerably designed by using a lot of graphics, which are more colorful and larger in size than American Web sites. Animated graphics and splash Web pages are usually found. Information presentation is also different; for example, many topics are presented in a single page. The study also reports that Mexican Internet users tend to prefer a non-hierarchical organization of information.

Some empirical studies have been conducted to explore the importance of aesthetics in interface design. Tractinsky (1997), for example, replicates the study of Kurosu and Kashimura (1995) which conducted with Japanese subjects. The study aims at investigating the relationships among aesthetics, apparent usability (a priori perceptions of the ease of use) and a set of inherent usability factors (e.g., location of the display, type of keypad, and grouping of keys) of 26 ATM interface design layouts with Israel subjects (Tractinsky, 1997). The results from both studies show that apparent usability significantly correlates to aesthetic in a positive direction, whereas inherent usability is not effective in explaining apparent usability (Kurosu & Kashimura, 1995; Tractinsky, 1997). Tractinsky (1997) also suggests that the degree to which aesthetics relate to usability is culturally dependent. The senses of aesthetics are markedly different from culture to culture. For instance, Japanese clipart looks lovely and "cute" whereas American clipart looks formal. It is suggested that the degree to which aesthetics relate to usability is culturally dependent (Tractinsky, 1997). Noiwan and Norcio (2000) express that it might be reasonable to assume that Thai aestheticism influence the designers' considerations in using graphical elements in Web design due to differences found in visual designs and information structure comparing with American Web. In color studies which related to cultural aspects, as cultural backgrounds could influence learned responses and reactions to color (Eiseman, 2000), color preferences might be considered culturally dependent. A challenging question, "are there universal color preferences that humans like or dislike?," has been asked on a cross-cultural basis for many years. Research on color preferences markedly varies. However, a trend in studying color in interface design across cultures is crucial. Hall (2000), for instance, ensures his belief of differences in color preferences across cultures by showing the recent study by Musashino University of Fine Arts in Tokyo that uses more than 5,000 subjects across 20 nations. Based on the study, the differences on color preferences are categorized into three major groups of nations and the differences on color associations are categorized into five major groups. Hall (2000) also cites another evidence that shows that photo businesses in Japan are concerned about color differences among regions. People in Tokyo, Osaka, and Fukuoka, for example, have slightly different preferences; therefore, the shades of color in the developed prints in each market are slightly different. Barber and Badre (1998) report preliminary differences in Web color design. For instance, based on that study, government Web sites in Brazil are designed by using a variety of colors, whereas the majority government Web sites investigated in that study are designed by using national colors throughout the sites. The study suggests that the preference for many colors in designing Brazil's Web sites is culturally dependent. Furthermore, a study by Duncker, et.al. (2000) also shows the preliminary results in usability testing on cultural interface design of digital libraries that subjects with different cultural backgrounds have different color preferences. English participants tend to use pastel color schemes with gray and low contrast. In contrast, Scandinavian participants tend to use dark colors also with low contrast. Jamaican participants tend to use bright colors with high contrasts and colorful schemes. African participants tend to use black

as background. European and American participants tend to use bright background with black text and few moderately colorful objects. However, no pattern is found in color use by Asian participants. Several efforts in determining cultural factors in color preferences still continue.

Conclusion

The paper attempts to discuss the efforts of HCI researchers in understanding cultural impacts in human information system. Developing successful computer interfaces, either for software or Web sites, require careful considerations on language translation and implications of culturally sensitive elements. Ignoring cultural issues, to make interfaces standard for all users around the world might not be a right solution. Rather, such interfaces should be designed to fit with intuitive usability in representational, cognitive, and attitudinal aspects of users in each particular culture, since users from different countries not only speak different languages, but also have different cultures that make them process information, think, feel and act differently.

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