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Building a culturally-competent web site: a cross-cultural analysis of web site structure

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Abstract

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Building a Culturally-Competent Web Site:
A Cross-Cultural Analysis of Web Site Structure

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ABSTRACT

The internationalization of Web sites requires Web designers to provide effective navigation experience for users from diverse cultural backgrounds. This research investigates the effect of cultural cognitive style on user perception of Web site structure characteristics and performance on the Web site, and the subsequent user satisfaction towards the Web site. More specifically, the authors focus on the breadth versus depth of a Web site's structure. A laboratory experiment involving participants from China and the United States was conducted to test the hypotheses. The results showed that cultural cognitive style and Web site structure indeed interact to affect user perception and performance. People with holistic and analytic cultural cognitive styles displayed different perceived navigability and user performance on "broad" and "deep" Web sites. This study adds a cultural dimension to our knowledge on how Web site structure can affect users' experience. It also suggests pragmatic strategies for Web site design practitioners to improve website design in order to produce compelling navigation experience for users from diverse cultures.

Keywords: *Cross-Cultural Web Site Usability, Cultural Cognitive Perspective, Web Site Breadth, Web Site Depth, Web Site Structure*

INTRODUCTION

In the context of globalization, the Internet has evolved into a platform for international communications and transactions. Statistics indicate that around 89 percent of Internet users live outside the United States by 2012 and more than 70 percent of Internet users are non-English speakers (Internet World Statistics, 2012). According to a Web site Globalization Report by International Data Corporation, more than 60 percent of all online spending is generated outside the United States (Bin, Chen, & Sun, 2003). In order to gain a competitive advantage by

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reaching global markets, companies set up Web site for each country in which they have a local presence. These Web sites are built with local language and content, but typically with uniform designs across different national cultures. However, Web site localization requires more than simple translation (Cyr, 2008).

Web site localization on the cultural level (i.e., adjusting cultural markers, such as aesthetic appeal, colors, logic, and communication patterns, etc.) is critical for user acceptance and satisfaction of Web site. It is shown that a culturally-competent Web site can facilitate companies to lower the cost of entry to an international market, increase sales, meet global demands, and establish a trustworthy and professional image online (Lohse & Spiller, 1998; Szymanski & Hise, 2000). Prior cross-cultural psychology literature has discovered a large number of cultural differences. These cultural factors are major variables in determining the acceptability and usability of an information system such as Web sites. Thus, to launch a localized Web site successfully, these subtle cultural nuances must be attended to.

Among various Web site design characteristics, this study will focus on the Web site's structure. Prior Web site structure literature has focused on the tradeoff between breadth and depth in relation to navigation (Galletta, Henry, McCoy, & Polak, 2006; Larson & Czerwinski, 1998; Parush & Yuviler-Gavish, 2004). However, both depth and breadth have pros and cons, leading to the difficulty in determining an optimal level of depth or breadth of a Web site. Much of the extant literature on Web site structure has adopted a universalist approach by assuming that a Web site's structure will uniformly produce similar user perception and performance across cultures. However, in practice, Web site structure is designed differently in North America and East Asia. For example, as one of the most popular electronic commerce Web sites in China, Taobao adopts a "broad" strategy by increasing the number of hyperlinks on its homepage. Users may only need to click once or twice to reach the end note. In contrast, a "deep" strategy is usually adopted by North American Web sites, such as, eBay and Amazon. On these sites, products are highly categorized and hierarchically displayed across various Web pages. Despite the phenomenon of different Web site structures between the West and the East, there has been no theoretical explanation for it. To fill this knowledge gap, our study employs a cultural cognitive perspective to theorize and validate Westerners' and Easterners' differential perception of Web site structure and performance on it.

Cultural cognitive perspective suggests that an individual's particular way of processing information can be significantly shaped by the culture he/she lives in (Nisbett, Peng, Choi, & Norenzayan, 2001). This culturally marked information processing strategy is referred as cultural cognitive style (Goldstein & Blackman, 1978; Markus & Kitayama, 1991; Miyamoto, et al., 2005; Nisbett, 2003; Nisbett, et al., 2001). It is argued that East Asians reason in a holistic and relational way. On the contrary, analytic cognitive style is generally observed in Westerners (Chau, Boland, & Nisbett, 2005; Nisbett & Miyamoto, 2005; Nisbett, et al., 2001). This perspective has been employed extensively in the psychological literature to explain cross-cultural differences in information processing (Boduroglu, et al., 2009; Choi & Nisbett, 2000; Ford, Wilson, Foster, Ellis, & Spink, 2002; Ji, Peng, & Nisbett, 2000; Kitayama, Duffy, Kawamura, & Larsen, 2003; Nisbett, et al., 2001). Viewing a Web site as an environment consisting of various information stimuli, we posit that cultural cognitive style will affect an individual's experience on the Web site.

Specifically, our research questions are:

1. How does a user's cultural cognitive style affect his/her perception of Web site structure characteristics, and performance when searching for information on the Web site?
2. Will better user perception of navigability and performance result in higher user satisfaction?

Our study has important theoretical and practical implications. Despite the effort on examining factors influencing Web site system quality, work that systematically investigates Web site structure characteristics across cultures is sparse. Therefore, we seek to fill this gap by exploring the influential role of cultural cognitive style on user navigation experience. This study contributes to the literature by adding a cultural dimension to our knowledge on Web site structure issues. First, it enhances our understanding of the possible user responses to different Web site structures in different cultural systems. Second, it provides an explanation regarding why the design feature of a Web site structure is popular in one country but is not as popular in another one. For practitioners, our findings are expected to provide Web site design strategies for companies who want to attract international audiences. By tailoring Web site structure to target users' distinct cultural cognitive styles, companies can produce compelling navigation experience for users from diverse cultures and make their online presence more effective.

LITERATURE REVIEW

Web Site Navigation, Perceived Navigability, Performance, and Satisfaction

Users are often goal-oriented when performing various activities on the Web (Eighmey 1997). They may search for a piece of information, locate a product, or complete a transaction. Navigation is a fundamental activity one engages in to achieve their various goals on the Web (Palmer, 2002; Wang & Yen, 2007). Web site usability and design researchers posit that users' navigation experience will affect their subjective evaluation and attitude to the Web site (Nielsen, 2000; Shneiderman & Plaisant, 2005). As an easy navigation experience that allows users to complete their tasks pleasantly and efficiently can heighten users' satisfaction with the Web site (Fang & Holsapple 2007; Wang & Yen, 2007), which is a key objective practitioners strive for, a deeper understanding of what Web site design features can increase users' satisfaction through facilitating their navigation is much needed.

Navigation involves one's browsing of Web pages that are interconnected through hyperlinks based on certain information organization and categorization principles used by a Web site (Fang & Holsapple 2007; Olston & Chi, 2003). A well designed Web site can facilitate users to arrive at the target page or locate the needed information with ease and efficiency and engender a feeling of success and satisfaction, whereas a disoriented and lost traversal will produce negative evaluations such as frustration and dissatisfaction as well as performance degradation (Palmer, 2002; Wolfinbarger & Gilly, 2003).

Users' web navigation experiences are often studied with their objective performance and subjective perception (Chou & Lin 1997; Fang & Holsapple 2007; McDonald & Stevenson 1998). Objective performance measures the time one needs to locate the target information and/or task correctness. Subjective perception, referred to as *perceived navigability,* describes the extent to which a user can follow a Web site's hyperlink structure to successfully find needed information with efficiency (Fang & Rau, 2003; McKinney, Yoon, & Zahedi, 2002; Palmer, 2002). A heightened perceived navigability suggests a pleasant and satisfactory web navigation experience, which is correlated with the satisfaction with the Web site (Fang & Holsapple 2007).

Web Site Structure – Breadth versus Depth

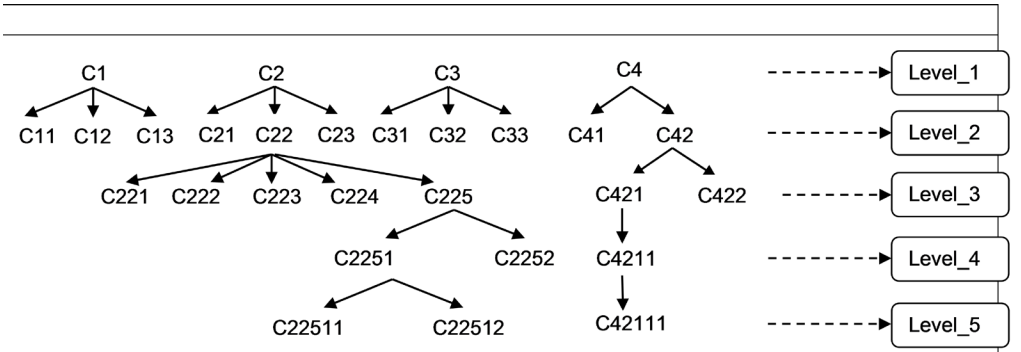
Users rely on a Web site's navigation structure to make their way through the Web site. A Web site's structure is like a road map to all the different pages and information contained within the

Web site. Studies have indicated that Web site structure is an important design element influencing users' navigation experiences and attributed the difficulty in traversing a Web site to its inappropriate structure (Fang & Holsapple 2007; Wang & Yen, 2007).

A key consideration in designing a Web site's structure is related to its breadth and depth in presenting the interrelated contents contained on the site (Galletta, et al., 2006; Larson & Czerwinski, 1998; Parush & Yuviler-Gavish, 2004). *Breadth* is defined as the number of options (e.g., hyperlinks or choices) per level, and *depth* refers to the number of levels in a hierarchy (Galletta, et al., 2006). Web site structure can vary in the number of hierarchical levels or clicks that must be made on one's way to a target page. Given a fixed number of end nodes within a Web site, a Web site designer may choose to use a "broad" strategy by decreasing the number of clicks while increasing the number of hyperlinks on each page, or a "deep" strategy with fewer hyperlinks on each Web page but more hierarchical levels. Figure 1 compares the broad and deep structures.

"Broad" and "deep" Web structures require users' distinct abilities to achieve an easy and efficient navigation due to their different reliance on the hierarchical relationships among the contents at the Web sites. A "deep" structure presents contents in a hierarchy and users can only access the contents at a particular hierarchical level by following the hierarchy level by level. The navigation on a deep Web site necessitates users' familiarity with hierarchical and categorical classification of the contents so that they can move around with clear directions. It also increases users' cognitive efforts to evaluate and choose their navigation paths. For users who are not skillful at categorizing concepts and unwilling to make decisions in face of a number of options, a "deep" Web structure may cause them to be lost or disorientated. On the other hand, a "broad" Web site attempts to flatten its hierarchy, resulting in more contents and hyperlinks to be displayed at each level. Though reducing users' efforts in evaluating concept categorization and making decisions about their paths, the "broad" structure calls for uses' proficiency in processing a Web page with extensive relational information. It may overwhelm or frustrate the user who lacks the ability to process stimuli based on their complex relationships.

Figure 1. Comparison between Broad and Deep Structure



The example is a five-level concept structure for the contents contained on a Web site. As a general practice, level_1 concepts are often displayed on the home page.

When the user clicks an item at level_1, the website with a broad structure will display all sub-levels of the item and all items under the sub-levels, whereas the website with a deep structure will only display level_2.

If a user is interested in an item at level 5, in the broad structure, he needs to click only once to get the link, whereas in the deep structure, he needs to click four times to expand the structure and get the link.

The tradeoff between breadth and depth has been extensively examined in the menu design literature (e.g., Jacko & Salendy, 1996; Norman & Chin, 1988). There has been a large number of studies exploring the ideal number of items in a menu design (Jacko & Salvendy, 1996; Miller, 1981). Primarily, the findings summarized that breadth is better than depth, although the breadth of the menus examined has varied from study to study. As for the studies in the Web design context, the goal is to discover principles for the design of various hyperlinks on a Web page for information retrieval tasks. In particular, researchers were interested in the structure of hyperlinks on the depth versus breadth distribution across expertly categorized Web pages. To summarize, an optimal depth and breadth of a Web site cannot be determined and prior studies concluded that optimizing the design becomes a difficult topic due to tradeoffs of multiple constraints.

Cognitive Mapping of Web Site Structure

While technical design characteristics reflect a universal level of Web site design, research indicates users' personal interpretations of the Web site often vary (Agarwal & Venkatesh 2002; McKinney et al. 2002; Te'eni 1989). As navigating requires users to process the displayed information to locate needed information, an important factor affecting users' navigation on a Web site is their mental representations of the information they intend to search on the Web site and the information contained and presented by the Web site. Both wayfinding and sensemaking literature in the human-computer interaction (HCI) field has suggested that users' cognitive structure or mental representations play an critical role during their navigation on a Web site.

Wayfinding is a term that has emerged from the research on how individuals traverse a hypertext environment. As the term implies, wayfinding means the ability to move through a physical or (in terms of hypertext) information environment without becoming lost (Jones, 1989). Wayfinding theory postulates that in order to accomplish a wayfinding task (i.e. "to reach a final destination"), a user would perform cognitive mapping (Passini, 1984). Cognitive mapping is the processing and organizing of information based on a user's past experience as well as from the current Web site environment to produce a cognitive map (Passini, 1984). Similarly, sensemaking literature has also focused on how users understand information in an environment (Dervin, 1992). When interacting with a large amount of information, people create mental representations to organize information in order to make sense of it. Sensemaking is portrayed as comprising human interactive actions or a "process" that includes the use of the existing cognitive system to process new information (Russell et al., 1993; Siau & Tan, 2005).

Given that individuals rely on their cognitive systems to process various information and stimuli in an information environment, a user's distinct cognitive orientation may endorse him/her certain advantages in dealing with a particular Web site structure. Therefore, one's cognitive characteristics may influence the preference of Web site breadth and depth. One of the most important cognitive characteristics is the cognitive style (Riding & Rayner, 1998). Further, one's cognitive style is often culturally marked. A recent study documenting American and Chinese users' distinct responses to Web sites designed by designers with the same or opposite cultural cognitive styles offers the evidence that Web users' culturally bound cognitive styles can affect their Web experiences (Faiola & Matei 2005). Extending the cultural cognitive perspective, this study attempts to investigate the role of users' cultural cognitive styles on their perception and performance on Web sites with different structures.

Cultural Cognitive Perspective

Cognitive style is referred as "stable individual preferences in mode of perceptual organization and conceptual categorization of the external environment" (Kagan, Moss, & Sigel, 1963, p. 74). When processing information, individuals consistently adopt a particular cognitive style. Cross-

cultural researchers also suggest that cognitive style is closely related to cultural conventions (Nisbett & Norenzayan, 2002). Living in a particular culture over time, individual can establish a particular cultural cognitive style.

More specifically, cultural cognitive perspective posits there are two cognitive styles, namely, holistic and analytic cognitive styles. East Asians reason in a holistic way, whereas Westerners tend to be analytic (Nisbett, 2003; Nisbett & Miyamoto, 2005; Nisbett, et al., 2001). The essential tenet of the cultural cognitive perspective is that East Asians' attention is oriented toward the field and to relationships between objects. In contrast, Westerners perceive the field as being composed of unconnected objects and pay attention mainly to the focal objects (Kitayama, et al., 2003; Masuda, Gonzalez, Kwan, & Nisbett, 2008).

Cognitive styles of holistic Easterners and analytic Westerners are reflected in many behaviors. For instance, Easterners and Westerners adopt different ways to categorize objects. Easterners organize objects in a more relational and less categorical way than Westerner (Ji, Z., & Nisbett, 2004). Furthermore, analytic Westerners tend to be more control-oriented compared to holistic Easterners when interacting with their environments (Nisbett, 2003). Ji, Peng, & Nisbett (2000) used the rod-and-frame test (Witkin et al., 1954) on East Asians' and European Americans' judgments about the verticality of the rod with the influence from the position of the surrounding frame. They found that European Americans desired to have more control in their interactions with environmental stimuli. When given manual control of the test, Americans' performance and confidence increased, but not that of Asians.

Cultural cognitive perspective has been employed in psychological literature (Boduroglu, et al., 2009; Choi & Nisbett, 2000; Kitayama, et al., 2003). However, it has been rarely applied in the information systems literature and in the online context. Considering cultural cognitive perspective provides explanations for information processing differences across cultures, we extend it to the domain of Web structure design to investigate cross-cultural Web navigation experience differences.

RESEARCH MODEL AND HYPOTHESES

By integrating the cultural cognitive perspective with Web site structure literature, our research model examines how cultural cognitive style interacts with Web site structure to produce systematically different navigation perception and performance, and subsequent satisfaction with the entire Web site between holistic Easterners and analytic Westerners (see Figure 2).

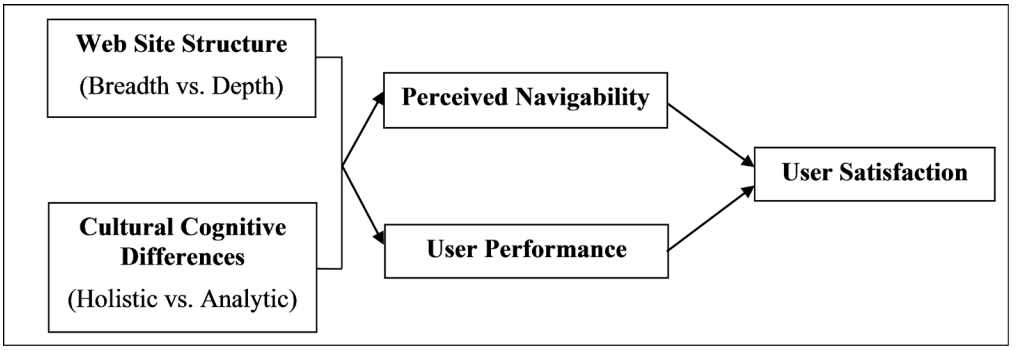
Cultural Differences and User Perception of Web Site Structures

We posit that users' particular cultural cognitive style may affect their navigation perception when using different Web site structures.

Keeping the information contents constant, a Web site can be developed with either a "deep" strategy or a "broad" strategy. A "deep" Web site is configured based on content categorization. Users need to traverse the "deep" Web site from top categorical levels down to the lower levels that contain the target information by making a number of decisions based on the hyperlinks on their traversal route (Galletta, et al., 2006; Nadkarni & Gupta, 2007). On the other hand, a Web site with a "broad" strategy allows users to have more direct access to the target information without clicking through many intermediate Web pages (Galletta, et al., 2006). The Web page on a "broad" Web site often displays more contents and their relationships.

Westerners may experience an easy navigation process within a "deep" Web structure due to their tendency to mentally represent objects in a categorical way and preference of exerting

Figure 2. Research model



personal control. First, Westerners make more use of rule-based categorization and taxonomy to mentally process and represent information and objects than East Asians. Empirical studies have documented that Westerners are more likely to group objects on the basis of category membership and shared features (Nisbett et al. 2001). For instance, when asked to choose two words more closely related among the set of "Teacher, Postman, and Homework", Westerners are more likely to choose "Teacher" and "Postman" as "Teacher and Postman are both occupations" than East Asians (Ji, et al., 2004). When searching for the target information, Westerners' categorization-oriented cognitive style may drive them to have a categorical mental representation of the target information. This mental representation fits the categorical information presentation on the "deep" Web site. The resultant cognitive fit (Vessey, 1994) may lead Westerners to perceive an ease of information processing on the "deep" Web site. Second, with a focus on the central object and the separation of it from its context, analytic Westerners tend to have a stronger belief in the controllability of external events than holistic Asians (Nisbett & Miyamoto, 2005; Simon, 2000). Such a belief drives Westerners to pursue personal goals and control in their interactions with environmental stimuli. Thus, they can obtain a greater sense of success if they are given more control over the environment (Ji, et al., 2000). To Westerners, the decision-making process associated the navigation on a "deep" Web site may produce a feeling of applying control over their actions. They will be comfortable with, or even enjoy, the process because it satisfies their pursuit of personal control. As exercising personal control can enhance the perceived ease of use (Venkatesh, 2000), Westerners may perceive the navigation on the "deep" Web site to be effortless. On the other hand, as Westerners are less competent in processing inter-object relationships, they may be overwhelmed by the relatively complex contents and their relationships displayed on the "broad" Web site.

In contrast, East Asians may have an easy time navigating on a "broad" Web site due to their reliance on contextual and functional relationships to represent objects. Compared to Westerners, East Asians often process and represent objects by paying attention to the relationships among the objects and the relationships between objects and their context. For example, when also asked to choose two closely related words among "Teacher, Postman, and Homework", Easterners would be more likely to group "Teacher" and "Homework" together as "Teacher" has a functional relationship with "Homework" ("Teacher assigns Homework"). Such an orientation toward the relationships among objects may drive East Asians to prefer seeing a bigger picture instead of isolated objects. They may therefore prefer a "broad" Web site, which contains more complicated content relationships at each structural level within its flat hierarchy and provides users a complete picture of the entire site in a glance. However, navigating on a "deep" Web

site could be a difficult undertaking for East Asians. First, organizing information categorically is not the dominant mental operation style for East Asians (Choi, Nisbett, & Smith 1997). To fit the categorical information presentation format on the "deep" Web site, they need to engage in additional cognitive operations to adjust their mental representation of the target information. The mismatch between East Asians' mental representations of objects and the "deep" Web site's information presentation may lead them to feel navigation difficulty on a "deep" Web site. Second, keeping a harmonious relationship with external environments is an important aspect of Eastern culture (Nisbett 2003). This culture encourages individuals to adjust themselves to fit environments or accommodate to existing reality rather than proactively control the environment (Ji et al. 2000). Thus, the need to exert control and make decisions when navigating a "deep" Web site can increase the cognitive load for holistic Asians, leading to a low navigability perception of the Web site.

Since perceived navigability evaluates users' perception of the ease of clicking through the Web site links to locate the needed information, holistic Easterners and analytic Westerners may report different levels of perceived navigability on "broad" and "deep" Web sites. Therefore, our hypothesis is as follows:

H1: *Cultural cognitive style and Web site structure interact to affect perceived navigability.*
H1a: *Users with holistic cultural cognitive style would have a higher perceived navigability on "broad" structure as opposed to "deep" one.*
H1b: *Users with analytic cultural cognitive style would have a higher perceived navigability on "deep" structure as opposed to "broad" one.*

Cultural Differences and User Performance of Web Site Structures

We also posit that users' performance in searching the target information on different Web sites would be influenced by their particular cultural cognitive style. Cognitive fit theory (Vessey & Galletta 1991) suggests that the correspondence between a problem solver's characteristics (i.e., cognitive style (Riding & Rayner, 1998)) and information presentation format results in superior task performance. Based on the information presented to him, a problem solver creates a mental representation of the problem in his limited working memory (Gentner & Stevens, 1983). If a mismatch between problem solver's cognitive style and information presentation exists, the problem solver must make extra cognitive effort to transform information into a format that is suitable for accomplishing the task. This extra effort may delay task completion, leading to inferior task performance (Vessey, 1994).

As discussed above, "broad" Web site structure in which information is presented within their complex conceptual and contextual relationships matches Easterners' cognitive advantage in processing detailed functional or contextual relationships. In contrast, a "deep" Web site that requires a user's evaluation of and decision making between possible navigation paths within the categorical hierarchy fits better with Westerners' cognitive orientation to organize objects categorically and preference for exerting control over one's course of actions. Therefore, cognitive fit would occur when holistic Easterners use a "broad" Web site and analytic Westerners use a "deep" Web site to search for target information and this fit would facilitate information searching performance. However, when Easterners use a "deep" Web site or Westerners use a "broad" Web site, their relatively disadvantageous ability in processing categorical information or dealing with complex inter-object relationships will require them to engage in additional mental presentation transformation, which could in turn prolong their information search process. Therefore, we hypothesize as follows:

H2: *Cultural cognitive style and Web site structure interact to affect user performance.*
H2a: *Users with holistic cultural cognitive style would have a better performance for "broad" structure as opposed to "deep" one.*
H2b: *Users with analytic cultural cognitive style would have a better performance on "deep" structure as opposed to "broad" one.*

Navigation and User Satisfaction

User satisfaction is one of the most important indicators of the success of various information systems and technologies in general (Etezadi-Amoli & Farhoomand 1996; Gelderman 1998) and Web sites in particular (Palmer, 2002). In the domain of information search, user satisfaction is viewed as an explicit account of users' subjective evaluation of various aspects of their interactions with an information source providing needed information (Su, 1992).

We expect that, when users navigate a Web site to accomplish various tasks, their satisfaction with the Web site will be positively correlated with their subjective evaluation of the Web site's navigability. Relatively high perceived navigability can result in a heightened user satisfaction with the Web site because it connotes an easy and pleasant navigation experience whereby users can successfully complete their tasks on the Web site (Stevenson, Bruner, & Kumar, 2000).

Additionally, user performance in terms of the amount of time needed to complete a task on the Web site reflects navigation efficiency objectively. A shorter duration indicates that the user's navigation is smooth without disorientation. Thus, we expect users will also be more satisfied with a Web site which enables them to perform well. Therefore, we hypothesize:

H3: *Perceived navigability will be positively related to user satisfaction.*
H4: *User performance will be positively related to user satisfaction.*

Control Variables

We controlled for several variables that may affect users' Web site navigation experience. First, a potential alternative explanation of user perception and performance with regard to computer related technologies is individual demographics (Webster & Ahuja, 2006). So we controlled for four demographic variables, including gender, age, education, and Internet experience. Second, we included user familiarity as a control variable as it has been suggested by prior literature to influence users' online perception and performance (Agarwal & Venkatesh, 2002; Nadkarni & Gupta, 2007).

RESEARCH METHOD

We conducted a laboratory experiment to test our hypotheses. Participants from China and the United States were recruited to represent holistic cultural cognitive style and analytic cultural cognitive style, respectively. We implemented two distinct experimental Web designs to represent "broad" and "deep" Web site structures.

Participants

As suggested by previous cultural cognitive studies, Chinese and Americans were used to represent holistic and analytic cultural cognitive styles, respectively (Nisbett, 2003; Nisbett & Miyamoto, 2005). Chinese participants were recruited at a large university in China and exchange students from the United States were recruited at a large university in Singapore. Since two sets of data

were collected at different locations, the Internet speed was recorded and tested as a control variable. Both Chinese and American participants were ensured that they had lived in their original country for the majority of their lives and spoke the native language as their primary language. To avoid selection bias, subjects were only apprised that it was an experiment on online shopping experience. Student participants were used due to subject availability and their prevalent use of electronic commerce Web site. To encourage participation, an $8 reimbursement was given when they finished the experiment.

We collected data from 125 students to test our hypotheses. The Chinese group included 63 participants. The mean of the participants' age was around 24 years old and 46.0 percent of the subjects were female. As for the American group, it was consisted of 62 participants. The mean of the participants' age was around 25 years old and 48.3 percent of the subjects were female.

Experimental Conditions

The experimental Web sites were created with two different hierarchical structures. In the "broad" condition, the Web site structure was flat and took subjects two levels to traverse (around sixteen hyperlinks per page). The "deep" Web site structure contained eight levels to traverse (around three to six hyperlinks per page). These levels were chosen to be consistent with previous studies of Web site structure design (e.g., Norman & Chin, 1988; Stevenson, et al., 2000). The design of the Web sites ensured that the lower child pages were accessible only through their parent page. We did not provide the functionality that allowed users to search or skip levels with shortcuts of navigation. The only exception was a link to the Web site's home page located on every page to provide a lifeline to a well-known starting point.

The experimental Web sites used in the experiment was firstly created in English for American participants and translated to Chinese for Chinese participants. To ensure comparability and equivalence in meaning, the method of back-translation was adopted (Brislin, 1970). Two graduate students conducted the translation work independently. The authors compared the translated version with the original one and made changes when necessary. Thus, two Web sites in each language were developed.

Procedure

During the experiment, all participants were randomly assigned to one of the two Web structure conditions ("broad" or "deep"). Each participant was given an information sheet that contained specific task explanation and instruction. They were requested to browse the experiment Web site and complete information search task without time limitation. But they were told that their performance was recorded. More specifically, they were asked to find a computer model that met all the given requirements by navigating the electronic commerce Web site and report the price of that computer model.

After participants finished the information search task, they were asked to fill up the questionnaire. It should be noted that in order to avoid language bias, the questionnaires were in English for American participants and in Chinese for Chinese participants.

Measurements

Perceived Navigability

Perceived navigability was adapted from McKinney el al. (2002) and Palmer (2002). It was measured with a seven-point Likert scale, with 1 indicating "strongly disagree" and 7 indicating "strongly agree" (see Table 1).

Table 1. Operationalization of constructs

Constructs	Item Description	Source of Items
Perceived Navigability (NAV)	(1-7 Likert scale, 1=Strongly disagree, 7=Strongly agree) NAV1: The Web site is easy to go back and forth between pages. NAV2: The Web site provides clear clicks to locate information. NAV3: In general, the Web site is easy to navigate.	Adapted from McKinney et al.(2002) and Palmer (2002)
User Satisfaction (SAT)	(1-7 Likert scale, 1=Strongly disagree, 7=Strongly agree) SAT1: In general, I am satisfied with the design of the Web site. SAT2: In general, the browsing experience that I have had with the Web site was satisfactory. SAT3: Using the Web site made me frustrated. (Reverse coding) SAT4: I feel terrible when using the Web site. (Reverse coding) SAT5: After using the Web site, I will never recommend it to my friends. (Reverse coding) SAT6: After using the Web site, I will never use it again. (Reverse coding)	Adapted from DeLone et al. (1992), McKinney et al. (2002) and Palmer (2002)
User Performance	It is measured by the time taken to find the answer.	Adopted from Adipat, Zhang, & Zhou (2011)
Familiarity (FAM)	(1-7 Likert scale, 1=Strongly disagree, 7=Strongly agree) FAM1: My knowledge of the Web site is high. FAM2: I visit or used to visit the Web site often. FAM3: I am familiar with the content on the Web site.	Adapted from Cox & Cox (2002)
Internet Experience	(1-7 Likert scale, 1=Strongly disagree, 7=Strongly agree) It is measured by the average Internet usage time per day during recent month.	Adopted from Webster & Ahuja (2006)

User Satisfaction

We adapted the six-item scale of user satisfaction developed by DeLone & McLean (1992), McKinney et al. (2002) and Palmer (2002) (shown in Table 1). This scale was developed specifically for Web sites and measures users' overall satisfaction with the Web site rather than their satisfaction with specific attributes of the Web site. Thus, this scale is appropriate and useful for this study.

User Performance

User performance was measured by search time. Participants were required to find answer (i.e., the price of the computer) from the Web site for a fact-based question. Search time was calculated by the time that a participant took to find the answer to the given question. During the experiment, participants clicked a "start" button on the user interface when they were ready to start the Web site navigation. As soon as they found an answer to the question, they clicked a "Finish" button to stop the time recording. The time duration was automatically recorded by the system. The participants were not allowed to browse the Web site again once they clicked the "Finish" button.

DATA ANALYSIS

Measurement Validation

All statistical tests were carried out at a 5% level of significance. Assessments of measurement include: (1) individual item reliability, (2) internal consistency, and (3) discriminant validity. Exploratory factor analysis (EFA) was employed to evaluate the constructs' convergent and discriminant validity. Using the principal component analysis and varimax rotation in SPSS, four factors were extracted with Eigen values greater than 1.0 (shown in Table 2). All items loaded on target factors with loading above 0.6, and loaded on other factors with loading below 0.36. Thus, discriminant validity was established. The internal consistency reliability of constructs was measured by Cronbach's alpha. The reliability coefficient of perceived navigability was 0.88, user satisfaction was 0.90, and familiarity was 0.79. All coefficients were acceptable (greater than 0.7) (Nunnally & Bernstein, 1994). Thus, convergent validity was established. After measurement validation, items of each construct were averaged as a measure of the target construct.

Manipulation Check

In order to check the successfulness of the Web site structure manipulation, subjects were asked to indicate the approximate number of clicks they did in order to find the answer. Then t-test was conducted. The results ($t = -9.97$, $p < 0.05$) showed that subjects in "deep" Web site structure condition clicked more (mean=5.94, std=1.81) than those in "broad" Web site structure condition (mean=2.76, std=1.75).

Cultural Cognitive Style Test

We used the grouping test to evaluate subjects' cognitive style (Ji et al. 2004). As suggested by cultural cognitive style perspective, holistic ones tend to group objects based on relationships and

Table 2. Results of exploratory factor analysis r^2=72.9%

Variables	Cronbach's Alpha	Items	Item loading		
Perceived Navigability (NAV)	0.88	NAV1	**.882**	.093	.064
		NAV2	**.859**	.170	.091
		NAV3	**.904**	.158	-.063
User Satisfaction (SAT)	0.90	SAT1	.207	**.875**	.018
		SAT2	.097	**.870**	.068
		SAT3	.217	**.841**	.097
		SAT4	.162	**.843**	.002
		SAT5	.070	**.713**	-.076
		SAT6	-.044	**.766**	.055
Familiarity (FAM)	0.79	FAM1	.118	-.019	**.762**
		FAM2	-.051	.005	**.906**
		FAM3	.010	.100	**.848**
Eigen Value			4.59	2.14	2.02

analytic ones tend to group based on categories (Ji et al. 2004). Thus, we presented participants with ten sets of three words (in one of three random orders) (e.g., "Monkey Panda Banana") and asked them to indicate which two of the three were most closely related. A grouping was coded as relational if it suggested an object-context relationship (e.g., monkey and banana) or as categorical if it suggested shared features or category memberships (e.g., monkey and panda). The objective of this test is to confirm the subjects chosen represent two different cultural cognitive styles.

We calculated the difference between the frequency of relationship-based grouping and the frequency of category-based grouping for each subject and used it as the dependent variable for the ANOVA test. Results revealed a significant main effect of subjects' country of origin on the difference value ($F = 11.24$, $p < 0.01$). Chinese participants showed a clearer preference for relationships-based grouping ($M = 5.60$, $SD = 2.75$) than American participants ($M = 2.90$, $SD = 5.60$), confirming that the participants chosen represented two different cognitive styles.

Results on User Perception and Performance

MANCOVA was employed to test the hypotheses. The independent variables were the Web site structure and cultural cognitive style. The dependent variables were perceived navigability and user performance. MANCOVA was firstly conducted on perceived navigability and user performance together. Results show that the treatment effects are significant ($p<0.05$), hence ANCOVAs were further conducted on these two dependent variables separately.

Perceived Navigability

ANCOVA was first conducted on the perceived navigability alone (see Table 3). Among all the control variables, familiarity, gender, education, and Internet experience were even distributed among four groups. So in order to minimize noise, only the age and Internet speed were treated as covariates in ANCOVA (Stevenson, 2009). The interaction involving Web site structure and cultural cognitive style was significant ($F = 10.139$, $p < 0.01$) (see Figure 3). This shows that individuals with different cognitive styles did perceive differently when using a "broad" versus a "deep" Web site. Thus, H1 was supported.

In order to identify the nature of the differences and test H1a and H1b, we split the dataset by cultural cognitive style and perform ANCOVAs for the users with holistic style and users with analytic style separately. The results showed that the effect of Web site structure on perceived navigability for users with holistic cultural cognitive style was significant ($F = 4.139$, $p < 0.05$) (shown in Table 4). Holistic Chinese subjects indicated higher perceived navigability on "broad" structure than "deep" one ($M_{broad} = 5.17$, $SD = 0.62$; $M_{deep} = 4.69$, $SD = 0.97$). Thus, H1a was supported. For Americans with analytic cultural cognitive style, the effect of Web site structure on their perceived navigability was also significant ($F = 4.530$, $p < 0.05$) (shown in Table 4). Analytic Americans reported higher perceived navigability on "deep" structure than "broad" one ($M_{broad} = 4.74$, $SD = 1.11$; $M_{deep} = 5.29$, $SD = 0.69$). Thus, H1b was supported.

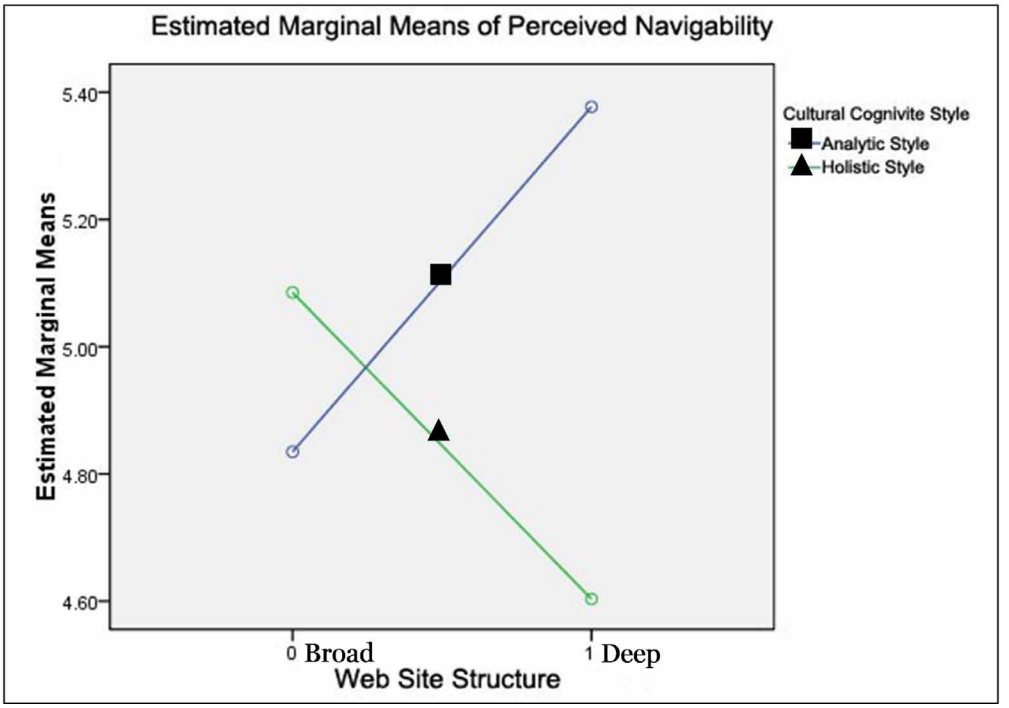
User Performance

ANCOVA was then conducted on the user performance alone (see Table 5). Among all the control variables, familiarity, gender, education, and Internet experience were even distributed among four groups. So in order to minimize noise, only the age and Internet speed was treated as covariates in ANCOVA (Stevenson, 2009). The interaction involving Web site structure and cultural cognitive style was significant ($F = 4.139$, $p < 0.05$) (see Figure 4). This shows that

Table 3. Results of ANCOVA (dependent variable: perceived navigability) R^2=11.5%

Source		df	Mean Square	F	p
Covariates	Age	1	2.167	2.919	.090
	Internet Speed	1	1.081	1.456	.230
Main Effect	Web Site Structure (STR)	1	.026	.035	.851
	Cognitive Style (COG)	1	1.416	1.907	.170
Interaction Effect	STR*COG	1	7.528	10.139	.002**
*: p<0.05, **: p<0.01					

Figure 3. Plots of interaction effect between web site structure and cultural cognitive style on perceived navigability



individuals with different cognitive styles did perform differently when using a "broad" versus a "deep" Web site. Thus, H2 was supported.

In order to identify the nature of the differences and test H2a and H2b, we split the dataset with cultural cognitive styles and perform ANCOVA for the users with holistic style and users with analytic style separately. The results showed that the effect of Web site structure on user performance for the users with holistic cultural cognitive style was significant (F = 17.501, p < 0.01) (shown in Table 4). Chinese subjects spend less time to locate the target information on the "broad" site than on the "deep" site (M_{broad} = 66.56, SD = 36.48; M_{deep} = 110.48, SD =

Table 4. ANCOVA of two cultural cognitive styles separately

Source	Dependent Variables	df	Mean Square	F	p
Users with Holistic Cultural Cognitive Style					
Web Site Structure	Perceived Navigability	1	3.158	4.716	.034*
	User Performance	1	30867.604	17.501	.000**
Users with Analytic Cultural Cognitive Style					
Web Site Structure	Perceived Navigability	1	3.795	4.530	.038*
	User Performance	1	1973.127	1.317	.256
*: p<0.05, **: p<0.01					

Table 5. Results of ANCOVA (dependent variable: user performance) R^2=29.7%

Source		df	Mean Square	F	p
Covariates	Age	1	24952.134	15.308	.000**
	Internet Speed	1	3.634	.002	.962
Main Effect	Web Site Structure (STR)	1	22650.557	13.896	.000**
	Cognitive Style (COG)	1	19903.389	12.210	.001**
Interaction Effect	STR*COG	1	6746.718	4.139	.044*
*: p<0.05, **: p<0.01					

46.07). Supporting H2a, Chinese with holistic cultural cognitive style have better performance on "broad" structure than "deep" one.

However, Americans with analytic cultural cognitive style did not spend significantly different time to locate the target information within the "broad" Web site structure and the "deep" Web site structure (M_{broad} = 52.65, SD = 39.90; M_{deep} = 75.23, SD = 47.17; p = 0.256) (shown in Table 10). Thus, H2b was not supported.

Results on User Satisfaction

Regressions were conducted on user satisfaction. After excluding the effects of all manipulated factors and control variables, perceived navigability had a significant positive effect on user satisfaction (t = 3.32, p < 0.01), but user performance did not have a significant effect on user satisfaction (see Table 6). Thus, H3 was supported and H4 was not supported.

In summary, the hypotheses testing results were displayed in Table 7.

Post-Hoc Analysis

Additional post hoc analyses were conducted to obtain a more comprehensive understanding of the research variables. We examined 1) the path model through structural equation modeling (SEM) analysis and 2) the relationship between perceived navigability and user performance.

First, SEM analysis was used to simultaneously analyze all paths with latent variables within one analysis (Gefen et al. 2011). Partial Least Squares (PLS) was chosen. Interaction terms

Figure 4. Plots of interaction effect between web site structure and cultural cognitive style on user performance

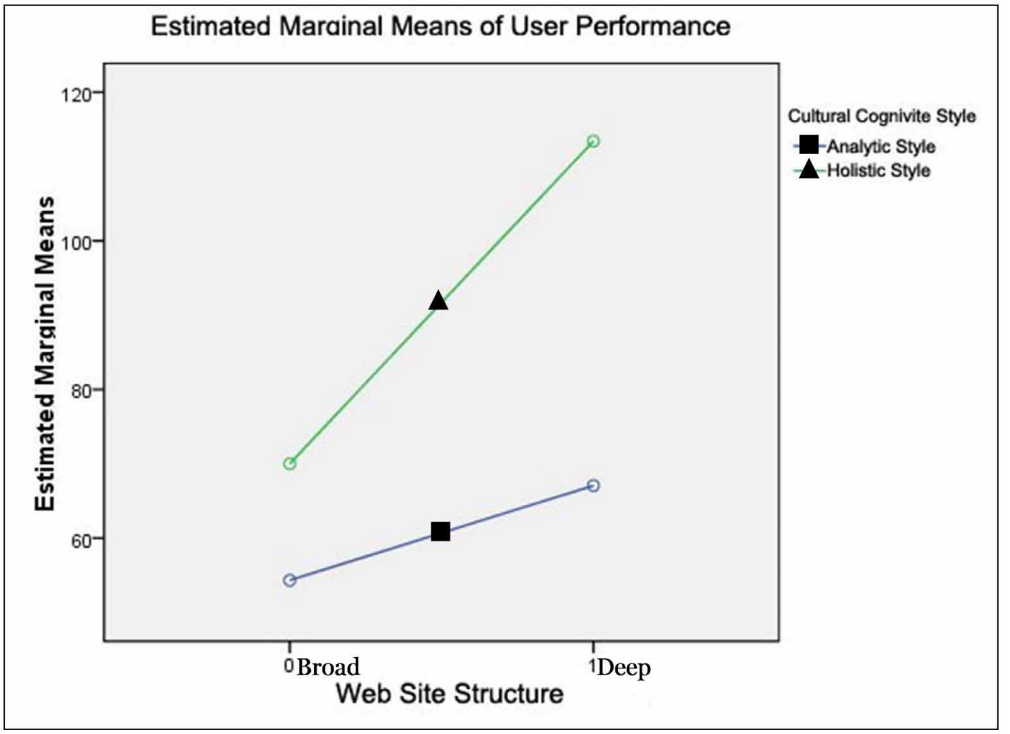


Table 6. Results of regression (dependent variable: satisfaction) R^2=22.1%

	Standardized Coefficients		
	Model 1	**Model 2**	**Model 3**
Age	-.266**	-.306**	-.290**
Internet Speed	.136	.008	.061
Web Site Structure		-.080	-.097
Cultural Cognitive Style		-.210*	-.202
Perceived Navigability			.300**
User Performance			.104
R^2	9.5%	12.8%	22.1%
R^2 change	9.5%**	3.3%	9.2%**
*: p<0.05, **: p<0.01			

were computed by cross-multiplying the standardized items of the relevant constructs. We used SmartPLS 2.0 to analyze the data. The results indicate that H1, H2, and H3 were supported. The interaction effects of Web site structure and cultural cognitive style significantly influence

Table 7. Hypotheses testing results

H1: *Cultural cognitive style and Web site structure interact to affect perceived navigability.*	Supported
H1a: *Users with holistic cultural cognitive style would have a higher perceived navigability on "broad" structure as opposed to "deep" one.*	Supported
H1b: *Users with analytic cultural cognitive style would have a higher perceived navigability on "deep" structure as opposed to "broad" one.*	Supported
H2: *Cultural cognitive style and Web site structure interact to affect user performance.*	Supported
H2a: *Users with holistic cultural cognitive style would have a better performance for "broad" structure as opposed to "deep" one.*	Supported
H2b: *Users with analytic cultural cognitive style would have a better performance on "deep" structure as opposed to "broad" one.*	Not supported
H3: *Perceived navigability will be positively related to user satisfaction.*	Supported
H4: *Performance will be positively related to user satisfaction.*	Not supported

perceived navigability ($b = -0.222$, $p < 0.01$) and user performance ($b = 0.164$, $p < 0.01$). Next, perceived navigability positively influenced user satisfaction ($b = 0.322$, $p < 0.01$) but user performance did not have a significant relationship with user satisfaction.

Second, perceived navigability did not have a significant impact on user performance (shown in Table 8). This indicates that perceived navigability and user performance, serving as subjective and objective indicators respectively, reflects one's navigation experience independently.

In summary, the post-hoc analysis results further confirm our ANCOVA results.

CONCLUDING REMARKS

Culture Differences in Evaluation of Web Site Structures

This research was motivated by an interest in examining the cross-cultural information systems design issues. To this end, we developed and tested a holistic model comprising Web site structure, cultural cognitive style, perceived navigability, user performance and user satisfaction. The major

Table 8. Results of regression (dependent variable: user performance) R^2=28.3%

	Standardized Coefficients		
	Model 1	**Model 2**	**Model 3**
Age	.268**	.317**	.313**
Internet Speed	-.197*	.065	.060
Web Site Structure		.310**	.308**
Cultural Cognitive Style		.371**	.367**
Perceived Navigability			-.025
R^2	12.0%	28.3%	28.3%
R^2 change	12.0%**	16.3%**	0.1%
*: p<0.05, **: p<0.01			

objective of this study is to identify the interaction effect of cultural cognitive style and Web site structure on user perception and performance. Specifically, by focusing on Web site structure, we attempted to resolve the theoretical debate regarding the tradeoff of the Web site breadth and depth. Not only does our model synthesize and integrate research on Web site structure, it also extends this body of work by clarifying how users' cultural cognitive style affects user perception and performance. Some interesting and important findings can be derived from this study.

First, cultural cognitive style and Web site structure interact to affect user perceived navigability. As suggested by prior user interface research, Web site can either be designed as a "broad" or "deep" structure depending on the number of decisions that must be made on the way to a target node (Galletta, et al., 2006). Our results extend previous understanding by demonstrating that analytic Westerners and holistic Easterners have distinct perceptions and preferences for Web site structure. Specifically, users with holistic cultural cognitive style would have a higher perceived navigability within a "broad" structure as opposed to a "deep" one. The findings also demonstrate that users with analytic cultural cognitive style would have a higher perceived navigability within a "deep" structure as opposed to a "broad" one.

Second, besides the subjective perception, cultural cognitive style and Web site structure also interact to affect user performance. The results suggest that users with holistic cultural cognitive style would have a better performance on a "broad" Web site as opposed to a "deep" one. However, there was no significant difference for users with analytic cultural cognitive style. The possible explanation is that on a "deep" Web site, subjects were required to go through more Web pages. Considering that time required to load these Web pages was increased, the time taken to find the answer was consequently influenced and increased. So Westerners did not achieve significantly better performance when navigating the "deep" Web site. However, the "deep" Web site structure did not lead to worse performance for Westerners as it did for Easterners ($M_{broad} = 52.65$, $M_{deep} = 75.23$, $p = 0.256$). This means that a deep hierarchical structure did not create so many troubles for Westerners as it did for Easterners on their way to locate the target information, supporting our expectation that Westerners' cognitive style would enable them to process categorical and structural information better than Easterners. However, they displayed the tendency to perform better on "deep" structure than on a "broad" one as we expected. Westerners spent more time on locating the target information on "deep" structure ($M_{deep} = 75.23$, $SD = 47.17$) than on the "broad" one ($M_{broad} = 52.65$, $SD = 39.90$).

Third, when users have higher perceived navigability, they are more satisfied with the Web site. This finding reinforces prior findings (Agarwal and Venkatesh 2002; Shneiderman 1998). It implies that the perceived navigability among users is important to their navigation experience on the Web site.

User performance, as defined in our study as an objective measure of the time users spend to complete their task to reflect their navigation experience, did not have a significant relationship with satisfaction. We offer a plausible explanation for this. Both perceived navigability and satisfaction are users' subjective evaluations. A smooth and pleasant navigation may result in an affective reaction to the Web site. Affective state is also an important component of user satisfaction with an information system (Sun and Zhang 2006). Thus, the emotional affect associated with high navigability could be transferred to the user's satisfaction. On the other hand, performance is an objective measure. Users may not have an accurate expectation of the amount of time they would spend before they start their tasks on the Web site and an appraisal of the time they eventually have spent after their tasks are completed. Unless on a Web site with extremely poor structure that causes users totally lost, users may not be aware of the time they spend when they are involved in their tasks in a reasonably designed Web site. Satisfaction, as a more subjective and conscious evaluation, therefore, may not closely fluctuate with performance.

Limitations and Future Research

Limitations that circumscribe the interpretation of our findings must be acknowledged. First, just like a large number of other laboratory experiment research, the sample in this study may not represent the entire current population of Web site users. In this study, student participants were used due to subject availability and their prevalent use of electronic commerce Web site. These limitations challenge the analysis, particularly as it relates to differences in performance of searching target information and attitude towards the Web site. Future studies may consider using non-student samples to obtain more generalizable results.

Second, although it was suggested and used by previous cultural cognitive studies that Chinese and American individuals represent holistic and analytic cultural cognitive style respectively (Nisbett, 2003; Nisbett & Miyamoto, 2005), the findings may not be be generalizable to other countries. To examine the cross-cultural effect, future research may consider increasing the range of participants' countries to validate and extend the findings of the present study. Participants from other populations, such as Japanese, Koreans, and Europeans could be recruited, so that additional manifestations of cultural differences could be systematically explored. Research has also shown holistic versus analytic cognitive differences are not confined to geographical country boundaries. Holistic versus analytic tendency can be a between-individual difference (Choi, et al) or dynamically activated by external cues (Hong et al. 2003). As our study only examined the effects of cognitive styles at the cross-country level, we suggest that future studies could also explore whether individuals' cognitive style differences would also matter in their Web site navigation experiences. Additionally, the conceptualization and manipulation of cultural cognitive style used the category of either holistic or analytic cognitive style and did not consider the degree of cultural cognitive style between holistic and analytic. Future research could be developed along this direction and examine the cultural cognitive style in a continuum.

Third, like other cross-cultural research, this study has limitations such as comparability of the samples. Participants from different cultures may differ in their interpreting of and responding to the survey questions. Although this study included objective measurement of user experience - user performance - to reduce this limitation, future research could try other methods to eliminate this issue. Further, other than cultural cognitive style, other socio-demographic differences between Chinese and American subjects may account for their varying navigability perception and performance on broad vs. deep Web sites. To address these limitations, future research could adopt the psychological priming method by manipulating cognitive style on subjects from the same culture and then study subjects' navigability and performance on broad vs. deep Web sites. We expect this study design can help to eliminate the effect of language or other unrelated cultural distinctions.

Fourth, although our participants were given autonomy and incentive in Web site navigation process, the navigation was conducted in a laboratory setting following a specific experimental protocol. This setting is not necessarily a reflection of everyday Web site navigation activity. To better determine the impact of cultural cognitive style and Web site structure in a more natural setting, future research may conduct a field experiment in which participants are asked to use Web sites with different structures over a period of time. It may allow us to measure the interaction effect of cultural cognitive style and Web site structure on people's everyday behaviors.

Lastly, this line of research can be continued in other ways. Future research could extend the current study by investigating the moderating role of cultural cognitive styles on other user interface designs where globalization is a concern. For example, the Web site menu design and the organizational information systems design could be studied by future research.

Theoretical Contributions

This study is meant to provide several implications for both researchers and practitioners. From the theoretical perspective, this study makes important contributions to the cross-cultural Web site usability literature. First, despite the effort on applying Web site structure to explore Web site usability issues in the context of a single country (Geissler, Zinkhan, & Watson, 2001; Hall & Hanna, 2004; Nack, Dorai, & Venkatesh, 2001; Palmer, 2002; Stevenson, et al., 2000), work that systematically investigates Web site structure characteristics across cultures is sparse. The present study fills the gap by identifying the influential moderating role of cultural cognitive style on Web site structure perception and performance. It adds a cultural dimension to our knowledge on user experience of Web site structure.

Second, although the role of cultural cognitive style has been emphasized in the psychology literature (Boduroglu, et al., 2009; Choi & Nisbett, 2000;Kitayama, et al., 2003), limited research has attempted to evaluate its effects on user experience in the online environment. This study extends the cultural cognitive perspective to the context of online environment and suggests that it can also be applied to explain users' information processing differences when navigating on the Web site.

Third, this study tested the research model using both subjective and objective measurements. Studying outcomes of user perception and performance together provides us a more complete story. It makes the model more useful by explaining variance in these two outcome variables with the same experimental manipulations. The research results are more robust and useful compared to research focusing on subjective measurement or objective measurement alone.

Practical Implications

From the practical perspective, this study also suggests a set of pragmatic strategies for Web site design practitioners to improve their Web sites in order to produce compelling navigation experience for users from diverse cultures. The trend of globalization has driven many companies to develop multilingual Web sites for visitors from all over the world. To maximize the satisfaction of users from distinct cultures, Web site designers may need to adapt the Web site according to people's different cultural cognitive styles.

Western companies may appropriately reduce the Web site layers in order to achieve a "broad" Web site for Easterners. When Eastern companies spread out international markets to reach Westerners, they may reduce information components at each Web site page and develop a "deep" Web site in order to produce comforting user navigation experience and achieve higher user satisfaction. Specifically, based on our findings, we suggest that when designing a website for Westerners, designers need to provide a well-structured web environment where information is organized and presented based on systematic categorization. Although the resultant high hierarchical structure will require a user to go through some intermediate steps before locating the target information, its advantage of giving the user the experience of exerting control seems to be appreciated by Westerners. On the other hand, designers should create a "flat" web environment where related information is presented altogether as the East Asian users are less capable of locating a piece of information by scrutinizing through a complex information categorization structure.

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