The Impact of Chinese Cultural Elements on the User Experience in Government Website Design

Tian Lei, Xu Liu, Lei Wu, Ziliang Jin and Yuhui Wang

Abstract E-government has been recognized the most effective way of improving the government's public management and service efficiency, but at the present stage of China's government web site is a big gap from the expectations of the public. A number of studies have compared the differences of government website design in the style of image under the different cultural atmosphere. Culture plays an important role in interface design, so in the atmosphere of Chinese traditional culture, there are a lot of cultural identification characteristics affecting the user's cognition and habits. This paper will study the mapping relationship between design elements and the cultural mental image, as well as the relationship between the government websites design integrated into the cultural elements and the user experience.

Keywords Government website · Cultural mental image · User experience

1 Background

E-government has been recognized around the world as the most effective way to improve the government's public management and service efficiency, but China's government website still has a long way to reach the expectations of the public at the present stage. For example: in order to conform with the characteristic of national, city, regional, many governments embedded different culture elements into website through a simply copying or grafting manner to build a traditional style website. Although this method will make user feel the traditional culture, produce a sense of familiarity,but it will also bring rigid sense to users. This will make differences with existing cognitive habits. A good user experience needs UI elements and website style match their user's cognitive and preference under the culture background.

T. Lei (✉) · X. Liu · L. Wu · Z. Jin · Y. Wang
Department of Industrial Design, Huazhong University of Science and Technology, Wuhan, China
e-mail: andrew.tianlei@hust.edu.cn

K.S. Hale and K.M. Stanney (eds.), *Advances in Neuroergonomics and Cognitive Engineering*, Advances in Intelligent Systems and Computing 488, DOI 10.1007/978-3-319-41691-5_4

2 Literature Review

2.1 Culture

Culture is a very abstract concept that relate to every aspect of society. The research of culture in academic world has been never stopped. Many research had compare the difference of government website culture image style which building in different culture environment, those research proved that culture is playing an important role in user interface design, culture background will impact user's cognitive of a website style [1]. For example, Mushtaha and De Troyer [2] found that the cultural background would influence users' feeling, choice and perception of the websites, based on the data from subjects. Smith et al. [3] used the Taguchi Method to study the difference between British and Chinese satisfactions and preferences of websites, based on Hofstede's study on the generic cultural differences. This study indicated that the attitude towards e-financial websites was very different. For example, Chinese users preferred to browse the website in a more general way compared to British users. These studies showed that the cultural context indeed affected the users' cognition and behaviors. This was because Chinese have holistic thinking style, which was possibly resulted from the deeply rooted Confucian philosophy.

In China, the culture is a kind of reflects on the characteristics of national style, it is overall characterization of the national history of ideological culture and ideology, Chinese traditional culture has various forms, according to the content, they can be classified as: exponents, piano chess calligraphy and painting, literature, traditional festivals, Chinese opera, traditional Chinese architecture, Chinese characters, Chinese, traditional Chinese medicine, philosophy of religion, folk art, Chinese Kung-fu, and many other types [4]. Traditional culture has a variety of forms, and have a deep, profound impact on the user, how form cultural into our interface design from inside to outside, and make it more in line with user's cognitive habits and visual style under the influence of Confucian culture, has been one of hot issues in Chinese interface design field.

There are a lot of traditional culture elements interface design cases, they provide us with a good idea: designer use cultural elements in a government website interface design, expresses the unique style of the culture image; Users can convey the cultural connotation according to the interface designer's visual elements, so find the mapping relationship between culture image and cultural elements, can not only help designers expression the culture image more accurately, but also make users feel more familiar, and have a more enjoyable visual experience [5].

2.2 Mental Image and Style

Mental image is an important concept in art and design field, but in a long term, we still cannot use a unified concept to define it, and it means under different cultural

backgrounds are different, in contemporary industrial design field, mental image has been used to express the concept of product, it make direct association with product form via the user's visual sense. Because those elements have similar characteristics and rules, and they represent the same mental image, and style is the best word to describe their properties [6]. As a method of the art research, style was originally produce in the art field, and it is used to distinguish different art forms, and different works in same art form, style was affected by the culture and geography.

We can think of style as a kind of benchmark, it can determine the time and place of the original creative, and also it can used to track inter-linkages between artistic groups, it can be used to describe the characteristics of cultural or material goods. Each user has a different style evaluation benchmark, under the same cultural background, there are also differences in cognitive of culture element, what mapping relationship between different design elements and culture image style? If we can find the corresponding relationship between the design elements and style imagery, this relationship must be able to help designer's expression the style imagery more accurate on interface, and selected elements to render the interface style in a faster way.

2.3 User Experience

Norman propose that the user experience is a key indicator to measure the quality of products, it can be considered that the user experience is based on cognitive and emotional experiences [7]. Moelinger [8] think that user experiences is composed of three part: practical experience, sensory experience, emotional experience. Lucas Daniel [9] said: user experience is user's practices, ideas and feelings during interaction, including the functionality experience and emotional experience that product provided to the user, user experience is highly subjective.

User experience is process that cognition something from outside to the inside, it is a mixture of behavior and emotions, so it is emotional. For the users that in the cultural background, if there is accurate mapping relationship between interface design elements and cultural mental image, whether this visual effect will let users feel more familiar, pleasure and produce a better user experience feelings, which it is worth to exploring.

3 Experiment I—Test Between Culture Mental Image and Design Elements

The first stage is to collect sample and culture image vocabulary, we extensively collect government websites at domestic and abroad, classify the sample according to the style, color, layout, characteristics, and the reference expert select typical

sample in each category for the final sample. Next is to deal with the samples, the purpose is to set a one-to-one correspondence between web design elements and sample.

Each factors including different categories and forms, the main performance of the web elements including page layout, color, page content, etc., in this paper, each design elements can be divided into three categories, such as A design elements for the "layout", About three kinds of features are: A1, frame type, A2. Top and bottom frame type, A3. Integrated framework, such as these, these are the design elements of the specific characteristics of the corresponding to each sample. And then the collection and selection the vocabulary which can reflect culture image.

3.1 Material: Mental Image Vocabulary and Samples

Widely collect vocabulary related to web design and cultural image, and selected 32 groups of vocabulary, then print them into the image form and make a 5 point scale questionnaire, from 1 to 5 points in turn represent "completely unable to express web interface style", "can't express web interface style", "general", "comparison can express web interface style", "completely can express web interface style". The participants according to image vocabulary evaluate the web interface style with scale level.

Eight male subjects, twelve female subjects, they are between the ages of 21 and 30, 15 participants from industrial design major, the other five students from non-industrial design professional, after test statistics, we select the following 12 groups of mental image vocabulary as shown in Table 1.

We collect many website interface at home and abroad, including government agencies, research institutions, universities and other sites, finally collected 118 screen-shots of the home page. The four kinds of layout of the interface as classification criteria, 118 websites can be divided into four categories, each category selected four typical samples, at last we select 16 different style websites, used as a research sample, as shown in Fig. 1.

Table 1 Groups of mental image vocabular

No.	Mental image	No.	Mental image	No.	Mental image
1	Elegant–Vulgar	2	Mechanical–Lively	3	Modern–Classic
4	Plain–Gorgeous	5	Popular–Personality	6	Monotonous–Rich
7	Rough–Delicate	8	Conflict–Harmonic	9	Local–International
10	Crowded–Sparse	11	Tolerance–Single	12	Heavy–Light

Fig. 1 Select part of the samples

3.2 Sample Analysis

The elements of web design has been summarized and classified by a lot of professional designers, each factors including different categories, each category has different forms. The main forms of the web interface elements including page layout, color, page content, banner, each design element has different characteristics, and these specific category can correspond to any samples (Table 2).

We analyze the design elements of the 16 samples, summing up the categories of them in each design element, the category with the letters and Numbers, the following is a former seven samples (Table 3).

Table 2 Website design element category

Design elements	The specific category		
A. Layout	A1. Left-right structure	A2. Up-down structure	A3. Comprehensive structure
B. Color hue	B1. Cold	B2. Warm	B3. Neutral
C. Page content	C1. More	C2. Less	C3. Moderate
D. Banner	D1. Large image	D2. Small image	D3. No banner

Table 3 Sample design element analysis

Design element / Sample	A. Layout	B. Color hue	C. Page content	D. Banner
1	A2	B1	C1	D2
2	A2	B1	C2	D1
3	A1	B1	C3	D2
4	A3	B2	C3	D1
5	A1	B1	C1	D1
6	A3	B2	C2	D1
7	A3	B1	C2	D1

3.3 Task and Procedure

Screening out of 12 images of vocabulary and 16 representative samples as experiment material, made 7 levels of semantic differential method questionnaire, for example, "Classical–Modern", participants choose to the left of the rating indicates that the samples are more inclined to "Classical" style, more to the right rating indicates that the sample more inclined to the style of "Modern".

3.4 Result

We put the questionnaire data input SPSS statistical software, the following Table 4 is the average scores of each sample about cultural image words (score range: −3 on behalf of the left image, 3 on behalf of the image on the right side, 0 for moderate), the following is a former seven samples.

Based on the average score of cultural mental image, establish a corresponding relationship between design elements and the cultural mental image. The purpose of analysis is to establish multiple linear regression equation of each mental image. Equation: represents a certain image prediction score value (that is the mental image number axis location on [−3, 3]), represents the value of each design element (0 or 1), the coefficient of is looking for. Data analysis method is Quantitative I theory and multiple regression analysis.

Establish reaction matrix [1 representative belong to this kind of item, 0 representative does not belong to this kind of item (Table 5)].

Establish Normal system of equations to a certain mental image, by the least square theory, available equation:

$$X^T XB = X^T Y \tag{1}$$

Table 4 The average score of cultural mental image

Sample / Mental image	1	2	3	4	5	6	7
Elegant–Vulgar	0.1875	0	−0.937	−1.562	−0.125	−2.562	−0.432
Mechanical–Lively	−1.25	1.25	0.187	0.687	1.562	1.437	−0.062
Modern–Classic	0.0625	1.562	0.937	0.687	1.562	2.125	1.125
Plain–Gorgeous	−1.125	0.812	−0.25	0.687	0.875	−0.18	−0.125
Popular–Personality	−1.687	0.812	−0.5	0.875	1.25	1	−0.375
Monotonous–Rich	−0.875	0.812	−0.187	0.625	1.687	−0.875	0.375
Rough–Delicate	−0.187	1.5	0.625	1.437	1.312	1.437	0.937
Conflict–Harmonic	0.5	1.375	1	1.562	1.625	1.812	1.437
Local–International	−1.687	1.812	1.125	1.5	1.75	1.75	1.062
Crowded–Sparse	0	−0.687	−0.312	−0.437	−0.75	−1.062	−0.562
Tolerance–Single	1.5	−0.187	1	1.125	0.812	0.812	0.875
Heavy–Light	−0.687	0.5	0.687	0.937	1.437	2.062	0.312

Table 5 The reaction matrix

Design element / No.	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3
1	0	1	0	1	0	0	1	0	0	0	1	0
2	0	1	0	1	0	0	0	1	0	1	0	0
3	1	0	0	1	0	0	0	0	1	0	1	0
4	0	0	1	0	1	0	0	0	1	1	0	0
5	1	0	0	1	0	0	1	0	0	1	0	0
6	0	0	1	0	1	0	0	1	0	1	0	0
7	0	0	1	1	0	0	0	1	0	1	0	0

X is the above reaction matrix, Y is the sample of this image for experimental measurement vector, and B is the need of solving the regression equation coefficient vector.

This system of equations with an infinite set of solutions, it can be find any a set of feasible solution and do the normalized processing, the result was the only

answer. Get coefficient vector B, and then we can selected biggest coefficient of all which in the category of each design element, it is one of the largest coefficient of design elements impact on the mental image. Experiment found the mapping relationship between cultural mental image and design elements. Take following three groups of cultural mental image vocabulary as examples.

"Plain–gorgeous" mental image vocabulary, the regression equation is:

$$\hat{Y} = 0.0491 + 0.1840A_1 + 0.5918B_3 + 0.2449C_3 + 0.5606D_1 \quad (2)$$

Meaning neutral or mixed color, big Banner, moderate page content, left-right structure can lead to more "gorgeous" mental image.

"Popular–Personality" mental image vocabulary, the regression equation is:

$$\hat{Y} = 0.0893 + 0.1920A_1 + 0.4997B_3 + 0.0231C_2 + 0.7474D_1 \quad (3)$$

Meaning great Banner, mixed color, left-right structure, less page content will cause more "personality" mental image.

"Heavy–Light" mental image vocabulary, the regression equation is:

$$\hat{Y} = 0.4955 + 0.4044A_1 + 0.3864B_3 + 0.1694C_2 + 0.5934D_1 \quad (4)$$

Meaning big banner, up-down structure, neutral or mixed color, more less page content will cause "light" mental image.

The data illustrated that: the style image experiment makes subjectivity, randomness and fuzziness of implicit cognition into dominant design direction, experiment found the mapping relationship between cultural mental image and design elements, every culture mental image vocabulary has the corresponding design elements of the form. This can make a design element to match the user's cultural cognition, finally meet user's expectations of the cultural connotation and style of the website image.

4 Experiment II—User Experience Study

The second stage is user experience experimental study, first we tested in accordance with the scale of semantic differential method, subjects according to the mapping relationship of design elements and the cultural mental image to evaluate. Then combined with the results of the mapping of cultural images and design elements to utilizing the cultural elements into government websites design project in varying degrees. The independent variable are "No Utilization", "Natural Utilization" and "Strong Utilization", the control variable are "interface layout",

"page color", "page content volume", the dependent variable are user experience and feedback time.

We only accept references written using the Latin alphabet. If the title of the book you are referring to is in Russian or Chinese, then please write (in Russian) or (in Chinese) at the end of the transcript or translation of the title.

4.1 Material

According to the analysis of the government website features and task flow, we determine the user's main operations and functions in government Web site. The results are as follows: when Users browse government websites, the operation and functions includes browsing news, viewing policy information, doing business and participating discussion. This results will serve as material of experimental II. Participants need to complete 4 tasks on 3 different kinds(which is "No Utilization", "Natural Utilization" and "strong Utilization") of government website interface, and then fill in usability model test subject for recording data of the user experience (Fig. 2).

4.2 Result

The way cultural elements utilizing have a significantly affect relationship with "satisfaction of the way cultural utilizing," "naturalness of the way culture utilizing," "interest of interactive", and we also found that "comprehensible of the Feedback" and "memorable" is irrelevant.

Five coefficients perform best in the Natural Utilization condition, perform worst in the no Utilization condition, (Fig. 3). This shows that despite the integration of cultural elements leads to clarity of feedback reduced, but enhance the other aspect experience of participants.

Fig. 2 The experiment task type

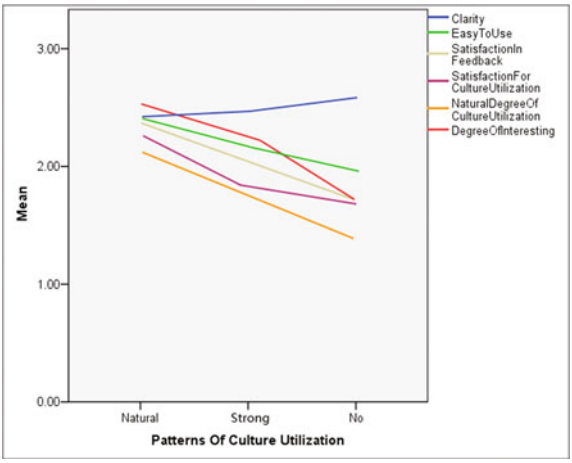

Fig. 3 Relationship between ways of culture utilization

5 Conclusion

The results showed that the mental image experimental transform 'subjectivity of users', 'randomness' and 'fuzziness tacit knowledge' into explicit design direction, so we can get the mapping relationship between design elements and government culture mental image, this result can be able to help designers selected design elements more accurately and quickly to maintain the user's cultural needs. At the same time, experiments also proved that naturally utilizing cultural elements into the government website interface design will enhance the user's awareness of website properties. And it is possible to make the user feel more pleasant, more interesting, enhance the user experience of the site. Part of the data also show that, cultural element utilizing have some negative effects on user experience, such as adding a certain amount of cognitive load which caused by the unfamiliar.

Acknowledgments This paper is supported by the HUST high-level international curriculum projects and the Fundamental Research Funds for the Central Universities HUST: (2014QN017).

References

1. Marcus, A.: Cross-cultural user-interface design. In: Smith M.J., Salvendy G. (eds.) Systems, Social and Internationalization Design Aspects of Human-Computer Interaction, pp. 502–505. Volume 2 of the Proceedings of HCI International 2001, New Orleans, Louisiana, USA, 5–10 Aug 2001
2. Mushtaha A., De Troyer, O.: Cross-Culture and Website Design: Cultural Movements and Settled Cultural Variables (2009)
3. Smith, A., French, T., Chang, Y., McNeill, M.: eCulture: Acomparative study of eFinance web site usability for Chineseand British users. Designing for global markets. Conference (6th 2001). In: Day, D., Duckley, L. (eds.) Proceedings of the 3rd International Workshop

Internationalisation of Products and Systems, pp. 87–100. The Open University, Buckinghamshire (2001)
4. Jianghua, X., Zhang, M.: Reconstruction of Chinese traditional cultural symbol in product design. Packaging engineering, classification codes TB472(2007)
5. Luo, S., Pan, Y.: The perceptual imagery theory in product design, technology and application research. Chin. J. Mech. Eng. (2007)
6. Yang,Y., Tian, L., Zhang, Y.: Handheld mobile device interface design based on user mental models. J. Zhejiang Univ. (2007)
7. Hoft, N.L.: Developing a cultural model. In: Del Galdo, E.M., Nielsen, J. (eds.) International Users Interface, pp. 41–73. Wiley, New York (1996)
8. Moeslinger, S.: Technology at Home: A Digital Personal Scale. CHI 97 Electronic Publications: Formal Video Program (1997)
9. Daniel, L.: Understanding user experience. Web Tech. Press **5**(8), 42–43 (2000)