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Towards cultural translation of websites: a large-scale study of Australian, Chinese, and Saudi Arabian design preferences

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ABSTRACT

Since websites are developed and maintained by different cultures, web page design may be influenced by the originating culture. This study examines the usage of design attributes between Australian, Chinese, and Saudi Arabian cultures. This study used automated and manual techniques to investigate design attributes including layout, navigation, links, multimedia, visual representation, colour, and text. Significant differences were found in each of the listed design attributes, suggesting that different interfaces may be needed for successful communication with different cultural groups. The results of this study confirm and extend prior research and anthropological models. The contribution of this study is the scale (460 websites in total) and breadth (seven design attributes) of the research. It also provides revised insights into culture and website design and the concept of cultural translation of web content.

1. Introduction

Users from different cultures have different psychological and social associations (Clemmensen 2006; Collazos and Gil 2011; Liao, Proctor, and Salvendy 2008), which lead them to prefer design elements associated with colour, graphics, navigation, and orientation of a website (Mushtaha and Troyer 2009).

To succeed in the global economy, adapting websites to a particular culture is important (Reinecke and Bernstein 2011; Zakaria, Stanton, and Sarkar-Barney 2003). However, Cultural adaptation often only provides language, date, time, currency, number formats translation, or modification of graphical design elements (Cyr and Trevor-Smith 2004; CLDR 2016; Mushtaha 2012). Modern 'internationalisation' guidelines (e.g. those of IBM [2016a]) identify that cultural norms must be considered when developing graphical interfaces, but to date there is no comprehensive set of cross-cultural guidelines which includes all aspects of web content. New cultural adaptation should consider cultural preferences for layout, navigation, links, multimedia, visual representation, colours, and text (Cyr and Trevor-Smith 2004; Mushtaha and Troyer 2014), expressing the national culture of a country (Calabrese et al. 2014; Singh and Matsuo 2004).

As foreign website designers may be unaware of local users' cultural preferences (Zakaria, Stanton, and Sarkar-Barney 2003), HCI usability researchers and practitioners are interested in accommodating cultural preferences during user interface design for enhancing usability (Daniel et al. 2011; Hsieh 2014; Mushtaha and Troyer 2012).

Despite increased research interest in culturally preferred design elements (Kincl and Štrach 2013; Steve et al. 2013), few studies systematically investigate these preferences across cultures. This study conducts a manual and automated website audit to measure, compare, and analyse website design between Australian, Chinese, and Saudi Arabian cultures with 460 websites.

Some of the culture-specific preferences observed in international website design may be explained by existing cultural models such as those of Hofstede, Hofstede, and Minkov (2010) and Hall and Hall (1990). Our study highlights the similarities and differences in cultural preferences for layout, navigation, links, multimedia, visual representation, colours, and text in Australian, Chinese, and Saudi Arabian cultures.

2. Culture and website design

Although a widely understood construct, there are different perspectives which result in many definitions of culture (Mushtaha 2012). The broad definition of culture incorporates many aspects of human behaviour containing attitudes, norms, values, beliefs, and actions (Hoft 1996). Culture affects the way people view the world, think, interact, behave, and how they respond

(Karahanna, Evaristo, and Srite 2005). Culture also influences groups of people from similar cultural surroundings to prefer similar ways of communication (Ford and Kotzé 2005).

Hall and Hall (1990) posit that culture controls people's behaviour in deep and persisting ways, and they consider culture in its entirety as a form of communication. According to Hofstede, Hofstede, and Minkov (2010), culture works as the mental software for humans, playing a significant role in forming their ways of thinking, feeling, and acting.

In this research, we adopt Hall and Hall's (1990) definition of culture as a form of communication. We consider cultural preferences and markers as those particular preferences and predispositions shared by a particular societal group. The way in which cultural groups form and evolve is firmly in the domain of anthropology and out of the scope of this research; however given our understanding that various cultural and national groups do exist, we will later explore how culture affects patterns of communication (including implicit channels) in the context of online services.

Cultural models seek to measure different cultures on a number of cultural variables or factors (Fitzgerald 2004; Harvey 1997; Olasina and Mutula 2015). Each cultural model establishes its own set of cultural factors. Hofstede, Hofstede, and Minkov's (2010) and Hall and Hall's (1990) cultural models are widely applied to study cross-cultural website communication (Calabrese et al. 2012; Hsieh and Hong 2013; Würtz 2005).

Hofstede, Hofstede, and Minkov's (2010) cultural model was built from large-scale quantitative comparison among national cultures. They determined that patterns of similarities and differences among national cultures differ mainly along the following cultural factors:

- Power distance: The degree of tolerance for the hierarchies that exist, and are accepted within a society. That is the extent up to which the less powerful members of institutions or organisations of a country expect that power is distributed dissimilarly. Those in high-power distance cultures are typically more accepting of disparities in wealth or status, whereas those in low-power distance cultures demand justification for such inequalities.
- Individualism vs. collectivism: The degree to which individuals are integrated into cohesive groups versus being expected to look after themselves.
- Uncertainty avoidance: A society's tolerance for risk and ambiguity versus desire for predictability.
- Long-term vs. short-term orientation: How much society values long-standing as opposed to short-term traditions and values.

Rather than equating culture to nationality, based on qualitative interviews and field studies, Hall and Hall's (1990) cultural model positioned some cultures by dividing culture into two key factors: context and time.

- High-context vs. low-context: The continuum of high- to low-context culture refers to the degree to which communication is implicit and thus requiring an understanding of the context. High-context groups would typically share long-standing associations and thus may communicate more implicitly and rely on shared verbal and non-verbal cues for effective communication. Low-context cultures on the other hand rely less on the contextual cues, instead utilising more explicit written and spoken communication which rely more heavily on the literal meaning of the words used.
- Monochronic vs. polychronic time perception: This relates to whether time is organised with a single task focus (monochronic) or multi-tasking (polychronic).

As shown in Table 1, expression of these cultural factors in the two above models can vary enormously between cultures. The culture-dependent interpretation of cultural values, context, and time influences all aspects of day-to-day activity (Fraternali and Tisi 2008). Understanding cultural differences gives an enhanced perception of how a person may fit within the contextual framework in website communication (Goebel-Lundholm and Reid 2011).

2.1. Cultural usability

Cultural usability is the integration of cultural aspects into interaction (Cyr and Trevor-Smith 2004; Rauterberg 2006), which allows interfaces to relate to the user's culturally specific attributes and values (Kooijmans and Rauterberg 2007; Steve et al. 2013). Barber and Badre (1998) merged culture and usability into 'culturability', in which cultural elements are considered in website design. The designers' preferences and biases towards certain design elements are expected to directly affect

Table 1. Cultural distance between countries.

Cultural factors	Australia	China	Saudi Arabia
Power distance	Low	High	Very High
Individualism	Very high	Low	Low
Uncertainty avoidance	Medium	Low	High
Long-term orientation	Very low	High	Low
Context	Low	High	High
Time perception	Monochronic	Polychronic	Polychronic

Source: Hofstede, Hofstede, and Minkov (2010) and Hall and Hall (1990).

the way a user interacts with the websites (Mushtaha and Troyer 2009; Shoib and Jones 2003).

Attention to cultural usability includes how information is presented and organised in web pages to design interfaces to fit a user's cultural background. The interface immediately conveys cultural values, and allows the system's functionality, in a culturally specific way, to support the user's task (Bernstein and Reinecke 2013).

Prior research indicated that preferences for design attributes, including layout, navigation, links, multimedia, visual representation, colours, and text, vary between cultures (Hsieh 2014; Mushtaha and Troyer 2014). Hsieh, Chen, and Hong (2013), Hsieh and Hong (2013), Goyal, Miner, and Nawathe (2012), and Cyr and Trevor-Smith (2004) identified significant differences in preferences for website design between cultures. Sheppard and Scholtz (1999), Sun (2001), Smith and Chang (2003), and Fraternali and Tisi (2008) gave examples of how cultural preferences (cultural markers) are widespread within a particular cultural group. They showed that cultural markers are introduced by the associated cultural group.

Hsieh (2014), Fraternali and Tisi (2008), Sun (2001), and Badre (2001) examined the effects of cultural markers on web usability. They concluded that people preferred interactive interfaces with cultural markers from their own cultures. User performance and communication effectiveness improved as a result of incorporating those design elements. Therefore, web usability could be strengthened by appropriate cultural markers. To increase the effectiveness of communication across cultures, cultural adaptation of these design attributes is required (Hsieh 2014).

2.2. Design attributes

Prior research suggests that there are important design attributes that enable effective communication between the user and the web page (Calabrese et al. 2012; Hsieh 2014; Mushtaha and Troyer 2014). This research identifies key design attributes, which are outlined below, along with the hypotheses that guide this study.

2.2.1. Layout
Well-structured websites are easier to access and understand (Hsieh, Chen, and Hong 2013; Tong and Robertson 2008). English users scan a web page from the upper left corner, whereas Arabic users scan Arabic web pages from the upper right corner (Marcus 2003; Mushtaha and Troyer 2012). Kralisch, Eisend, and Berendt (2005) found that users from monochronic cultures prefer linear and hierarchical structures, whereas users from polychronic cultures prefer parallel

structures. Therefore, the organisation and location of information on a web page should be related to the script direction of the user's first language.

This work will test whether the usage of column structures; location of the main menu; location of the clickable banners; web page length; total number of items of a web page including headings, links, and images; and display density differ between cultures. Display density was defined as a total number of items divided by web page length in pixels.

> H1: The usage of layout elements differs between Australian, Chinese, and Saudi Arabian cultures.

2.2.2. Navigation
Navigation should support the user to better find and discover information and functionality (Yu and Roh 2002). Reinecke and Bernstein (2011) declare that culture would influence the navigation elements in web design. Users from low-uncertainty avoidance countries, who are tolerant of risk and uncertainty, tend to prefer less control in navigation. However, users from high-uncertainty avoidance countries, where anxiety arises when uncertain situations are encountered, require a formal navigation structure with more control to prevent them from getting lost. Calabrese et al. (2012) showed that users from low-context cultures and short-term orientation cultures prefer navigation structures that are simple and characterised by quick navigation. In this study, navigation refers to the type of main menu, number of visible links in the main menu, level of choices in the main menu, use of a Fat Footer that provides repeating navigation, and use of Quicklinks – a list of unstructured links that are placed in a salient place on a page (Pernice 2014).

> H2: The usage of navigation elements differ between Australian, Chinese, and Saudi Arabian cultures.

2.2.3. Links
Web page organisation and navigation are grounded in links (Yu and Roh 2002). The correct use of links provides paths for navigation (Yu 2001). Sun (2001) found that users from a high-context culture (e.g. China), feel comfortable with visuals related to local culture; however, users from a low-context culture (e.g. Germany), feel uncomfortable when they can't see the logical connection between two elements on the page, and prefer links alphabetically arranged in the navigation bar. Links include the use of internal as well as external clickable banners, standard and local icons, number of total links, external links, links opening in a new browser window, and skip links.

H3: The usage of links differs between Australian, Chinese, and Saudi Arabian cultures.

2.2.4. Multimedia

Multimedia is a factor researchers have previously examined in relation to culture (Cyr and Trevor-Smith 2004). Multimedia consists of slideshow image or text animation, and scrolling, cartoons, and multimedia control capability with the 'Pause' or 'Play' button. The heavy use of multimedia is dependent on the cultural background of the users (Hsieh 2008). According to Hall and Hall (1990), Usunier (1991), and Hermeking (2005), users from high-context cultures share a strong preference for visuals, which are based on graphics.

H4: The usage of multimedia elements differs between Australian, Chinese, and Saudi Arabian cultures.

2.2.5. Visual representation

Differences exist in visual representation between cultures. Based on Hofstede's cultural factors, Marcus and Gould (2000) and Calabrese et al. (2012) developed their cross-cultural web design guidelines and strategies. On web pages, collectivistic and high-power distance cultures use images to promote characteristics of collectivistic societies and greater focus on leaders. Low-power distance and individualism in cultures favour public images. Therefore, the use of images including leaders, elderly individuals, larger groups, political or religious images, group achievements, people in daily life, nature, and young individuals may vary between cultures.

H5: The usage of visual representation differs between Australian, Chinese, and Saudi Arabian cultures.

2.2.6. Colour

It is well accepted that colours may have contradicting or even no meaning between cultures (Mushtaha 2012). For example, red may imply happiness for Chinese, anger, danger, and risk for Japanese, death for Egyptians, aristocracy for French, but US users may associate red with danger (Barber and Badre 1998). Although the meaning of a colour may be different for each culture, traffic lights around the world use red, yellow, and green to convey specific meaning (IBM 2016b). Therefore there are some context-dependent scenarios which deviate from the cultural norms (Cyr and Trevor-Smith 2004). The appropriate use of colours may improve user engagement and reduce the risk of errors.

H6: The overall usage of colour differs between Australian, Chinese, and Saudi Arabian cultures.

2.2.7. Text

Scanning is more common than reading (Nielsen 2007). Users scan the web page for the desired data by concentrating on emphasised text, which can be indicated by bold, strong, different font sizes, or different font colours. Abdulkhair (2004) showed that for Arabic users, the use of different colours and bold are the most commonly preferred presentation for important text, while for the majority of English users, bold and larger font sizes are used. In this study, text elements refer to the use of the XHTML tags for heading (H1–H6), bold, and strong text. These elements were derived from Abdulkhair (2004).

H7: The usage of text elements differs between Australian, Chinese, and Saudi Arabian cultures.

3. Research methodology

3.1. Development of measurement instrument

Systematic investigation of cultural preferences on websites requires the identification and organisation of available design elements (Cyr and Trevor-Smith 2004; Fraternali and Tisi 2008).

Prior research in HCI has already studied design elements to determine how linguistics, age, and culture affect website usability, understanding, and acceptance. To improve the generalisability of results, a list of design elements were derived by reviewing previous research (Abdulkhair 2004; Al-Khalifa and Garcia 2014; Cyr and Trevor-Smith 2004; Fraternali and Tisi 2008; Goyal, Miner, and Nawathe 2012; Hsieh, Chen, and Hong 2013; Marcus and Gould 2000; Sun 2001; Würtz 2005).

This list was also extended with new design elements including level of choices in the main menu, visible links in the main menu, Fat Footer, Quicklinks, standard icons, local icons, skip links, number of external links, and presence of multimedia control capabilities.

All design elements were organised into a set of identified design attributes. These design elements are ultimately linked to one or more of Hofstede's and Hall's cultural factors in the existing literature.

3.2. Survey sample

Websites were categorised by cultural groups. Cultural groups that contained country, language, and categories of websites were defined. This study defines culture based on nationality. Three nationalities have been chosen: Australian, Chinese, and Saudi Arabian. These nationalities were selected, because they have diverse cultural characteristics, as indicated by Hall and Hall (1990)

and Hofstede, Hofstede, and Minkov's (2010) cultural factors.

Three languages have been chosen. English is used by Australians, Simplified Chinese is used by Chinese, and Modern Standard Arabic is used by Saudi Arabians. The categories of websites surveyed were 'government' and 'news and media'. These websites target a variety of local people (Mohammadi, Shameem, and Mousmi 2012; Mushtaha 2012). Generally, the design elements applied are indicative of customs, norms, values, and preferences (Barber and Badre 1998; Cyr and Trevor-Smith 2004; Hsieh 2008). These government and news and media websites are less likely to be influenced by foreign partners or parent companies from other cultures, as the target audience is the local population. They were thus selected to maximise the visibility of cultural preferences and minimise corporate branding.

3.3. Selection of websites

The Dmoz is a multilingual open directory of website links that contains hierarchically structured lists of websites organised by region or category. Websites were selected based on availability in Dmoz (2014) website categories of a country. WinHTTrack (HTTrack 2015), an open-source website copying program, was used to download and store the identified websites in November 2014. To filter website addresses, an open-source offline tool AwebHUT (Rukshan and Baravalle 2011) was used. The list of website addresses was stored in a Microsoft Excel spreadsheet, and each website was assigned a number.

We decided to represent each cultural group with 200 websites, 100 from 'government' and 100 from 'news and media' categories. If the number of websites in a category were less than 100, all available websites were used. However, if the websites were greater than 100, it was decided to randomly select 100 websites from a category of each country. In the same way as Callahan (2006), the Microsoft Excel RANDBETWEEN function was used to randomly select websites from each country. The initial sample consisted of 487 websites: 200 Australian, 200 Chinese, and 87 Saudi Arabian.

3.4. Website audit

This study identified the occurrence of design elements. As the homepage is a face to the world (Rukshan and Baravalle 2012), homepages were evaluated. This quantitative study used automation and manual user evaluation to determine the presence of culturally specific design elements. Therefore, data collection of design elements was split into automated and manual components.

3.4.1. Automated collection

In order to improve data quality, automation was used wherever possible (Kincl and Štrach 2013). Thus, time-consuming tasks were automated. For example, total numbers of links, overall use of colour, web page length, total number of items, display density, number of external links, number of headings, number of bold and strong, and links opening in a new window are all elements which were measured using automated techniques.

AwebHUT (Rukshan and Baravalle 2011) was chosen to perform XHTML tag identification and design element computation. For example, the link's opening behaviour can be examined from the 'target' value of the anchor tag. Internal and external links can be counted from the 'href' value of the anchor tag. To compute web page length, and overall use of colour, a screenshot of the home page is taken to measure its height and overall colour values. For colour, hexadecimal colour code and the ratio of colours in a web page were recorded. The ratio of colour is defined as follows:

$$\text{Ratio of colour X} = \text{number of occurrences of X/total number of colours on page.}$$

ColorHexa (2015) was used to convert the numeric codes code to a colour name. All computed values were saved into a database for later analysis.

3.4.2. Manual collection

Not all design elements can be automatically evaluated (Abdulkhair 2004; Kondratova et al. 2005). A manual audit was conducted on the same websites, in which coders evaluated the availability and frequency of design elements in websites.

Using an online questionnaire, to record and code findings, human coders assessed websites. The visual parameters of websites were manually measured. If a design element was not found in a website, evaluators gave a value of '0'; otherwise, they recorded the number of occurrences of that particular design element.

Three final-year university students were employed as coders in this study. Using a user manual to explain the terminology, coders were first trained. Six websites, two per cultural group, were chosen for a pilot study. All six websites were piloted by all coders. The pilot scoring was compared for cross-coder consistency and reliability.

Any inconsistencies were discussed to resolve points of ambiguity and disagreement by training participants. Design elements were reviewed for implicit and explicit language by the researchers and the coders. After the training, sample websites were re-evaluated. Complete scoring consistency was subsequently achieved by all

coders. The coders, one per cultural group, were then appointed to evaluate websites.

From the sample of 487 websites, during manual and automated evaluations, a total of 27 web pages did not display properly for various reasons including website unavailability and partial page loading. Based on website availability, 191 Australian, 190 Chinese, and 79 Saudi Arabian websites were evaluated giving a total of 460 websites. These were all coded by the trained team who were remunerated for their time.

4. Results

The results were combined and analysed using two different statistical methods. For the categorical data derived from the manual audit, chi-square analysis was used to perform cross-tabulation comparisons. To conduct multiple comparisons between countries, a z-test was performed, which adjusts p-values with the Bonferroni method for multiple comparisons. Percentages of the number of websites (% within country) were reported due to the differences in sample size.

To deal with the numerical data gathered by the automated audit tool, univariate analysis of variance was used to perform a pairwise comparison for mean difference on the numerical variables. Outliers were identified through boxplots and stem and leaf diagrams. This procedure removed outliers where the distance from the median exceeded 1.5 times the interquartile range. A relatively small number of outliers were identified for each variable. Statistical significance, at the 0.05 level, was identified in the design element usage between Australian, Chinese, and Saudi Arabian cultures.

Table 2. Chi-square comparisons for layout.

Variable	% Within country			Deg. of freedom	Chi-square	Sig. level
	Australia	China	Saudi Arabia			
Banner – single colour	79.1a	61.6b	35.4c	2	26.282	.000
Main navigation on top	94.8a	98.4a	83.5b	2	23.264	.000
Main navigation on right	0.0a	0.0a	16.5b	2	64.520	.000
Two-column	81.7a	61.6b	72.2a,b	2	18.982	.000
Three-column	69.6a	93.2b	84.8b	2	36.170	.000
Four-column	48.7a	16.3b	29.1b	2	46.268	.000
Clickable banner on centre	19.4a	47.9b	25.3a	2	37.565	.000
Clickable banner on bottom	49.7a	71.1b	46.8a	2	22.689	.000

Note: each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the .05 level.

4.1. Layout

As outlined in Tables 2 and 3, Hypothesis 1 was supported. The usage of layout elements differs between cultures. Single colour banners were popular in Australian (79.1%) websites, followed by Chinese (61.6%) websites, but were unpopular and found in only 5.4% of Saudi Arabian websites. For a visual navigation scheme (non-text), clickable banners are used. The use of this is popular in Chinese websites, followed by Saudi Arabian websites.

The usage of column structures, including two-column, three-column, and four-column, was considered to identify how web pages are structured. The two-column structures, which give more focus on the content (Hsieh, Chen, and Hong 2013), are popular in Australian (81.7%) websites. However, the use of three-column structures was most popular in Chinese (93.2%) websites, followed by Saudi Arabian (84.8%) websites, but was least popular in Australian (69.6%) websites. The four-column structure was popular in Australian (48.7%) websites but was less preferable in Saudi Arabian (29.1%) and Chinese (16.3%) websites. Results suggest that Australian websites used a greater number of columns.

Chinese web pages were the most dense, reflected in the measures of display density and the total number of items. Australian web pages were least dense. Web page length was not statistically significant between cultures.

4.2. Navigation

Hypothesis 2 that the usage of navigation elements differs between cultures was supported. As demonstrated in Table 4, significant differences were observed. The type of main menu including static and dynamic was considered. The static menu always displays headers

Table 3. Pairwise comparison for layout.

Variable	Country (I)	Country (J)		Mean
		Australia	China	
Total number of items (in a web page including heading, links, and images)	Australia	–	–	189.6
	China	123.83* (.000)	–	313.4
	Saudi Arabia	7.67 (.693)	−116.15* (.000)	197.3
Web page length (in pixels)	Australia	–	–	3839.2
	China	−129.79 (.598)	–	3709.4
	Saudi Arabia	−453.88 (.163)	−324.10 (.320)	3385.3
Display density (=total number of items/web page length)	Australia	–	–	0.05
	China	0.04* (.000)	–	0.08
	Saudi Arabia	0.01* (.002)	−0.03* (.000)	0.06

Note: *is the mean difference (I − J) that is significant at the .05 level.

Table 4. Chi-square comparisons for navigation.

Variable	% Within country			Degree of freedom	Chi-square	Sig. level
	Australia	China	Saudi Arabia			
Main menu – static	24.6a	83.2b	43.0c	2	133.852	.000
Main menu – dynamic	71.2a	8.4b	53.2c	2	158.675	.000
Level of two choices in the main menu	41.4a	0.0b	13.9c	2	105.472	.000
More than 10 visible links in the main menu	8.9a	71.6b	27.8c	2	162.963	.000
Quicklinks	7.9a	0.5b	2.5a,b	2	14.084	.001
Fat Footer	70.2a	0.0b	44.3c	2	204.065	.000

Note: each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the .05 level.

Table 5. Chi-square comparisons for links.

Variable	% Within country			Degree of freedom	Chi-square	Sig. level
	Australia	China	Saudi Arabia			
Standard icons	93.7a	61.6b	89.9a	2	67.013	.000
Local icons	57.6a	63.7a	64.6a	2	1.916	.384
Local icons with captions	50.3a	60.0a	46.8a	4	18.177	.001
Internal clickable banner	52.9a	85.3b	73.4b	2	47.968	.000
External clickable banner	51.8a	78.4b	57.0a	2	30.990	.000
Skip to content	30.9a	0.0b	0.0b	2	95.320	.000

Note: each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the .05 level.

and its sub-headers, whereas the dynamic menu opens up sub-headers when the user selects a header. Static main menus were popular in 83.2% of Chinese websites, followed by 43% of Saudi Arabian websites, but were unpopular and found in only 24.6% of Australian websites. Dynamic main menus were popular in Australian (71.2%) websites, followed by Saudi Arabian (53.2%) websites, but were unpopular and found in only 8.4% of Chinese websites.

Main menus are often used to categorise data for structuring content. The level of choices (sub-headings) in the main menu was considered to identify how content was structured in the main menu. Two levels of choices were most popular in Australian (41.4%) websites followed by Saudi Arabian (13.9%) websites, but completely absent in all tested Chinese websites. Results suggest that Australian websites are the most categorical followed by Saudi Arabian websites and Chinese websites. The results suggest that Chinese users may prefer uncategorised content.

A Quicklinks block is used for easy and quick access to important pages. This was found in Australian (7.9%) websites, followed by Saudi Arabian (2.5%) websites, and almost non-existent in Chinese (0.5%) websites.

A Fat Footer is a form of a repeating navigation. This was most popular in Australian (70.2%) websites, followed by Saudi Arabian (44.3%) websites, but was unpopular and absent in all tested Chinese websites.

4.3. Links

As noted in Tables 5 and 6, Hypothesis 3, that the usage of links differs between cultures, was supported.

For symbolic navigational aids, icons are used. The use of standard icons was most popular in Australian

(94%) websites, followed by Saudi Arabian (89.9%) websites, but found in only 61.6% of Chinese websites. The use of local icons was common between cultures.

Some organisations and cultures may use more external links to demonstrate the strength of the group's network to emphasise social as well as organisational goals (Gould, Zakaria, and Yusof 2000). With a mean of 28.4 links, Chinese websites used more external links than Saudi Arabian (10.4 links) and Australian (7.8 links) websites. Since users might get confused with the external links (Abdulkhair 2004), too many external links may distract Australian and Saudi Arabian users, who are from high-uncertainty avoidance cultures as described by Hofstede, Hofstede, and Minkov (2010).

The skip to content feature considered whether cultures provide a support to skip repetitive navigation links. This was popular in Australian (30.9%) websites, but completely absent in all tested Chinese and Saudi Arabian websites.

Link opening behaviour, including opening in a new window, varies between cultures. With a higher mean of 168.6 links per web page, Chinese websites have

Table 6. Pairwise comparison for links.

Variable	Country (I)	Country (J)		Mean
		Australia	China	
Number of links	Australia	–		121.0
	China	101.28* (.000)	–	222.3
	Saudi Arabia	0.85 (.946)	−100.43* .000)	121.9
Number of links open in a new window	Australia	–		7.9
	China	160.71* (.000)	–	168.6
	Saudi Arabia	1.64 (.842)	−159.07* .000)	9.5
Number of external links	Australia	–		7.9
	China	20.49* (.000)	–	28.4
	Saudi Arabia	2.56 (.147)	−17.93* (.000)	10.4

Note: * is the mean difference (I − J) that is significant at the .05 level.

more links that open in a new window than Saudi Arabian (9.5 links) and Australian (7.9 links) websites. Users from Saudi Arabia and Australia may prefer sequential browsing, conducted in the same browser window.

4.4. Multimedia

Hypothesis 4, that the usage of multimedia elements differs between cultures, was supported. As outlined in Table 7, usage of all design elements except slideshow was significantly different between cultures.

To incorporate human presence on websites, cartoons are used (Hsieh and Hong 2013; Würtz 2005). This is popular in Saudi Arabian (78.5%) websites, followed by Chinese (40.5%) websites, and 38.7% of Australian websites.

Pop-ups, image or text animation, as well as scrolling are used to gain user attention. These elements were popular in Chinese and Saudi Arabian websites, but were unpopular in Australian websites. Multimedia control capabilities with the 'play' or 'pause' button were considered. This is most popular in Australian (16.2%) websites, followed by Saudi Arabian (11.4%) websites, but unpopular and found in only 0.5% of Chinese websites.

4.5. Visual representation

Hypothesis 5, that the usage of visual representation differs between cultures, was supported. As outlined in Table 8, image characteristics varied. Images of leaders were most popular in 72% of Saudi Arabian websites, followed by 42% of Chinese websites, but were unpopular and only found in 14% of Australian websites. Images of people in daily life were popular in 62.3% of Australian websites, but only 33.2% of Chinese and 25.3% of Saudi Arabian websites used this. Images of nature were most popular in 27.2% of Australian websites, followed by 21.5% of Saudi Arabian websites, but were unpopular and found in only 5.3% of Chinese websites.

Images that promote individualistic characteristics were popular in Australian websites. Images of young individuals and images of smaller groups were popular in Australian websites. However, images that promote collectivistic characteristics were popular in Chinese and Saudi Arabian websites. The images of larger groups, as well as political or religious images, and group achievements were popular in both Chinese and Saudi Arabian websites.

4.6. Colour

Hypothesis 6 was supported. The overall usage of colour differs between cultures. Since many colours are used in websites, it was difficult to manually decide which one was dominant and should be coded. Therefore, automation was provided to more accurately examine the overall use of colours between cultures.

The results of this colour evaluation are presented in Table 9. There are some bright colours that are highly prevalent within some culture(s), and less prevalent in other culture(s). Blue and red were highly used in Chinese websites. The use of green was found to be common in Saudi Arabian websites. Australian websites used white more than other countries.

4.7. Text

Hypothesis 7 was supported in that the usage of text elements differs between the three cultures examined. To search for the desired data while scanning a web page, text emphasis including bold, strong, and headings is used (Abdulkhair 2004).

As shown in Table 10, with a relatively higher mean of 3.4, the average use of bold and strong features in Chinese websites was greater than Saudi Arabian (1.2) and Australian (1.0) websites. With a higher mean of 31.1, the average number of headings in Australian websites was greater than Saudi Arabian (16.4) and Chinese (13.4) websites.

5. Discussion

This study explored how usage of design attributes differs between Australian, Chinese, and Saudi Arabian

Table 7. Chi-square comparisons for multimedia.

Variable	% Within country			Degree of freedom	Chi-square	Sig. level
	Australia	China	Saudi Arabia			
Pop-ups	0.5a	19.5b	11.4b	2	37.430	.000
Slideshow	67a	74.7a	64.6a	2	3.928	.140
Image/text animation	0.5a	66.3b	40.5c	2	183.779	.000
Image/text scrolling	3.1a	50.0b	46.8b	2	112.465	.000
Multimedia control capabilities	16.2a	0.5b	11.4a	4	94.465	.000
Cartoon	38.7a	40.5a	78.5b	2	39.839	.000

Note: each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the .05 level.

Table 8. Chi-square comparisons for visual representation.

Variable	% Within country			Degree of freedom	Chi-square	Sig. level
	Australia	China	Saudi Arabia			
Image of leaders	13.6a	41.6b	72.2c	2	89.683	.000
Image of people in daily life	62.3a	33.2b	25.3b	2	46.244	.000
Image of nature	27.2a	5.3b	21.5a	2	33.563	.000
Image of young individuals	78.0a	37.4b	44.3b	2	68.468	.000
Image of elderly individuals	44.5a	54.2a,b	67.1b	2	11.859	.003
Image of smaller groups	64.9a	26.8b	64.6a	2	64.345	.000
Image of larger groups	51.8a	58.4a,b	72.2b	2	9.494	.009
Image of political	4.2a	48.9b	57.0b	2	116.08	.000

Note: each subscript letter denotes a subset of country categories whose column proportions do not differ significantly from each other at the .05 level.

cultures. The results of the study provide statistically significant evidence to support the hypotheses that the usage of design attributes varies between cultures.

The amount and type of multimedia varies between cultures. Chinese and Saudi Arabian websites use more images, cartoons, and animated objects than Australian websites. Chinese and Saudi Arabian cultures are considered high-context cultures, in which additional information beyond a written format is preferred (Calabrese et al. 2012; Cyr and Trevor-Smith 2004). Users from these cultures are polychronic: doing many things at once (Chao et al. 2002). The heavy use of images, cartoons, and animated objects in a high-context culture aids their understanding of a web page. However, the aesthetics of high-context culture websites may appear overwhelming for members of low-context cultures (Heimgärtner 2007; Mandl 2009).

Australia is considered a low-context culture, and users from these cultures are monochronic (Chao et al. 2002). Monochronic societies prefer direct and explicit communicating patterns (Hall and Hall 1990), often by way of written text (Sun 2001). The heavy use of images and animation may be distracting for many Australian users. Therefore, the Australian pages use static text, fewer images, animated objects, and multimedia controlling

capabilities with 'play' or 'pause'. Interestingly, the use of slideshow was equally common in all three countries.

The results of the navigation and links design elements studied suggest that Australian website content is commonly grouped in a text-based navigation scheme. By grouping information, the content is usually placed in the centre of the web page (Reinecke and Bernstein 2011). Results suggest that Australian website main menus only show top-level grouping headers and deeper layers are discovered with a click. Using text-based context-independent design along with a sequential reading and navigating pattern, conducted in the same browser window, users from Australia prefer greater navigation control, with fewer options, to get faster results (Hsieh, Chen, and Hong 2013).

China is considered a high-context culture, and users from this culture are polychronic (Chao et al. 2002), and they prefer to navigate in a parallel structure (Fraternali and Tisi 2008); the heavy use of links that open in a new browser window aids parallel browsing. These findings are similar to Kralisch, Eisend, and Berendt's (2005), who found that monochronic culture prefer linear navigation patterns, while polychronic cultures, in contrast, show non-linear navigation behaviours and tend to switch between several open web pages. The Saudi Arabian culture is also monochronic and its high-uncertainty avoidance nature limits the number of links that open in new windows to prevent users from getting lost. Prior research claims that Arabic pages have an affinity for high context but low content (Liginlal et al. 2014).The heavy use of links in Chinese home pages may be related to a technical reason. It is difficult to

Table 9. Overall use of colour.

Colour name	% in the page		
	Australia	China	Saudi Arabia
Light grey	48.6	46.4	45.9
White	13.7	8.6	9.0
Black	2.9	0.5	3.1
Dark grey	5.2	1.6	5.6
Light cyan	1.3	3.5	1.9
Light blue	1.0	2.5	1.4
Light yellow	0.8	0.9	1.1
Light red	0.7	1.3	0.9
Very dark blue	0.7	0.0	0.0
Lime green	0.1	0.0	0.7
Soft blue	0.1	3.9	0.1
Desaturated blue	0.1	1.2	0.4
Dark blue	0.2	1.0	0.1
Strong red	0.0	1.0	0.0
Other colours	24.6	27.6	29.8

Table 10. Pairwise comparison for text.

Variable	Country (I)	Country (J)		Mean
		Australia	China	
Number of bold and strong	Australia	–		1.0
	China	2.37* (.000)	–	3.4
	Saudi Arabia	0.21 (.629)	−2.16* (.000)	1.2
Number of headings	Australia	–		31.1
	China	−17.65* (.000)	–	13.4
	Saudi Arabia	−14.65* (.000)	3.42 (.380)	16.4

Note: *is the mean difference (I − J) that is significant at the .05 level.

type Chinese characters on a Western alphabet-based keyboard, so instead of using search, Chinese users may prefer to click links.

The layouts of the three cultures were all significantly different. Chinese web pages have the highest display density. Generally, the arrangement of Chinese language text is more crowded than English (Chu and Yang 2010). This is because of the Chinese writing system, which drastically differs from Latin alphabetic systems (Dyson and Suen 2016). Chinese does not have an alphabet but uses a logographic system for its written language, using stroke modulations. With 10 strokes on average, Chinese characters are far denser than English letters. Further, each Chinese character stands as a discrete unit, a self-contained form within an imaginary square box, and a line of Chinese text is not separated by spaces into individual words (Dyson and Suen 2016). The lack of capital letters and spaces between characters of the language may make interpretation complex to readers of Western scripts, who are trained mentally to look for larger letters to find where a sentence begins and ends. Because of these inevitable typological differences between Chinese and English languages, the web pages of Chinese websites are much more visually dense. Despite the role of Chinese typographical differences in influencing the density of a website, this research extended the concept to 'display density' by evaluating the total number of items including links, images, and headings in a page. The high-context cultures such as Chinese depend on verbal and non-verbal cues to communicate effectively (Goyal, Miner, and Nawathe 2012; Hsieh, Chen, and Hong 2013; Hsieh and Hong 2013). The high density of textual and non-textual items helps Chinese users to navigate. However, the results suggest that the density of Saudi Arabian web pages is in between that of China and Australia.

Differences in page length were not statistically significant between cultures. These results contradict prior work by Callahan (2006) and Jano et al. (2015) who showed that high-uncertainty avoidance cultures prefer shorter pages. One explanation for this discrepancy is the finding that high-uncertainty avoidance cultures, including Australian and Saudi Arabian, currently design websites to include Fat Footers. The appearance of these oversized footers, separated from website content, provides additional support, and prevents users from getting lost. However, if the recently introduced Fat Footers were discounted from the length, then Australian and Saudi Arabian web pages would be statistically shorter than the Chinese web pages, and would thus be in line with prior research.

Visual representation varies between cultures. Images of leaders, elderly individuals, larger groups, as well as political or religious images, and group achievements are popular in Chinese and Saudi Arabian websites. The heavy use of these types of images can be related to the high-power distance and collectivistic culture of the Chinese and Saudi Arabian cultures, as described by Hofstede, Hofstede, and Minkov (2010). The high-power distance demonstrates that there is unequal power distribution among them and is readily apparent in their environment (Al-Khalifa and Garcia 2014; Reinecke and Bernstein 2011). The collectivistic culture uses images that promote characteristics of collectivistic societies.

However, as described by Hofstede, Hofstede, and Minkov (2010), people in the low-power distance and individualism cultures such as Australia share equal power distribution. Images of people in daily life, nature, and images that promote values characteristic of individualistic societies are more common in Australian websites.

The overall use of colour varies between cultures. Chinese and Saudi Arabian websites used traditional colours or colours found in the national flag. Chinese preferred red, which signifies happiness in China (Barber and Badre 1998; Russo and Boor 1993). Saudi Arabian websites used green, where the green is associated with paradise, and is considered to be the colour worn in heaven (Abdulkhair 2004). Barber and Badre's (1998) also found that high-context countries usually employ their traditional or national colours throughout websites.

Even though users from different cultures may interpret colours differently (De Bortoli and Maroto 2001), it is to be noted that there may be other non-cultural factors, such as prevalent technology, and an individual's prior experience that can potentially influence universal colour preferences. Highly contrasting bright colours and the use of strong and bold are prevalent in Chinese websites, whereas the use of softer colours and formal headings are more frequently used in Australian websites. The high-context nature of the Chinese websites may use strong and bold text to emphasise important text.

6. Conclusion

'Think globally, act locally' is a strategy to gain global market (Liginlal et al. 2014; Zakaria, Stanton, and Sarkar-Barney 2003). To succeed globally, Zakaria, Stanton, and Sarkar-Barney (2003) and Hoft (1999) suggested that website designers and developers accommodate cultural preferences in websites. This motivated the need to investigate the preferences of target cultures.

The local website audit, from Australian, Chinese and Saudi Arabian cultures, revealed that many website

design elements are culturally specific. These aspects relate to Hofstede, Hofstede, and Minkov (2010) and Hall and Hall (1990) cultural factors, including power distance, individualism, uncertainty avoidance, long-term orientation, context, and time perception. Therefore, Hofstede, Hofstede, and Minkov (2010) and Hall and Hall (1990) cultural models can be used to compare design similarities and differences between cultures.

The automated and manual website audit described in this paper provides a current view on design preferences in websites, and is the first such study to conduct a large-scale evaluation of 460 websites. The findings of this research highlight that different interfaces may be needed for successful communication with different cultural groups. Since different cultures have differing needs (Hsieh and Hong 2013; Hsieh, Chen, and Hong 2013), web designers should appropriately align the web pages to the culture. Such websites would help users to think and act in culturally appropriate ways (Nasrul et al. 2012), which has potential for commercial advantage (Cyr and Trevor-Smith 2004).

Simple language translation, such as that provided by automated online services, even if performed accurately, only addresses one aspect of the overall communication. Furthermore, this approach runs the risk of sending mixed or inconsistent messages as the (translated) language of one culture may be paired alongside the culturally specific layout and interface of another culture, potentially causing issues of its own. Further work must also consider the complex interaction effects between the different cultural factors and strength of association between specific adaptations and the overall website usability. In some parts of the world, there may be hundreds or even thousands of local cultural groups and language dialects. It is impractical to assume that a cultural translation model could result in a similar number of variants of a website – instead a broader cultural baseline must be established, from which an optimal website design can be designed to fulfil the needs of a number of related cultural groups. The study described in this paper has made progress towards this ambitious goal by looking beyond the confines of a specific language or content. This study has evaluated broader 'design elements' such as the navigation structure, colour choices, or imagery. The resulting quantitative data may subsequently be abstracted into culture-aware design templates to encapsulate the significant characteristics of a culturally specific website. The creation of these templates may improve website design in the era of globalisation. This study also generates further questions about culture and web design. The next step of our work is to formalise and implement these culture-aware templates, and to perform a cross-cultural usability study evaluating the efficacy of this type of cultural translation in a real-world implementation.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Abdulkhair, M. 2004. "A Multilingual Automated Web Usability Evaluation Agent." Ph.D. Thesis, Department of Computer Science, The University of Sheffield, UK.

Al-Khalifa, H.S., and R. A. Garcia. 2014. "Website Design Based on Cultures: An Investigation of Saudis, Filipinos, and Indians Government Websites' Attributes." Lecture Notes in Computer Science 8518: 15–27.

Badre, A. 2001. "The Effects of Cross-cultural Interface Design Orientation on World Wide Web User Performance." GVU Technical Report GIT-GVU-01-03.

Barber, W., and A. Badre. 1998. "Culturability: The Merging of Culture and Usability." In Fourth Conference on Human Factor and the Web: HFWeb98, Basking Ridge, NJ, USA.

Bernstein, A., and K. Reinecke. 2013. "Knowing What a User Likes: A Design Science Approach to Interfaces that Automatically Adapt to Culture." Management Information Systems 37 (2): 427–453.

Calabrese, A., G. Capece, M. Corbò, N. L. Ghiron, and M. M. Marucchi. 2012. "Cross-cultural Strategies for Web Design." World Academy of Science, Engineering and Technology, International Journal of Social, Business, Psychological, Human Science and Engineering 6 (11): 437–442.

Calabrese, A., G. Capece, F. Di Pillo, and F. Martino. 2014. "Cultural Adaptation of Web Design Services as Critical Success Factor for Business Excellence: A Cross-Cultural Study of Portuguese, Brazilian, Angolan and Macanese web Sites." Cross Cultural Management – An International Journal 21 (2): 172–190. doi:10.1108/CCM-09-2012-0070.

Callahan, E. 2006. "Cultural Similarities and Differences in the Design of University Websites." Journal of Computer-Mediated Communication 11 (1): 239–273.

Chao, C., T. Pocher, Y. Xu, R. Zhou, and K. Zhang. 2002. "Understanding the Polychronicity of Chinese." In Fifth Asian-Pacific Computer-Human Interface Conference, Beijing, China.

Chu, J., and G. Yang. 2010. "A Culture-based Study on Information Density of E-commerce Websites." In International Conference on Computer Design and Applications (ICCDA 2010), Qinhuangdao, China.

CLDR. 2016. "Unicode CLDR Project." Accessed 16 June 2016. http://cldr.unicode.org/

Clemmensen, T. 2006. "Whatever Happened to the Psychology of Human-Computer Interaction?" Information Technology & People 19 (2): 121–151. doi:10.1108/09593840610673793.

Collazos, C. A., and R. Gil. 2011. "Using Cross-Cultural Features in Web Design Patterns." In Eighth International Conference on Information Technology: New Generations, Las Vegas, NV, USA

ColorHexa. 2015. "Color Encyclopedia: Information and Conversion." ColorHexa. Accessed 22 July 2015. http://www.colorhexa.com/

Cyr, D., and H. Trevor-Smith. 2004. "Localization of Web Design: An Empirical Comparison of German, Japanese, and United States Web Site Characteristics." *Journal of the American Society for Information Science and Technology* 55 (13): 1199–1208. doi:10.1002/asi.20075.

Daniel, A. O., A. Oludele, R. Baguma, and T. van der Weide. 2011. "Cultural Issues and Their Relevance in Designing Usable Websites." *International Journal of Innovative Technology & Creative Engineering* 1 (2): 20–29.

De Bortoli, M., and J. Maroto. 2001. "Colors Across Culture: Translating Colors in Interactive Marketing Communications." In *European Languages and the Implementation of Communication and Information Technologies (Elicit) Conference*, Paisley, UK.

Dmoz. 2014. "Dmoz." AOL Inc. Accessed 15 May 2014. http://www.dmoz.org/

Dyson, Mary C., and Y. Ching, Suen. 2016. *Digital Fonts and Reading. Vol. 1, Series on Language Processing, Pattern Recognition, and Intelligent Systems*. Singapore: World Scientific Publishing.

Fitzgerald, W. 2004. *Models for Cross-cultural Communications for Cross-cultural Website Design*. Technical Report NRC/ERB-1108 and NRC-46563. Canada: National Research Council Canada.

Ford, G., and P. Kotzé. 2005. "Designing Usable Interfaces with Cultural Dimensions." In *IFIP TC13 International Conference on HCI – 2005*, Rome, Italy.

Fraternali, P., and M. Tisi. 2008. "Identifying Cultural Markers for Web Application Design Targeted to a Multi-Cultural Audience." In *The Eighth International Conference on Web Engineering: ICWE 2008*, Yorktown, NJ, USA.

Goebel-Lundholm, M., and C. Reid. 2011. "Constructing Culturally Competent Website for International Business Programs." *Journal of Management Policy and Practice* 12 (2): 142–150.

Gould, E. W., N. Zakaria, and S. A. M. Yusof. 2000. "Applying Culture to Website Design: A Comparison of Malaysian and US websites." In *18th Annual ACM International Conference on Computer Documentation: Technology & Teamwork*, Cambridge, MA, USA.

Goyal, N., W. Miner, and N. Nawathe. 2012. "Cultural Differences Across Governmental Website Design." In *Fourth International Conference on Intercultural Collaboration ICIC'12*, Bengaluru, India.

Hall, E. T., and M. R. Hall. 1990. *Understanding Cultural Differences*. London: Intercultural Press.

Harvey, Francis. 1997. "National Cultural Differences in Theory and Practice Evaluating Hofstede's National Cultural Framework." *Information Technology & People* 10 (2): 132–146.

Heimgärtner, R. 2007. "Measuring Cultural Differences in HCI as Preparatory Work for Cultural Adaptability in Navigation Systems." In *Eighth International Workshop on Internationalization of Products and Systems (IWIPS 2007)*, Merida, Mexico.

Hermeking, M. 2005. "Culture and Internet Consumption: Contributions from Cross-cultural Marketing and Advertising Research." *Journal of Computer-Mediated Communication* 11 (1): 192–216. doi:10.1111/j.1083-6101.2006.tb00310.x.

Hofstede, G., G. J. Hofstede, and Michael. Minkov. 2010. *Cultures and Organizations: Software of the Mind*. 3rd ed. New York: McGraw-Hill Education.

Hoft, N. 1999. "Global Issues, Local Concerns." *Technical Communication* 46 (2): 145–148.

Hoft, N. 1996. "Developing a Cultural Model." In *International Users Interface*, edited by E. M. Del Galdo and J. Nielsen, 41–73. New York: John Wiley.

Hsieh, H. C. L. 2008. "A New Model for Cross-Cultural Web Design." Ph.D. Thesis, School of Design and System Engineering, Brunel University.

Hsieh, H. C. L. 2014. "Evaluating the Effects of Cultural Preferences on Website Use." *Lecture Notes in Computer Science* 8528: 162–173.

Hsieh, H. C. L., C.-H. Chen, and S. D. Hong. 2013. "Incorporating Culture in Website Design: A Comparison of Taiwanese and Australian Website Characteristics." *Lecture Notes in Computer Science* 8024: 393–403.

Hsieh, H. C. L., and S. D. Hong. 2013. "Localization of Web Design: An Investigation of Culturally Preferred Web Attributes in Taiwan and the UK." *Lecture Notes in Computer Science* 8024: 404–413. doi:10.1007/978-3-642-39137-8-45.

HTTrack. 2015. "HTTrack Website Copier." Accessed 15 March 2014. http://www.httrack.com/

IBM. 2016a. "Internationalization of Graphical Images." IBM. Accessed 16 July 2016. http://www-01.ibm.com/software/globalization/topics/graphics/index.html

IBM. 2016b. "Internationalization of Graphical Images: Cultural Impacts on Graphical Designs." Accessed 17 July 2016. http://www-01.ibm.com/software/globalization/topics/graphics/cultural.html

Jano, Zanariah, Shuhaida Md Noor, Rabiah Ahmad, Mohd Shamsuri Md Saad, Rosli Saadan, Mohamad Bokhari, and Aida Nasirah Abdullah. 2015. "Website Usability and Cultural Dimensions in Malaysian and Australian Universities." *Asian Social Science* 11 (9): 1–10. doi:10.5539/ass.v11n9p1.

Karahanna, E., J. R. Evaristo, and M. Srite. 2005. "Levels of Culture and Individual Behavior: An Integrative Perspective." *Journal of Global Information Management (JGIM)* 13 (2): 1–20.

Kincl, Tomáš, and Pavel Štrach. 2013. "Cultural Differences in Online Beer Marketing: Findings from Automated Attention Analysis." *Behaviour and Information Technology* 32 (7): 644–654. doi:10.1080/0144929X.2013.789080.

Kondratova, I., I. Goldfarb, R. Gervais, and L. Fournier. 2005. "Culturally Appropriate Web Interface Design: Web Crawler Study." In *Eighth International Conference on Computer and Advanced Technology in Education (CATE 2005)*, Oranjestad, Aruba.

Kooijmans, T., and M. Rauterberg. 2007. "Cultural Computing and the Self Concept: Towards Unconscious Metamorphosis." In *International Federation for Information Processing (IFIP2007)*, New York, USA.

Kralisch, A., M. Eisend, and B. Berendt. 2005. "The Impact of Culture on Website Navigation Behaviour." In *11th International Conference on Human-Computer Interaction*, Las Vegas, NV, USA.

Liao, H., R. W. Proctor, and G. Salvendy. 2008. "Content Preparation for Cross-cultural E-commerce: A Review and

a Model." *Behaviour & Information Technology* 27 (1): 43–61. doi:10.1080/01449290601088424.

Liginlal, D., M. Rushdi, R. Meeds, and R. Ahmad. 2014. "Localization for a High Context Culture: An Exploratory Study of Cultural Markers and Markers and Metaphors in Arabic E-Commerce Websites." In *E-Commerce, E-Business and E-Service*, 21–27. London: Taylor & Francis Group.

Mandl, T. 2009. "Comparing Chinese and German Blogs." In *20th ACM Conference on Hypertext*, Torino, Italy.

Marcus, A. 2003. "Global and Intercultural User-Interface Design." *The Human-Computer Interaction Handbook*. Mahwah, NJ: Lawrence Erlbaum Associates.

Marcus, A., and E. W. Gould. 2000. "Crosscurrents: Cultural Dimensions and Global Web User-Interface Design." *Interactions* 7 (4): 32–46. doi:10.1145/345190.345238.

Mohammadi, A. K., F. Shameem, and A. C. Mousmi. 2012. "Arabic Interface Analysis Based on Cultural Markers." *International Journal of Computer Science Issues* 9 (1): 255–262.

Mushtaha, A. 2012. "Towards Designing Localized Websites." Ph.D. Thesis, Department of Computer Science, Vrije University Brussel, Belgium.

Mushtaha, A., and O. D. Troyer. 2009. "Cross-culture and Website Design: Cultural Movements and Settled Cultural Variables." In *13th International Conference on Human-Computer Interaction (HCI International 2009)*, San Diego, CA, USA.

Mushtaha, A., and O. De Troyer. 2012. A Pyramid of Cultural Markers for Guiding Cultural-centered Localized Website Design. In *Proceedings of the 8th International Conference on Cultural Attitudes towards Communication and Technology: CATaC 2012*, Perth, Australia.

Mushtaha, A., and O. D. Troyer. 2014. "The Cultural Conceptual Model for Simplifying the Design of Localized Websites." *Lecture Notes in Computer Science* 8518: 158–169.

Nasrul, M. A., K. M. Nor, M. Masrom, and A. Syarief. 2012. "Website Fit: An Overview." *Procedia – Social and Behavioral Sciences* 40: 315–325.

Nielsen, J. 2007. "Banner Blindness: Old and New Findings." Nielsen Norman Group. Accessed 25 May 2015. http://www.nngroup.com/articles/banner-blindness-old-and-new-findings/

Olasina, Gbolahan, and Stephen Mutula. 2015. "The Influence of National Culture on the Performance Expectancy of E-Parliament Adoption." *Behaviour & Information Technology* 34 (5): 492–505. doi:10.1080/0144929X.2014.1003326.

Pernice, K. 2014. "Quicklinks: Bad Label or Indicative of Usability Issues." Nielsen Norman Group. Accessed 10 March 2015. http://www.nngroup.com/articles/quicklinks-label-intranet/

Rauterberg, M. 2006. "Usability in the Future – Explicit and Implicit Effects in Cultural Computing." Mensch & Computer 2006, München, Oldenbourg Verlag.

Reinecke, K., and A. Bernstein. 2011. "Improving Performance, Perceived Usability, and Aesthetics with Culturally Adaptive User Interfaces." *ACM Transactions on Computer-Human Interaction* 18 (2): 1–29. doi:10.1145/1970378.1970382.

Rukshan, A., and A. Baravalle. 2011. "A Quantitative Approach to Usability Evaluation of Web Sites". In *Advances in Computing and Technology*, London, UK.

Rukshan, A., and A. Baravalle. 2012. "Automated Usability Testing: Analysing Asia Web Sites." In *International Conference on Business and Information 2012 (ICBI 2012)*, Colombo, Sri Lanka.

Russo, P., and S. Boor. 1993. "How Fluent is Your Interface? Designing for International Users." In *Human Factors and Computer Systems, INTERCHI'93*, Amsterdam, Netherlands.

Sheppard, C., and J. Scholtz. 1999. "The Effects of Cultural Markers on Web Site Use." In *Fifth Conference on Human Factors and the Web*, Gaithersburg, MD.

Shoib, Gamila M., and Matthew R. Jones. 2003. "Focusing on the Invisible: The Representation of IS in Egypt." *Information Technology & People* 16 (4): 440–460. doi:10.1108/09593840310509653.

Singh, N., and H. Matsuo. 2004. "Measuring Cultural Adaptation on the Web: A Content Analytic Study of U.S. and Japanese Web Sites." *Journal of Business Research* 57 (8): 864–872. doi:10.1016/S0148-2963(02)00482-4.

Smith, A., and Y. Chang. 2003. "Quantifying Hofstede and Developing Cultural Fingerprints for Website Acceptability." In *International Workshop on Internationalization of Products and Systems (IWIPS 2003)*, Berlin, Germany.

Steve, W., R. Adrian, C. Daniel, and K. Jin-Su. 2013. "Culture and the Importance of Usability Attributes." *Information Technology & People* 26 (1): 77–93. doi:10.1108/09593841311307150.

Sun, H. 2001. "Building a Culturally-competent Corporate Web site: An Exploratory Study of Cultural Markers in Multilingual Web Design." In *19th Annual International Conference on Computer Documentation*, New York, USA.

Tong, M.C., and K. Robertson. 2008. "Political and Cultural Representation in Malaysian Websites." *International Journal of Design* 2 (2): 67–79.

Usunier, J.-C. 1991. *International Marketing: A Cultural Approach*. New York: Prentice Hall.

Würtz, E. 2005. "Intercultural Communication on Web Sites: A Cross-Cultural Analysis of Web Sites From High-Context Cultures and Low-Context Cultures." *Journal of Computer-Mediated Communication* 11 (1): 274–299. doi:10.1111/j.1083-6101.2006.tb00313.x.

Yu, B.-M. 2001. "The Effect of Interaction Between Menu Design and Information Structure on Information Searching Performance and Attitude on the World Wide Web." Ph.D. Thesis, ProQuest, UMI Dissertations Publishing.

Yu, B.-M., and S.-Z. Roh. 2002. "The Effects of Menu Design on Information-Seeking Performance and User's Attitude on the World Wide Web." *Journal of the American Society for Information Science and Technology* 53 (11): 923–933. doi:10.1002/asi.10117.

Zakaria, N., J. M. Stanton, and S. T. M. Sarkar-Barney. 2003. "Designing and Implementing Culturally-Sensitive IT Applications: The Interaction of Culture Values and Privacy Issues in the Middle East." *Information Technology & People* 16 (1): 49–75.