Research on Visual Communication of Cultural Symbols Based on Central Composite Design Methodology

Qiyuan Lu
Lanzhou City University, Lanzhou 730070, China

Abstract

In the Internet information era, the novel design of web UI (user interface) plays an important role in satisfying users with good browsing experience. The visual communication of traditional cultural symbols can effectively attract users. It is of positive significance to combine the two effectively and increase the visual communication effect of traditional cultural symbols in web design. To this end, this paper uses the method of empirical analysis and selects 300 elements of traditional culture as samples to verify the visual communication effect of traditional cultural symbols integrated in web design. After the image processing algorithm is improved and optimized, the optimized star map registration makes the web UI design and the visual communication effect of traditional cultural symbols have a higher degree of fusion. The final experimental results show that the application of Dreamweaver 2013 and the optimized algorithm can effectively integrate the visual effects of traditional cultural symbols in web designing.

Keywords: Web Design, Traditional Culture, Symbol, Visual Communication, Research.

1. RESEARCH BACKGROUND

1.1 Literature review

In the digital age, the information dissemination industry is seeing a profound change. With the rapid development of technology, information dissemination may become the best media. Web design should focus more on the arrangement and classification of visual communication information, which is characteristic of web design and should be a basic quality that today's designers must possess (Djamasbi et al., 2010). Designers must get to know the internet and its characteristics better, in order to make their designs more suitable for internet communication. At the same time, with the aid of global Internet, the information dissemination of online media has broken the limitation of time and space with a broader development prospect. By analyzing the psychological activities of users from a psychological point of view, we can see that a relatively novel UI can greatly enhance the users’ experience. It is thus advised to take visual communication design as an entry point to set a better interface layout and splendid color matching (Lee and Koube, 2010). It is also advisable for designers to think about how to pursue the good aesthetic effect of interface design, make their designs better fit the users’ habits and aesthetic expectations and reduce their burden of thinking. However, web users are wandering among real and virtual communities, juxtaposed and mutually reflected, which leads to a broader degree of interaction. Moreover, designers should analyze the aesthetic needs and various visual components in web designing, satisfy users with better visual effect experience and make the visual information on webs manifested and conveyed more reasonably and effectively.

In general, webs can be designed with reference to traditional cultural symbols so as to come up with colorful and unique UIs. This requires that the cultural value conception of brands be deeply integrated under the premise of an accurate understanding of traditional culture so as to make information dissemination more convenient and industry-specific elements visually processed (Li and Dong, 2009). That is, designers are required to be well-informed with profound cultural heritage, and better understand the traditional cultural elements so as to make them perfectly united in artistic conception. For example, traditional formative arts can neither be like sculpturing nor be like drawing at will (Renzaho et al., 2008). When the atmosphere highlighted by traditional culture is hardly fused with the feelings of people, especially when it is difficult to meet their spiritual appeal, the decorative arts attached to the external forms can be vividly expressed. Especially in web designing, the visual communication of traditional cultural symbols can be integrated in the designing of web contents and interfaces, which can effectively enhance the browsing experience of users.

1.2 Research purposes

Based on the information dissemination function of web interfaces and the visual communication effect of traditional cultural symbols, an empirical analysis on the fusion effect between the two is designed. Based on a brief overview of the connotation of traditional cultural symbols, the paper puts forward the necessity of its application in web design. Grid system and central composite design methodology are applied to conduct an empirical analysis of the fusion effect of the two. The horizontal and vertical cross-projection method is used to determine the coordinates of the bounding quadrilaterals of star points; after the corresponding star point coordinates following the original star map transform are obtained, the final registration effect graph can be obtained according to the gray values of star points corresponding to these coordinates. In order to fully verify the effect of visual communication of cultural symbols integrated into web designing, this paper selects 300 traditional cultural elements as samples. After the image processing algorithm is improved and optimized, the optimized star map registration makes the web UI design and the visual communication effect of traditional cultural symbols have a higher degree of fusion. In addition, CUDA image algorithm program tests are conducted on the test objects, which are two different sets of landscape images of 1024x1024. The horizontal and vertical coordinate values of the two sets of images are obtained by entrance of the values of \( t_\theta \), \( \cos \theta \) and \( \sin \theta \) into Dreamweaver 2013. Calculation is made with computers to obtain two sets of latest data. The final experimental results show that the application of Dreamweaver 2013 and the optimized algorithm can effectively integrate the visual effect of traditional cultural symbols in web designing.

2. THEORETICAL ANALYSIS ON VISUAL COMMUNICATION OF CULTURAL SYMBOLS IN WEB DESIGNING

2.1 Theoretical connotation of visual communication of traditional cultural symbols

The main connotation of visual communication of design lies in designing with the shapes and element information in sight. The visual communication technology was introduced from abroad last century (Zografos, 2010). In other words, visual communication design is an enhanced expression of graphic design. In the field of web designing, visual communication is demonstration of all information needed for communication based on visual elements, that is, visualizing and formalizing the contents of information conveyed (Lissitsa, 2015). In the digital age, modern web interfaces have more generalized forms compared with traditional ones (Lee, 2011). The aim of graphic design is to convey the information people want to express, but the information that graphic design expresses has some limitations, which are manifested in terms of text, picture form and color, etc.; graphic design is of the static category (Tsethlikai and Rogoff, 2013). In web designing, based on the digital characteristics of visual communication means, the information dissemination of web design should not only be limited to traditional graphic design, but also be more colorful (Tian, 2014). This phenomenon is mainly manifested in the following aspects. Firstly, the dynamic effects of video interfaces have enriched web designing; secondly, video interfaces can be converted and linked, and each video interface has its own combination of visual elements to provide a new kind of information for web design (Duncan and Eero, 2012). Moreover, the converted and linked video interfaces can help to build a three-dimensional structure for the visual communication and information dissemination of web design, thus enriching the online information dissemination. In general, the effective integration of visual communication technology in web designing can enrich the manifestation forms of web design and optimize web design methods.

3. EMPIRICAL ANALYSIS ON THE FUSION EFFECT OF THE VISUAL COMMUNICATION OF CULTURAL SYMBOLS WITH WEB DESIGN

Attention should be paid to such problems in web UI layout design as how to improve the aesthetic effect of interfaces so as to satisfy users with better visual experience and improve the quality of communication. The author believes that grid system and central composite design methodology can be applied as an essential method, which can make feasible the fusion of web UI design and cultural symbols and further enhance the visual effect. An empirical analysis is made below on the fusion effect of the two.

3.1 Construction and operation of fusion equation

It is designers’ main task to strengthen visual process layout design according to users’ visual recognition modes. They are supposed to put the main information in the right places, in order to arouse browsing users’ interest. In general, web UI design needs to use traditional cultural symbols reasonably. Only in this way can the primary and
secondary contents of information be reasonably arranged to adapt to users’ sight. Technical measures can be taken to establish a visual center. Specifically, vertical and horizontal cross-projection methods are used to determine the positions of cultural image symbols according to centroid points. Moreover, the least square method is used to measure matching points and calculate Rotation Parameter R and Translation Parameter T. Determine the matching point for Point i according to the following equation:

\[
\begin{bmatrix}
X_i \\
Y_i
\end{bmatrix} = \begin{bmatrix}
\cos \theta & \sin \theta \\
-\sin \theta & \cos \theta
\end{bmatrix} \begin{bmatrix}
X_i \\
Y_i
\end{bmatrix} + \begin{bmatrix}
t_x \\
t_y
\end{bmatrix}
\]

(1)

Wherein, x and y are the horizontal and vertical coordinates of the \(i^{th}\) corresponding point in the original star map, while \(X_i\) and \(Y_i\) are the horizontal and vertical coordinates of the \(i^{th}\) corresponding point in the star map to be registered. In the specific web UI design, it is required to analyze the visual flow characteristics of people, based on which information contents are to be arranged. Web interface layout should be designed according to these contents, and visual flow experience should be done so as to enhance the visual effect of web elements and achieve the purpose of information dissemination. Therefore, Equation (1) can be decomposed into the following two equations:

\[
g(F) = (x - i)(g(D) - g(C)) + g(c)
\]

(2)

\[Y_i = t_y + (-\sin \theta) \cdot x_i + \cos \theta \cdot y_i
\]

(3)

For Equation (1), make \(a = t_x\), \(b = \cos \theta\) and \(c = \sin \theta\), and we will get the following equation:

\[x_i = a + b \cdot x_i + c \cdot y_i
\]

(4)

The values of Parameters a, b and c are the minimum values of the following error function:

\[E_x = \sum_{i=1}^{N}(a + b \cdot x_i + c \cdot y - X_i)^2
\]

(5)

Take derivatives of a, b and c with Error Function \(E_x\), make them zero, and we can get the following matrix function:

\[
\begin{bmatrix}
\sum_{i=1}^{N}1 \\
\sum_{i=1}^{N}x_i \\
\sum_{i=1}^{N}y_i
\end{bmatrix}
\begin{bmatrix}
a \\
b \\
c
\end{bmatrix} = \begin{bmatrix}
\sum_{i=1}^{N}x_i \\
\sum_{i=1}^{N}x_i \cdot x_i \\
\sum_{i=1}^{N}x_i \cdot y_i
\end{bmatrix}
\begin{bmatrix}
a \\
b \\
c
\end{bmatrix}
\]

(6)

Run Equation (6) to obtain the values of \(a\), \(b\) and \(c\), and then we can obtain the values of \(t_x\), \(\cos \theta\) and \(\sin \theta\). By using Rotation Parameter R and Translation Parameter T obtained in the least square method as described above, the corresponding star point coordinates of the original star map after rotational translation can be obtained. After the corresponding star point coordinates following the original star map transformation are obtained, the final registration effect graph can be obtained according to the gray values of star points corresponding to these coordinates.

### 3.2 Effect test of matching between web design and the visual communication of cultural symbols

In order to more fully verify the visual communication effect of cultural symbols integrated in web designing, this paper selects 300 elements of traditional culture as samples. The verification process is described as follows: Set X as all training sample images - scale 600, and Y represents the sample type identification set; since it is a binary classification problem, set \(Y = \{ -1, +1 \}\), make the web UI interface be 1 and the symbols of traditional culture elements be -1. \(S = \{(X_i,Y_i) | i = 1, 2, ..., 600\}\) is the training set, in which \(X_i\) is the image of each training sample and \(Y_i\) is the corresponding classification label. \(E\) denotes the average identification errors of all the samples in the training set, and \(\sigma\) is the error threshold set in advance. When the training error is less than \(\sigma\), the training is stopped.

(1) Initialize weights for 600 samples, and initially assume that the weights for all samples are equal: \(Wt (i) = 0.001\), where \(Wt (i)\) represents the weight assigned to Sample \((X_i, Y_i)\) during the \(t^{th}\) iteration.
(2) while \( E > \sigma \), classify all the samples in Training Set S by using Weak Classifier \( c_t \) obtained in subset training. Make

\[
\alpha_t = \ln[(1 - \varepsilon_t)/\varepsilon_t]/2
\]

Wherein, \( \varepsilon_t = Pr_l - W_l \) and \( (h_l(X_l) \neq Y_l) \); the weight for each sample is renewed according to \( \alpha_t \) as follows:

\[
W_{t+1}(l) = \frac{w_t(l)}{\varepsilon_t} \times \begin{cases} e^{-\alpha_t}, & H_l(X_l) = Y_l \\ e^{\alpha_t}, & H_l(X_l) \neq Y_l \end{cases}
\]

The above experimental results show that, after the image processing algorithm is improved and optimized, the web design UI interface is better fused with the visual communication of traditional cultural symbols. The optimized star map registration makes the accelerating effect of final registration effect graph more delicate and clearer.

### 3.3 Matching process and result analysis

WEB standards of the new generation have proposed new web design concepts, that is, making feasible the separation of form and content mainly by use of "DIV + CSS" layout, and, on this basis, enhancing the functionality of webs, since the form is no longer the focus of the users’ attention. Therefore, in order to serve the contents and sections, web designers should optimize the framework of UI design, and then hierarchically arrange the framework and layout according to the contents, which will make the web structure clearer and the layout more flexible. In this environment, CUDA image algorithm program test is performed on the test objects, which are two different sets of landscape images of 1024x1024. The horizontal and vertical coordinate values of the two sets of images are obtained by entrance of values of \( t, \cos \theta \), and \( \sin \theta \) into Dreamweaver 2013 and entrance of two sets of image data into Equations (2) and (3). Calculation is made with computers to obtain two sets of latest data. Therefore, serial executions and CUDA values are listed in a sheet to form a sharp contrast. The test results are as follows:

<table>
<thead>
<tr>
<th>Performance</th>
<th>Serial Execution /ms</th>
<th>CUDA Execution /ms</th>
<th>Acceleration Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star point detection</td>
<td>678.211</td>
<td>16.576</td>
<td>46.114</td>
</tr>
<tr>
<td>Star point match</td>
<td>345.971</td>
<td>29.045</td>
<td>15.364</td>
</tr>
<tr>
<td>Total time</td>
<td>1400.245</td>
<td>50.244</td>
<td>30.154</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance</th>
<th>Serial Execution /ms</th>
<th>CUDA Execution /ms</th>
<th>Acceleration Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Star point detection</td>
<td>726.541</td>
<td>23.154</td>
<td>40.145</td>
</tr>
<tr>
<td>Star point match</td>
<td>340.124</td>
<td>29.077</td>
<td>15.124</td>
</tr>
<tr>
<td>Total time</td>
<td>1301.187</td>
<td>49.641</td>
<td>29.721</td>
</tr>
</tbody>
</table>

As indicated in Table 1 and Table 2, there can be a comparatively wide gap between the registration results of the two sets of star maps. The serial execution of the total time in the optimized algorithm is shortened by 99.058/ms, and the CUDA execution is shortened by 0.603/ms. It is obvious that the application of Dreamweaver 2013 and the optimized algorithm can effectively integrate the visual effect of traditional cultural symbols in web designing.

### 4. CONCLUSION

With the diversified development of various media, information dissemination and promotion has been accelerating accordingly, which can lead the media environment towards a new direction of development. As a manifestation of emerging media, web design affects the way in which people behave with the ways in which information spreads. The visual communication effect of traditional cultural symbols is relatively good. It is the key of web interface design and also the purpose of the paper to fully integrate the two to satisfy users with better browsing experience. In order to make these functions possible, you should classify the existing information, and then use the associated cultural visual symbols to optimize, so that consumers can quickly get the information...
they need. In addition, web information can also be conveyed in visual, auditory and other means to enhance the efficiency of information dissemination. It is especially important that users’ interactive experience of web interfaces should be emphasized and the universality of user operation taken into account, based on which interactive tools shall be set so that users can interact with merchants in a timely manner.

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