Cross-cultural Analysis of
Top Page Design among Brazilian, Chinese, Japanese and United States Web Sites

Toshihisa Doi[1] and Atsuo Murata[1]

[1] Graduate School of Natural Science and Technology, Okayama University,
3-1-1 Tsushimanaka, Kita-ward, Okayama, Japan
tdoi@okayama-u.ac.jp, murata@iims.sys.okayama-u.ac.jp

Abstract. The aim of present study was to reveal the differences of web design including cultural preference among the four countries that have different cultures. Twenty local municipal sites were randomly chosen from United States, Japan, China, and Brazil. The characteristics of these web sites was investigated from viewpoint of the following seven categories: (1) text, (2) layout, (3) navigation, (4) multimedia, (5) links, (6) items location, (7) color. When the web site had each factor, the researcher gave a "1" for that factor. Chi-square goodness-of-fit test was performed to compare the percentage of "0" or "1" of each factor among the four countries. Additionally, the correspondence analysis was performed to grasp the characteristics of each country. The characteristics of the top page design of the four countries were grasped based on these analyses.

Keywords: Web design · Cultural difference · Appearance · Cultural usability

1   Introduction

Because global internet users are large number and they have diverse cultures, the localization of web design is accelerated to adapt to a particular language, culture, and preference. To enhance user satisfaction and accessibility when visiting web sites, web designers must consider the cultural aspect and choice proper design elements for the localized web site. According to Petrie et al. [1], the approach to develop accessible and usable design will be different in the different cultural contexts. As for the web design, the cultural viewpoint of web usability has been discussed by several researchers. Barber and Badre [2] and Marcus and Gould [3] reported that there are several different characteristics of the user-interface design among each country that has different cultural characteristics. They considered the relationship between culture and usability should be important to organize and visualize information on web sites.

To consider the cultural usability of web sites, the characteristics of the web design in the different culture should be grasped. Cyr and Trevor-Smith [4] were investigated the differences of the web design characteristics among German, Japanese, and United States web sites as a basic finding to examine the design direction considering the localized web sites. They reported the web sites of these countries had statistically significant different characteristics in the several viewpoints. Alexander et al.

[5, 6] tried to develop cross-cultural web design guidelines based on the findings of the cultural differences among some countries.

However, these investigations were conducted to the limited countries. Besides, the trend of web design is rapidly changed. To expand the above studies and catch the latest trend of web design, the survey to grasp the cultural differences of web design should be performed continually.

The aim of the present study was to reveal the differences of the web design including cultural preference among the four countries that have the different cultures. This study is important as a basic study to discuss what web design is preferable in each culture and how the design elements should be considered in the cultural aspect.

2 Method

2.1 Analyzed websites

The analyzed web sites in this study were chosen from Brazil, China, Japan, and United States. Each 20 local municipal sites were chosen randomly from each country. The total sample size was 80 web sites. The examples of the web sites of each country are shown from Fig. 1 to Fig. 4.
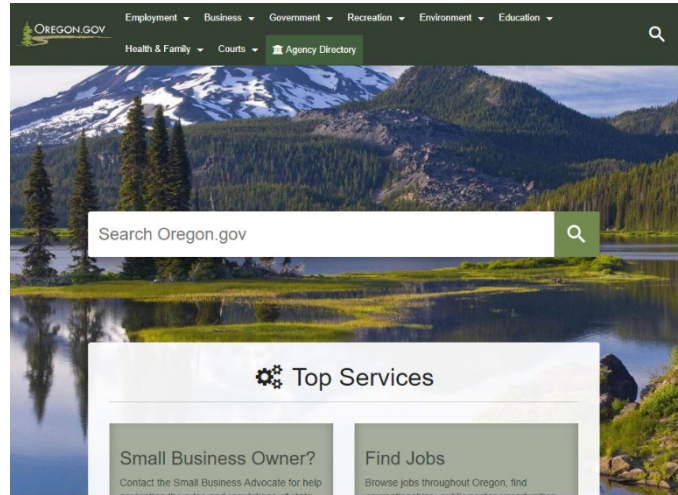

Fig. 1. An example of the web site in Brazil (https://www.mg.gov.br/).

Fig. 2. An example of the web site in China (http://www.fujian.gov.cn/).

Fig. 3. An example of the web site in Japan (http://www.pref.hokkaido.lg.jp/).

Fig. 4. An example of the web site in United States
(https://www.oregon.gov/pages/index.aspx).

2.2 Cultural characteristics

Cyr and Trevor-Smith [4] and Alexander et al. [5,6] used Hofstede's model of national cultural differences [7,8] to grasp the cultural characteristic of each country. This study also used the model to select the counties and grasp the cultural characteristics. Hofstede's model of national cultural differences shows the national characteristics from the viewpoint of the six dimensions of national culture: (1) power distance, (2) individualism, (3) masculinity, (4) uncertainty avoidance, (5) long term orientation, and (6) indulgence. According to Hofstede's model of national cultural differences, the four countries that were selected for this investigation have different cultural characteristics. The score of the six dimensions of the four countries is shown in Table 1.

Table 1. Country cultural dimensions.

Country dimension	Brazil	China	Japan	United States
Power distance	Med (69)	High (80)	Med (54)	Low (40)
Individualism	Low (38)	Low (20)	Med (46)	High (91)
Masculinity	Med (49)	Med (66)	High (95)	Med (62)
Uncertainty avoidance	High (79)	Low (30)	High (92)	Low (46)
Long term orientation	Low (44)	High (87)	High (88)	Low (26)
Indulgence	Med (59)	Low (24)	Low (42)	Med (68)

2.3 Web design characteristics

The characteristics of the web sites was investigated from viewpoint of the following seven categories: (1) text, (2) layout, (3) navigation, (4) multimedia, (5) links, (6)

items location, (7) color. These categories were chosen according to the several previous studies [4-6]. Table 1 shows the characteristics of each category.

Table 2. Web design characteristics of each category.

Category	Web design characteristics
Text	Translation available
	Headings
	Point form
	Bold
Layout	Headline image
	Grid layout
	1 column layout
	2 columns layout (Sub contents on left)
	2 columns layout (Sub contents on right)
	3 columns layout
Navigation	Global navigation
	Keyword search
	Navigation on footer
Multimedia	Video
	Sound
	Animation
Links	Internal links
	External links
	Symbols used for links
	Text links
	Changes color
Items location	Banners on left
	Banners on right
	Banners on bottom
	Banners on top
	Banners on middle of page
	Menus on left
	Menues on right
	Menues on bottom
	Menues on top
	Search box on top left
	Search box on bottom
	Search box on middle of page
	Search box on top right
Color	Main color tone: Vivid
	Main color tone: Deep
	Main color tone: Light
	Background color: White

2.4　Analysis

The 80 web sites were investigated whether the top page of the web sites has each web design characteristics. Each characteristic was given "0 (not present)" or "1 (present)". When the web site had each characteristic, the researcher gave a "1" for that

characteristic. The investigation was conducted to the top page of each web site. When the web site had several top pages of each language, the native language top page was analyzed.

As a statistical analysis, the chi-square goodness-of-fit test was performed to compare the percentage of "0" or "1" of each characteristic among the four countries. Additionally, the correspondence analysis was performed to grasp the characteristics of each country.

3   Results

3.1   Text

The results of the actual counts of each country and the chi-square goodness-of-fit test in the text category are shown in Table 3. All characteristics of the text category showed significant difference among the four countries. Translation function was frequently appeared on Japanese sites significantly. In contrast, translation function was not found on Brazilian sites at this investigation. As for headings and point form in text of the top pages, these were frequently found on Chinese and Japanese sites. As for bold of text, Brazilian and United States sites frequently used it.

Table 3. Result of chi-square goodness-of-fit test of text category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Translation available	0	10	17	10	29.52	3	0.000
Headings	18	20	20	13	16.40	3	0.001
Point form	4	20	19	3	52.58	3	0.000
Bold	14	8	7	17	14.12	3	0.003

3.2   Layout

The results of the actual counts of each country and the chi-square goodness-of-fit test in the layout category are shown in Table 4. Headline image, grid layout, 1 column layout, and 3 columns layout showed significant differences among the four countries. As for 2 columns layout, only few sites adopted it in each country. The percentage using headline image of Japanese sites was significantly low. As for the layout of web site, most United States sites adopted 1 column grid layout. In contrast, Japanese sites frequently adopted 3 columns layout.

Table 4. Result of chi-square goodness-of-fit test of layout category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Headline image	19	20	14	20	15.50	3	0.001
Grid layout	8	13	6	16	12.62	3	0.006
1 column	12	13	6	18	15.33	3	0.002
2 columns (Sub contents on left)	3	1	3	1	2.22	3	0.528
2 columns (Sub contents on right)	4	4	2	1	2.85	3	0.416
3 columns	1	1	7	0	15.40	3	0.002

3.3 Navigation

The results of the actual counts of each country and the chi-square goodness-of-fit test in the navigation category are shown in Table 5. A navigation on a footer showed significant difference among the four countries. The percentage using the navigation on footer of Japanese sites was significantly low. Because global navigation and keyword search were used in most web sites of each country, there was no significant difference.

Table 5. Result of chi-square goodness-of-fit test of navigation category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Global navigation	19	19	17	17	2.22	3	0.528
Keyword search	19	19	20	20	2.05	3	0.562
Navigation on footer	11	11	5	16	12.22	3	0.007

3.4 Multimedia

The results of the actual counts of each country and the chi-square goodness-of-fit test in the multimedia category are shown in Table 6. Video showed significant difference among the four countries. The percentage using video files on the top page of Brazilian sites was significantly high. Most web sites of the four countries did not put sound and animation files on the top page.

Table 6. Result of chi-square goodness-of-fit test of multimedia category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Video	9	1	2	0	19.61	3	0.000
Sound	1	0	0	0	3.04	3	0.386
Animation	0	0	0	0	—	—	—

3.5 Links

The results of the actual counts of each country and the chi-square goodness-of-fit test in the links category are shown in Table 7. Symbols and changes color showed significant difference among the four countries. The percentage using symbols for the links of Brazilian and Japanese sites was significantly low. In United States sites, the percentage of the function that changes color when the cursor put on the links was low.

Table 7. Result of chi-square goodness-of-fit test of links category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Internal links	20	20	20	20	—	—	—
External links	20	19	20	17	6.32	3	0.097
Symbols used for	8	19	8	13	17.08	3	0.001
Text links	20	20	20	19	3.04	3	0.386
Changes color	16	20	20	14	12.34	3	0.006

3.6 Items location

The results of the actual counts of each country and the chi-square goodness-of-fit test in the items location category are shown in Table 8. Banners on right, banners on bottom, banners on middle of page, search box on middle of page, and search box on top right showed significant difference among the four countries. There were few banners on the top page of United States sites. In contrast, Japanese sites had many banners, and these were frequently put on the bottom of the top page. The search box of United States sites was frequently put on the middle of the top page.

Table 8. Result of chi-square goodness-of-fit test of items location category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Banners on left	0	2	2	1	2.35	3	0.504
Banners on right	4	3	10	1	12.90	3	0.005
Banners on bottom	3	2	15	1	33.25	3	0.000
Banners on top	1	0	1	0	2.05	3	0.562
Banners on middle of page	3	6	7	0	9.38	3	0.025
Menus on left	4	3	9	4	5.87	3	0.118
Menues on right	1	1	2	1	0.64	3	0.887
Menues on bottom	2	1	2	4	2.38	3	0.498
Menues on top	18	19	18	19	0.72	3	0.868
Search box on top left	1	0	3	3	4.23	3	0.238
Search box on bottom	1	1	0	0	2.05	3	0.562
Search box on middle of page	3	5	7	15	17.71	3	0.001
Search box on top right	14	13	11	3	14.96	3	0.002

3.7 Color

The results of the actual counts of each country and the chi-square goodness-of-fit test in the color category are shown in Table 9. Main color tone: vivid, main color tone:

deep, and background color: white showed significant difference among the four countries. Brazilian and Chinese sites tended to use vivid colors as a main color of the top page. United States sites tended to use deep colors as a main color of the top page. Besides, United States sites were not frequently used white color as a background color of the top page.

Table 9. Result of chi-square goodness-of-fit test of color category.

	Actual count				Chi-square	Degrees of freedom	p-value
	Brazil	China	Japan	United States			
Main color tone: Vivid	14	10	5	4	13.36	3	0.004
Main color tone: Deep	5	5	8	13	9.01	3	0.029
Main color tone: Light	1	5	7	3	6.25	3	0.100
Background color: White	18	17	14	9	12.29	3	0.007

3.8   Correspondence analysis

Because there were too many web design characteristics to explain the result of the correspondence analysis when all web design characteristics are used for the correspondence analysis, the web design characteristics that showed statistically significant difference among the four countries were used to perform the correspondence analysis. The scatter plot of the score of both the row (countries) and the column (web design characteristics) is shown in Fig. 5 as a result of the correspondence analysis. When the distance between each item (country and characteristic) is close, it could be considered as the relationship between the items is strong relatively.

As shown in Fig. 5, Brazil was positioned near vivid (main color tone), white (background color), headline image. China was positioned near headings, changes color (links), symbols used for links, headline image. Japan was positioned near changes color (links), headings, white (background color), banners on right, banners on middle of page, point form. United States was positioned near grid layout, deep (main color tone), symbols used for links, 1 column (layout), navigation on footer, bold (text).
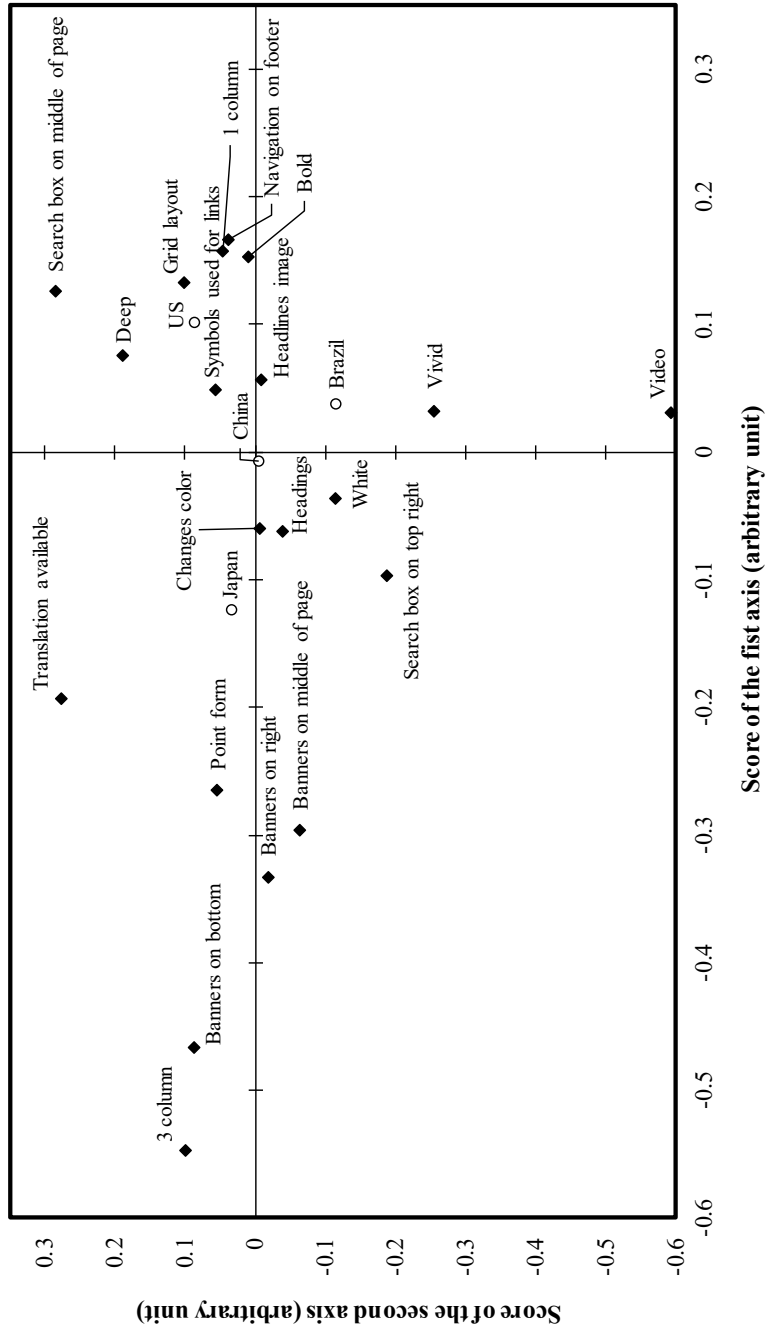
Fig. 5. Result of correspondence analysis.

4   Discussion

The characteristics of the web site design in the four countries were summarized below. The culture of each country has different characteristics in web designs.

4.1   Brazil

Heading and bold of text were frequently used on the top page of Brazilian sites. As a characteristic feature of the text category of Brazilian sites, we could not find the translation function at this investigation. The color of web site was similar with Chinese site. In many sites, the background color was white, and vivid colors were used as the main color of the top page frequently. Besides, Brazilian sites frequently put on video files on the top page as compared with the others.

4.2   China

Chinese sites had similar characteristics with Japanese site about the text style. Headings and point form were tended to use on the top page, and the bold of text was not used frequently as compared with Brazil and United States. However, the layout structure was similar with United States and Brazilian sites. The 1 columns grid layout may be most popular layout in Chinese. Besides, the headline image was put on the top page frequently. As for the links, Chinese sites frequently used the symbols as a design element. Although the layout structure was similar with Japanese sites, Chinese sites did not have many banners on the top page as compared with Japanese sites. As for the color of the top page, most Chinese sites adopted white color as a background color. According to the results of the correspondence analysis, China was put on the almost center of the other three countries. This means that Chinese sites has the similar characteristics with each country. Text style is similar with Japanese sites, characteristics of layout and links are similar with United States sites, and color is similar with Brazilian sites.

4.3   Japan

Japanese sites provided the translation function as compared with the other countries. As for the text style, Japanese sites frequently used the heading and point form in the text on the top page. These characteristics of the text was similar with Chinese sites. These similar characteristics may be caused by using Kanji character that is used in both countries. As for the layout, Japanese sites had the characteristic layout structure as compared with the others. The 3 columns layout was frequently used, and the footer navigation was not frequently used in Japanese site. Other three countries rarely used the 3 columns layout. Besides, there were many banners on the top page in Japanese sites. These banners were put on right and bottom area in most web sites. The frequently use of the banners is considered as the unique feature of Japanese sites.

4.4 United States

As for the text style, United States sites frequently used the bold of text. Heading and point form was not frequently used as compared with the other three countries. United States sites used the 1 column grid layout and put a large photograph as a headline image in many web sites. Besides, the footer navigation was frequently used. As for the items location, the location of the search box was characteristic as compared with the other countries. In many United States sites, the search box was one of prominent design elements on the top page and put on the center of the top page. As for the color, United States sites frequently used the deep color as the main color of the top page. The percentage that the background color is white was lower than the others.

References

1. Petrie, H., Weber, G., Darzentas, J.S., Jadhav, C., Liu, Z.: Cross cultural differences in designing for accessibility and universal design, In: Bernhaupt, R., et al. (eds.) INTERACT 2017, Part IV, LNCS 10516, 518-520 (2017)
2. Barber, W., Badre, A.N.: Culturability: The merging of culture and usability, In: Proc. of 4th conf. on Human Factors and the Web (1998)
3. Marcus, A., Gould, E.W.: Cultural dimensions and global web user-interface design, Interactions 7(4), 33-46 (2000)
4. Cyr, D., Trevor-Smith, H.: 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 (2004)
5. Alexander, R., Murray, D., Thompson, N.: Cross-cultural web usability model, In: Bouguettaya, A., et al. (eds.) WISE 2017, Part II, LNCS 10570, 75-89 , Springer, Cham (2017)
6. Alexander, R., Murray, D., Thompson, N.: Cross-cultural web design guidelines, In: Proc. of the 14th International Web for All Conference on The Future of Accessible Work, 10 pages, ACM (2017)
7. Hofstede, G., Hofstede, G.J., Minkov, M.: Cultures and organizations: Software of the mind, McGraw-Hill, New York (2010)
8. Hofstede Insights, https://www.hofstede-insights.com/