

Identifying Cultural Markers for Web Application Design Targeted to a Multi-Cultural Audience

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Abstract

This paper addresses the problem of defining a Web design process suitable for the multi-cultural audience of a Web application in the globalization era. Traditional usability guidelines implicitly depend on the background of the audience, and may overlook specific preferences dictated by the cultural context. To overcome this limit, the notion of culturability has been proposed, which extends traditional usability to take into account usage preferences stemming from multiple cultural conventions. The paper builds upon a case study (the comparison of Chinese and Western e-commerce Web sites) and proposes a working definition of culturability, based on cultural markers; moreover, an effective methodology for identifying cultural markers and turning them into design guidelines is established and validated by letting groups of users with different cultures evaluate exemplary Web applications incorporating different versions of the candidate cultural markers.

1 Introduction

The ultimate goal of Web Engineering is promoting the development of applications that offer a satisfactory user's experience. User's satisfaction depends on a number of factors, which are both material and immaterial. Usability [18] is the discipline that, even before the advent of Web applications, has investigated the impact of qualitative factors in the design of user interfaces. Thanks to this discipline, several consolidated guidelines nowadays exist that distill our common perception of what the user considers a well-designed Web application (e.g., one in which the logo appears in the top left corner of the page and is linked to the home page, or that comprises clear navigation clues).

Usability is largely a matter of conventions. If we look back at the (short) history of Web page styles, we can eas-

ily recognize that the notion of what is usable has evolved over time: the rise and fall of HTML frames or the advent of Google-like essential page design are examples of such progression. More precisely, usability is a cultural phenomenon, that is, it depends on the symbols, beliefs, practices and social relationships that govern human activity in a given time and place.

If usability is bound to culture, the question arises of what notion of usability should be considered in the globalization era, in which people, with so different cultural backgrounds, design, develop, use and evaluate Web applications.

The goal of this paper is to explore the notion of *culturability* [1], defined as *usability in presence of influential cultural factors*. The study is conducted quantitatively, in the spirit of Web Engineering: 1) a practical definition of culturability is introduced; 2) the notion of *cultural marker* is used to characterize the factors that determine the user's preference under a given culture; 3) a methodology is proposed for inferring cultural markers from the checkpoints suggested by state-of-practice usability guidelines and from the observation of existing Web applications, using popularity as an indirect measure of application quality; 4) four candidate cultural markers are identified using as a running case the comparison between Chinese and Western (mostly US-style) Web applications; 5) the identified cultural markers are validated by running an experiment with users. In the end, the cultural markers can be easily exploited to derive rules applicable in the interface design task of the Web engineering process.

We underline that the contribution of the paper is not only in the specific cultural markers and design guidelines discovered during the analysis of the running case, but also in the proposed methodology for cultural marker discovery and validation, which can be applied to elicit the influential cultural factors for any given audience of a Web application and for checking that a Web design adheres with the

underlying culture of the targeted audience.

The paper is organized as follows: Section 2 briefly overviews the (many) definitions of culture and cultural models given by philosophy and anthropology. Section 3 introduces a working definition of culturability, based on measurable cultural markers. Section 4 introduces the running case and proposes a methodology for quickly discovering the most likely candidate cultural markers. Section 5 presents the procedure for validating candidate markers via experimental testing with users; Section 6 discusses the cultural markers discovered in the running case and how they can be used as design guidelines. Finally, Section 7 presents the conclusions and highlights ongoing and future work.

2 Culture and Cultural Models

Defining culture is not an easy task, and surely one that is beyond the scope of this paper. The foundation of the systematic study of culture can be traced back to Gustav E. Klemm in 1843 [14] and according to Kroeber and Kluckhohn, in 1952 there were already 300 different definitions of culture [16]. For example, culture has been defined as:

- The way of life of people, the sum of their learned behavioral patterns, attitudes and material things (Hall [10]).
- The “software of the mind”. The collective programming of the mind, which distinguishes the members of one human group from another (Hofstede [12]).
- Behavioral products, values, languages, ways of life of ancestors, art, music, shared preferences, rules, norms, attitudes, and belief. Cultural elements are transmitted, shaped, shared, and taught among people in each particular culture, thereby differentiating a culture from another one (Segall et al. [20]).

Cultural Models have been developed as systematic theories aimed at capturing the recurrent patterns in human culture. For example, Edward T. Hall outlined a systematic vision of culture, based on the three key factors of *context*, *time* and *space* [11]:

- **Context.** In high-context cultures, the understanding of items largely depends on their context. Communication requires shorter messages because large part of the meaning is contained in the context.
- **Time.** The time factor indicates how people manage their tasks through the timeline, in a mono-chronic or poly-chronic fashion. Table 1 shows different characteristics of mono-chronic and poly-chronic cultures [11]

Mono-chronic culture	Poly-chronic culture
Do one thing at a time	Do many things at once
Concentrate on the job	Highly distractible and subject to interruptions
View time commitments as critical	View time commitments as objectives
Low context and need information	High context and already have information
Committed to the job	Committed to people and human relationships
Adhere religiously to plans	Change plans often and easily
Emphasize promptness	Base promptness on the importance and significance of the relationship
Accustomed to short-term relationships	Strong tendency to build lifetime relationships

Table 1. Mono- vs Poly-chronic cultures.

- **Space.** Different cultures developed different needs for space (the need for bigger apartments, bigger offices or bedrooms etc.). There are several factors related to space that are affected by culture. For instance, in some cultures, the central position is perceived as the prominent one, while other cultures give more importance to higher positions.

The culture-dependent interpretation of context, space and time influences all aspects of human activity; therefore, it is not surprising that such influence may extend also to the user’s experience when interacting with a software application.

3 Culture-aware product design and culturability

The understanding of the different cultural backgrounds of users plays a prominent role in industrial product development, where requirements analysis and product design are influenced by cultural variables. The automotive and furniture industries are well-know example of a sector where products are tailored to the cultural specificity of the market where they are deployed (see e.g., [9]).

Software products are no exception. Previous studies have proven that culture does influence interface acceptance [7]. Users from different cultures were found not only to have different preferences about interface design, but also to use different criteria of acceptance [7] [5].

In [22], the link between culture and Web site quality expectations is explored. Based on Hofstede’s Cultural Model [12], two dimensions (masculinity and long-term orientation) are shown to be the most closely related with higher Web site quality expectations.

Marcus and Gould [17] have investigated how cultural factors influence Web usability in international trades, ad-

vocating their importance to reach a higher level of usability, as well as a better understanding of Web content.

Day ([6]) classifies the approaches to the design of multicultural systems into three categories, namely: 1) *globalization*, which adopts a culture-less standard model across different cultures, ignoring culture-specific considerations; 2) *internationalization*, which is based on a culture-neutral base structure, on top of which culture-specific elements are added; 3) *localization*, which exploits a user-oriented design process and aims at developing specific interfaces to meet the needs of particular local markets and users.

Del Galdo has studied the economic impact of cross-culture design and showed how the design of multiple interfaces for different cultural groups significantly increases development cost [8].

The merge of Culture Models and usability is investigated by Barber and Badre [1], who coined the term *Culturability*, synthesis of *culture* and *usability*. The paper advocates the existence of prevailing interface design elements and Web site features within a given culture, called *cultural markers*. These could be color preference, spatial organization of the Web page, navigational patterns and so on. Barber and Bardre examined the cultural markers of Web sites from different nations and cultures, by clustering several Web sites according to their language, nation and genre and by manually inspecting each cluster looking for recurrent design preferences. Web sites that contain the cultural markers of their target audience are considered more acceptable by users of their underlying culture.

Finally, [21] investigates *cultural attractors*, defined as those interface design elements that take cultural factors into account and better match the expectations of the target users groups.

4 Discovery of cultural markers

The contribution of this paper w.r.t. the related work discussed in the previous Section is a practical, low-impact, method for identifying cultural markers. As a side-result, we discuss four candidate cultural markers emerged from the comparison of Chinese and Western-style Web applications, and show how the identified factors can be used to complement state-of-the-practice usability guidelines.

4.1 Methodology

The proposed methodology aims at the statistical identification and validation of cultural markers *for specific cultural groups and for a specific application domain*. The method is designed to quickly highlight the most relevant cultural markers without requiring high-cost activities. This goal is achieved by exploiting application ranking as an indirect quality measure, which significantly reduces the need

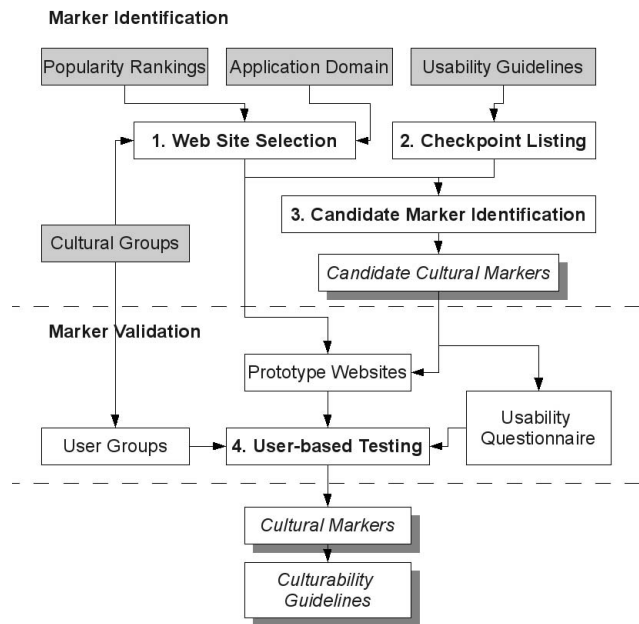


Figure 1. Scheme of the method for cultural marker identification and validation.

of large-scale user testing, a task that presents both logistic problems and remarkable costs [6]. A final user-based validation step is still present, but on a limited scale.

Figure 1 shows the steps that lead to the identification and validation of cultural markers: 1) *Web site selection*: a set of existing Web applications in the domain of interest is selected for each one of the cultural groups under examination; 2) *Checkpoint listing*: an initial list of *checkpoints* is prepared, exploiting the sets of checkpoints suggested from well-known usability guidelines; 3) *Candidate marker identification*: each checkpoint is evaluated and if its value shows significant differences across cultural groups, it is elected as a *candidate cultural marker* 4) *User-based testing*: candidate cultural markers are confirmed or rejected by means of experimental testing; user testing takes as input exemplary applications, designed so to emphasize the relevance of the candidate cultural marker on the user's experience.

The methodology is illustrated in detail in the following Section, by showing its application to a running case consisting of the identification of cultural markers for e-commerce Web applications targeted to the Chinese and Western audience.

4.2 Web Sites Selection

A candidate cultural marker can be defined as a Web design element that meets the preferences of a specific user group, due to some influential cultural factor. In principle, the identification of candidate cultural markers would require a notion of usability for the target user group, which is instead the final goal of the investigation. Therefore, some a priori notion of quality must be assumed, which must be later verified by user testing.

An intuitive, yet approximate, measure of Web application quality can be the popularity of a Web site, as measured by international Web application rankings. Although the success of a Web site obviously depends on many aspects, including marketing issues and business models, the user experience plays an important role in determining acceptance. Furthermore, if one examines a sufficiently large number of top ranked Web sites, the probability that popularity is uniquely determined by marketing factors decreases. By this (admittedly simplifying) assumption, it is possible to take popularity as expressed by directory ranking as a first approximation of relative Web application quality, and consider highly recurrent features in top-rank Web applications as “good practices” for the target class of applications. Then, comparing the good practices of two distinct cultural groups may reveal candidate cultural markers.

4.2.1 Case Study: Web Sites Selection

The case study focuses on the differences between the Western and Chinese audience, concentrating on e-commerce Web applications. The importance of cultural markers in this sector is revealed by a first-cut analysis of the e-commerce market in China, where native Chinese Web sites are generally preferred with respect to foreign competitors. For instance, according [13], in the B2C area the two most popular Web sites in China are the Chinese Dangdang Web site, followed by the multinational Joyo Web portal. The former has 19% market share and 12.95 million registered users, whereas the latter has a smaller market share (16%) and 10.87 million registered users. Even more significantly, in the C2C market, Taobao and eBay are the top sites in China, with Taobao having a market share of 74% and eBay of 16% [13].

The case study examined in this paper spans thirteen e-commerce Web sites, listed in Table 2. The set comprises 6 Web sites from Western countries and 7 from China and all the Web sites rank in the top positions in Alexa’s Global Top 500 Ranking and in the official “Electronic Commerce Report in China” [19].

Name	URL	Alexa Rank	Culture
eBay	www.eBay.com	19	West
Amazon	www.amazon.com	30	West
Alibaba.com	www.alibaba.com	105	West
Mobile.de	www.mobile.de	271	West
Ikea UK	www.ikea.com/gb/en	412	West
Shopping.com	www.shopping.com	494	West
Taobao.com	www.taobao.com	31	Chi
Soufang.com	www.soufang.com	284	Chi
Paipai.com	www.paipai.com	349	Chi
eBay China	www.eBay.com.cn	425	Chi
Alibabal.com.cn	www.alibaba.com.cn	>500	Chi
Dangdang	www.dangdang.com	>500	Chi
Joyo.com	www.joyo.com	>500	Chi

Table 2. Web sites selected for cultural marker identification

4.3 Web Usability Checkpoints

The first step to identify candidate cultural markers is the definition of an initial set of usability-related features, called *checkpoints*, whose usage can be quantitatively assessed in the set of Web sites under examination. The purpose is to verify if some usability-related features have a different treatment in the compared cultures

A list of checkpoints can be easily derived by reviewing the consolidated and widely available Web usability guidelines; in our case study, we have based the selection of checkpoints on three recognized usability guidelines: “Research-Based Web Design and Usability Guidelines” [15], Jacob Nielsen’s Usability Heuristics [18] and the “MiLE” method [4]. The identified checkpoints are categorized in the *Page Layout, Navigation, Links and Search* classes.

4.3.1 Page layout

Page layout has to do with the arrangement and style of pages. Three checkpoints, suggested by the reviewed usability guidelines, have been considered, which admit an easy quantitative assessment.

1. *Page length.* Page length can be measured quantitatively by considering a full screen (e.g., at 1024x768 resolution) as the measurement unit [15].
2. *Total amount of items in the home page.* This checkpoint counts the independent content elements in the home page, including: links, pictures, videos, titles, paragraphs, and captions [15].
3. *Display density.* As in [2] and [15], this checkpoint is defined as: $DisplayDensity = TotalNumberOfItems / PageLength$.

4.3.2 Navigation

Navigation checkpoints assess the facilities available to explore information within a Web site. The following navigation checkpoints are used, measured with a Boolean value denoting their presence or absence.

1. *Persistent navigation option*: any navigation feature that can be constantly used to navigate the Web site.
2. *Site map*: a specific representation of the Web site navigational structure.
3. *Breadcrumb navigation*: use of position-dependent hierarchy of links as an orientation clue.

4.3.3 Links

All the checkpoints in this class evaluate the percentage of occurrence of link with some specific feature: $RatioOfLinksWithFeatureX = \frac{NumberOfLinksWithFeatureX}{TotalNumberOfLinks}$.

1. *Text Links Percentage*.
2. *Image Links Percentage*.
3. *Video Links Percentage*.
4. *Percentage of links opened in a new browser window*.
5. *Clickability clues: Percentage of mouse's pointer changing to the hand icon*.
6. *Clickability clues: Percentage of underlined links for denoting active links*.
7. *Clickability clues: Percentage of color or font changes for denoting active links*.

4.3.4 Search

The following Boolean checkpoints indicate the presence of search functions of different kinds.

1. *Internal Search*: the Web site adopts a search system.
2. *Persistent search*: the search form remains visible in each page.
3. *Scoped search*: users can limit the search to specific portions of the site.
4. *Advanced Search*: multiple search criteria are provided.

Checkpoint	Western Websites	Chinese Websites	Δ %
Page length	2.4	2.6	8.3%
*Total amount of items	223.8	417.9	86.7%
*Display Density	89.6	160.3	78.9%
Persistent Navigation option	100%	100%	0.0%
Site map	83%	71%	16.9%
Breadcrumb navigation	67%	86%	28.4%
Text Link Percentage	83.17%	92.16%	10.8%
Image Link Percentage	16.20%	7.80%	-
Video Link Percentage	0.63%	0.04%	-
*Links opened in a new browser window	7.45%	75.35%	911.4%
Clickability clues: Mouse's shape changing to hand	100.00%	100.00%	0.0%
*Clickability clues: links underlined	43.14%	1.99%	2067.8%
Clickability clues: color or font changed	56.77%	79.91%	40.8%
Internal search	100%	100%	0.0%
Search is visible on each page	83%	86%	3.6%
Scoped search	67%	71%	5.9%
Advanced search	50%	57%	14.0%

Table 3. Results of the checkpoints evaluation.

4.4 Candidate Cultural Markers

Table 3 shows the results of checkpoint evaluation. In the sequel, we comment on the most remarkable differences between Chinese and Western results, and, when possible, relate the identified discrepancies to differences in the respective cultural models¹. Note that some usability checkpoints (e.g., search-related checkpoints) did not turn out to be good candidate cultural markers, simply because the site inspection phase did not reveal any sensible difference between Chinese and Western e-commerce Web sites with respect to them.

A checkpoint has been considered as a candidate cultural marker if the relative difference between the results obtained in the cultural groups is higher than 50%. Boolean features that appear infrequently, i.e., that obtain in both groups of Web site a frequency lower than 20%, were not considered as significant markers.

Display density. There is a remarkable difference in the display density of Western and Chinese sites (89.6 versus 160.3). Figure 2 gives a pictorial comparison of the display density of Taobao (Chinese) and eBay (Western).

A first-cut interpretation can be drawn from the nature of the Chinese with respect to, e.g., the English language.

¹The proposed explanation is supported by intuition, without the ambition of scientific rigor from an anthropological viewpoint.



Figure 2. Taobao.com vs eBay.com

Chinese Website	%	Localized Website	%
Taobao.com	94.8	Ebay.com.cn	45.7
Dangdang.com	96.1	Joyo.com	10.0

Table 4. Links opened in a new browser window.

Written Chinese has no separation between words or characters except for the punctuation, and Chinese words generally require less space than the correspondent English translation; this fact makes written Chinese more dense and may support the preference for more dense Web pages.

Total amount of items. Chinese Web sites display about twice the number of items of Western pages. Being the average page length a constant between these cultural groups, this marker is directly connected to the display density feature. The fact that Chinese pages are more dense, does not translate into shorter pages, but into more items shown simultaneously to the user.

Links opened in the new browser window. The remarkable difference on the ratio of links opening a new browser window can be appreciated also by comparing very similar applications by direct competitors, as done in Table 4. The heavy use of navigation targets in a new browser window could be related to contingent technical reasons, e.g., the still limited bandwidth available, which may induce the habit of keeping multiple windows open for parallel download and browsing. But also to cultural reasons: the poly-chronic nature of the Chinese culture compared to the mono-chronic Western culture. Whereas Western users tend to consider problems in a sequential way, the Chinese tradition uses a different problem-solving approach, based on the simultaneous consideration of multiple problems, reasons, and explanations. This tendency to parallelism may support the Chinese preference for multi-window browsing.

Clickability clues: links underlined. The percentage of underlined links in Chinese Web sites is extremely low (1,99 %). This result is related to the visual nature of the Chinese ideograms; underlining could hamper the readability of text and even introduce wrong meaning, because ideograms with alternative meaning exist that differ only by the underlining.

5 Experimental Validation of Candidate Cultural Markers

Once a set of candidate cultural markers has been identified, its relevance can be subjected to validation by means of experimental testing with the users. The proposed validation procedure comprises the following steps: 1) construction of exemplary Web pages displaying alternative usage of the identified candidate cultural markers; 2) definition of

the user groups for the testing; 3) task-based cultural marker relevance testing; 4) result verification with questionnaire-based user's feedbacks.

5.1 Exemplary Web sites

The first step consists in building one exemplary Web site for each cultural group under examination. The structure and layout of each Web site should embed the candidate cultural markers for the associated cultural group. For numerical cultural markers (e.g., number of items per page) the Web site should reflect the average value of the feature for the relevant cultural group. For Boolean cultural markers, the Web site should embed the most frequently used feature for the reference cultural group (e.g., use of active link underlining).

In our running case, we have defined the page layouts for user's testing based on the most popular Chinese and Western C2C e-commerce applications, www.taobao.com and www.ebay.com. For allowing Chinese and English-speaking users perform the test on the exemplary Web site of the other culture, both exemplary applications have been translated in the other language, leading to four exemplary Web sites (Taobao-like in Chinese, eBay-like in Chinese, Taobao-like in English, and eBay-like in English).

The candidate cultural markers under revision have been exploited to set the layout features of the Taobao-like and eBay-like Web sites:

- **Display density.** The page layouts exhibit a display density of about 90 items per unit-page for the eBay-like Web site and 160 for the Taobao-like one, equal to the average value for the respective cultural group.
- **Total amount of items in the home page.** The pages include a number of items equal to the average values in Table 3, 220 items for the eBay-like Web site and 520 for the Taobao-like one. To comply with the above mentioned display density, page length is set to 2.6 for the Taobao-like Web site and 2.4 for the eBay-like Web site respectively, in accordance with the average page length associated with the two cultural groups.
- **Links opened in a new browser window.** The eBay-like home page opens each link in the same browser window, while the Taobao-like home page opens a new window for each link.
- **Clickability clues: links underlined.** Textual links are not underlined in the Taobao-like Web site, whereas they are underlined in the eBay-like layout.

5.2 User Groups

A distinct set of users is selected for each cultural group (in the running case, Chinese and Western users). Further-

more, to verify if the cultural markers are robust with respect to limited foreign cultural influences, cross-cultural, intermediate groups can also be used (e.g., Chinese users living in Western countries, or vice versa).

The experimental test has involved 30 users, divided in three groups:

- **Western users.** Users from Western countries exposed only to the Western context and culture. They have no knowledge of the Chinese language and hence evaluate the English version of the Taobao-like and eBay-like Web sites.
- **Chinese users.** Chinese users exposed only to Chinese context and culture. They have little familiarity with the English language and evaluate the Chinese version of the Taobao-like and eBay-like Web sites.
- **Chinese users influenced by Western culture.** Chinese users that have studied or lived in Europe at least for one year. They have good knowledge of the English language and have been asked to evaluate the Chinese version of the Taobao-like Web site and the English version of the eBay-like Web site.

5.3 Testing Procedure

Two different testing methodologies are used: task-based testing and questionnaire. Task-based testing is performed according to the well-known technique of contextual inquiry [3]. A single task has been designed for the user to carry on: *finding one model of Apple iPod Nano, along with its corresponding price. The task is accomplished when the page of the product is reached.*

The test Web sites have a predefined set of paths directly leading from the home page to the requested page. Each time the user navigates outside these predefined paths an error is counted. Three task performance indicators are considered: 1) percentage of users that complete the task; 2) average completion time; 3) average number of errors during the task.

After the task-based testing, users are allowed to get familiarity with the Web site for a short time, and are subsequently requested to complete a questionnaire about their experience. Feedback is asked on the features identified as candidate cultural markers and for each feature the user has to quantitatively express his evaluation of the navigational experience.

Results of the task-based testing and of the questionnaires are then analyzed to verify if the presence (absence) of a cultural marker positively (negatively) affects the completion of a task or the subjective perception of the user's experience.

Western Users	Taobao-like, English	eBay-like, English
Completeness of task	1	0.92
Time to accomplish the task	101	77
Avg. number of errors	1	2.33
Chinese Users	Taobao-like, Chinese	eBay-like, Chinese
Completeness of task	1	1
Time to accomplish the task	42	59
Avg. number of errors	0.5	0.5
Chinese Users with Western Influences	Taobao-like, Chinese	eBay-like, English
Completeness of task	1	0.82
Time to accomplish the task	32	61
Avg. number of errors	0.09	0.78

Table 5. User-based testing: performance indicators.

Western Users	Taobao-like, English	eBay-like, English
Display Density	4.58	2.83
Total amount of items	4.75	3.08
Clickability Clues	2.33	3.33
Chinese Users	Taobao-like, Chinese	eBay-like, Chinese
Display Density	3.5	3.17
Total amount of items	3.33	2.83
Clickability Clues	3.17	3.33
Chinese Users with Western Influences	Taobao-like, Chinese	eBay-like, English
Display Density	3.73	3.27
Total amount of items	4.09	3.45
Clickability Clues	3.27	3.36

Table 6. Questionnaire results.

6 Results and Discussion

Tables 5 and 6 summarize the task performance indicators and the questionnaire answers.

We first note that the assigned task has been completed with a high percentages of success (95% across all groups and tested Web sites), with only a few exceptions. This value suggests the adequacy the selected task: tasks that are always completed without difficulties or too complex for the average user should be avoided.

The relevance of cultural factors is confirmed by the data on completion time. The time to accomplish the task in the Taobao-like Web site shows that Western users perform significantly worse than Chinese users (they need more than twice the time). Furthermore, all groups of users on average perform better on the exemplary application that incorporates the cultural markers associated with their group (Chinese people perform better on the Taobao-like site than on the eBay-like one, and Western people vice versa). Influence of Western culture seems not to affect task perfor-

mance of Chinese users. Finally, it must be noted that the time to complete the task in the eBay-like Web site (which has a somehow simpler structure) does not change significantly across the three user groups.

All groups make more mistakes while completing the task in the Western model, but the result is not statistically significant, given the small number of occurred errors.

We next examine the answers given to the questionnaire on each cultural marker, to see if cultural markers are confirmed by the subjective perception of the users. Numerical values relate to the perceived intensity of a feature (e.g., page length), measured on a 1 to 5 scale (1=too few/low, 2=few/low, 3= moderate/right, 4=high/many 5=too high/too many).

- Display Density.** When asked to rate the adequacy of display density, all the groups consider the home page in the TaoBao-like example more dense than the eBay-style one. But the density of the Chinese page is perceived as disturbing only by Western people (who give a 4.58 score). In fact, Chinese users perceive the Taobao-like page to be moderately more dense than the eBay-like one (its score is from 13% to 14% higher). Instead, Western users perceive this difference to be much more significant (they give Taobao a score 61% higher than eBay). Display Density seems confirmed as a cultural marker, whereby Chinese users better appreciate more dense pages. The checkpoint could easily be translated into a design guideline, suggesting more dense layouts for Chinese audience than for Western audience.
- Total amount of items.** The Taobao and eBay examples are remarkably different also in the amount of items shown in the home page. Again, the answers to the questionnaire show that all the user groups perceive this difference. However, Chinese users rate it as moderate (18% of difference in their scores). Instead Western users weight it much more (about 54%). This factor is confirmed as a cultural marker. In this case a cultural-aware guideline would suggest to use, for a Chinese audience, a higher number of items per page than for a Western audience.
- Clickability Clues.** Chinese users declare no perceived difference in link detection between Chinese and Western home pages, i.e. their detection mechanism is not influenced by the underlining of words, but is focused on fonts, colors and on the shape-changing pointer. On the contrary, Western users have difficulties in the identification of links in the Chinese page. The result confirms the cultural marker. A correspondent guideline should reinforce the utility of underlining, but only for Western Web sites.

Cultural Group	new window	same window	no pref.
Western	25.0%	66.7%	8.3%
Chinese w/ influences	90.9%	9.1%	0.0%
Chinese w/o influences	83.3%	0.0%	16.7%

Table 7. Link opening preference.

- **Link opening.** Link opening preferences have been tested adding a direct question (if during the navigation users preferred links opening a new browser window or the same window). Table 7 shows that almost all Chinese users, independently of their Western influences, prefer links that open the destination page in a new browser window or tab. Western users instead are more comfortable with links that are opened in the same browser window. The result confirms the link opening preference as a cultural marker. A guideline can be formulated to suggest the correct target opening style when the Web site addresses Chinese or Western users.

7 Conclusions and future work

The paper has presented a practical definition of *culturability*, i.e., usability in presence of influential cultural factors, and an effective procedure for identifying and validating *cultural markers*, defined as Web design patterns affected by the cultural context of users. As an illustrative example, the proposed methodology has been applied to the comparative study of the preferences of Chinese and Western users in the utilization of a typical e-commerce Web page layout. Cultural markers are then used for refining usability guidelines, incorporating a better sensibility for culture-oriented acceptance criteria. Specifically, the illustrated case study has identified four candidate cultural markers (amount of items, display density, clickability clues, and link opening), all of which have been validated by experimental testing and are thus potentially interesting for obtaining usability guidelines tailored to a Chinese audience. The contribution of the paper is both in the discovered cultural markers and in the method for detecting them, which is very simple and applicable to any category of Web application and audience.

Ongoing work is extending the analysis presented in the paper to novel Web application categories and cultures, with the aim of collecting a repository of cultural markers, culture-aware usability guidelines and design patterns fostering a better development process for Web applications in the globalization era.

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