

# Interface Design Effects on Webpage: A Theoretical Study and Website Evaluation

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**Abstract**—Interface design influences the usage of website. Once the users feel comfortable about the interface they will be more likely to visit and stay with the website. For its significance, this research aims at evaluating website interface and ascertaining the factors affecting the usage of the site. The evaluation was performed on a website built for promoting an ancient culture heritage place, the Phoenix town in China. Based on a theoretical framework for website interface evaluation developed by the authors, 20 users were interviewed with the questions about the usability and visual attractiveness of the Phoenix town website. The results indicated that users were generally satisfied with the interface design of Phoenix's website. Besides, how interface design affected the usage of website was identified. The easy operation for a website was determined by its navigation, link, button, layout and style, while the abundant and clear design on image and text improved the acceptance by the users and encouraged more of their activities on the website.

**Index Terms**—interface, usability, visual attractiveness, website evaluation

## I. INTRODUCTION

About the webpage, interface design has the potential to change users' behaviors. These changes will result in users either leaving or revisiting the website. Based on the same function and content, the browse sometimes is preventing by the operation, while the design style will also hamper users' browse. For reducing users' frustration on webpage, some scholars have proposed the design principles for web makers; the popular one is how to cut down people's thinking times, which was raised by Krug [1]. But how users' responses are consistent with the expectation from web makers and which factors are mainly impacted the browse of website, are needed for the systematic evaluation. To address this issue, this research provides a theoretical way to evaluate the interface of website, and then explore the relationship among various compositions of interface. That can identify the visual factors affected on the usage of website.

For achieving the aim, a website with distinct cultural characteristics was firstly selected as testing object, which would be benefited for identifying users' preferences under the influence of culture. Phoenix's

website was designed for an ancient town in China; and this town is originated from BC5500 where owns a long history and cultural characteristics [2]. In this paper, the evaluation was implemented on Phoenix's website; and a framework was developed for the evaluation of the interface. The classification of interface factors was composed of this framework, which would profit to make a systematic analysis on website interface. Based on this framework, the research developed a theoretical method for the assessment.

Supported by the theoretical method, the process provides a systematic way for designers to test the preferences from users. And what interface factor was mainly responsible for the effect on website usage, was found out in the result. The primary motivation behind this study is to improve the web interface design, also this study try to enrich the related literatures about web interface design, like the experience of interaction. The paper eventually promotes the consistency of interface design between users and web makers.

## II. LITERATURE REVIEW

### A. Website Interface

The interface as the surface of website is directly displayed for users. The quality of interface design is the main responsible for users' revisiting the website. A good design will improve the revisiting rate. Then, what is the "good" interface design for a website? In the academic area, scholars sum up some principles for the website and there are also some evaluation methods for testing the interface design. Hartmann, Sutcliffe and Angeli (2008) design an evaluation system on the judgment of aesthetics and interface quality [3]. Their research content is comprehensive including the usability, functionality, engagement and so on, but there is no specific discussion on the composition of web interface. Moreover, though discussing about the design features, layout elements and users' perception, Altaboli and Lin (2011) provide an approach to assess the visual aesthetics of website interface [4]. Although their research provides an evaluation way, the factors affected on the web interface are not clearly identified. In my research, the evaluation is based on the composition of web interface, and aims to identify the factors effects on the usage. About the composition of web interface, Sherson's definition can be the reference for this study. Sherson (2002) proclaims

that the website interface is concerning to how well the site assists users to achieve their goals, and how effectively the site communicates visually [5]. In this description, it means that the interactions with users and visual elements displayed on screen have the strong relationship on interface design. Based on the principle, the assessment of website interface in this research would be mainly presented by usability and visual attractiveness.

### B. Usability

The term of usability seems to be defined elusively by different researchers. The different viewpoints have led to different definitions and standards. In this study, it focuses on the website interface. Scholar Benbunan (2001) describes that the website usability is concerning to how well and how easily a user, without formal training, can interact with an information system of a website [6]. For the specific statement, Quesenberg (2003) considers it as the extent to achieve tasks with effectiveness, efficiency, satisfaction, error tolerance and easy of learning by users [7]. Based on the two definitions, the usability in this study could be deemed as the interaction between users and website interface, which was composed of effectiveness, efficiency, satisfaction, error tolerance and learn ability. The effectiveness means the accuracy with users' operations on the website, while the speed of operation reflects the efficiency. The error tolerance is relating to how the interface can help users recovering from the error.

### C. Visual Attractiveness

The influence of visual attractiveness in website context is obvious. Under the same contents and functions, the aesthetics design can improve the revisiting rate of users. For the website, the visual aesthetics represents the appearance of website interface; the attractiveness comes from each element of the interface. According to Alsudani and Casey's description, the visual attractiveness is composed of two parts; one part looked at a web page as pure individual factors like color, design, pictures, video clips, flash animation and so on [8]. The second part looked at a web page as relationships between individual elements that form the whole visual composition of a web page. This principle was referenced in my study; the attractiveness was finally tested through some design elements.

## III. METHOD

According to the principle mentioned above, the framework of assessment in this research was mainly presented by usability and visual attractiveness. Users' operations and interactions with webpage constitute the usability, while the visual attractiveness is concerning to design elements. Fig. 1 shows the theoretical framework. The research process in this paper was divided into 3 parts: usability assessment, aesthetics assessment and relationship discussion. Phoenix's website as the research object was discussed mainly through users testing and interviews. What's more, this website mainly serves

Chinese users, hence 12 general users and 8 designers from China would be invited to participate in the interview; each participant performed some activities on Phoenix's website. After that, questionnaires were issued with users and designers respectively. For the relationship discussion, some web terms needed to be described the visual aesthetics. Designers as the web experts, who are familiar with these terms, were invited to ask for the relationship discussion. Hence, questionnaires designed for users only included the assessment between usability and visual attractiveness, while the relationship discussion was added in that of designers.

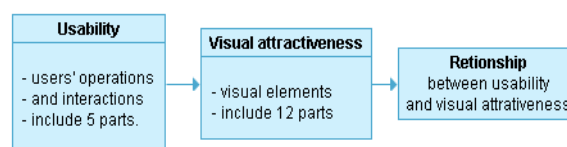


Figure 1. A framework for the evaluation of web interface

### A. Assessing Usability of Phoenix's Website

Based on the Quesenberg's definition, the evaluation of web usability would concern to 5 points (effectiveness, efficiency, satisfaction, error tolerance and learn ability). For my research, 12 statements were designed to express these 5 points respectively. Finding the introduction and users' messages of phoenix town and assessing the navigation of web reflect the effectiveness of Phoenix's website; while the efficiency was explored through evaluating the speed of website and links; Users' emotion, the ability of operation and 404 pages were respectively represented with satisfaction, learn ability and error tolerance. Each statement owns a value; participants indicated level of their agreements with the statement on a five-point scale of "Strongly disagree" to "Strongly agree". After that, participants were required to identify the important and dispensable statements for a tourism website. Each important statement would obtain the value of 1, while the dispensable one would gain the value of -1. The purpose was to sequence the 5 points of usability. Which point is most important for users? While which point is most necessary for users? Finally, the mean and standard deviation would be adopted to analyze the data of assessment and sequence.

### B. Assessing Visual Attractiveness

In this research, visual attractiveness could be tested through the aesthetic design on interface. According to Phoenix's website, the aesthetics design here included 12 elements (text, image, icon, menus/list, link, video, button, line, form, space, layout, style). Participants were required to express broadly their first impressions on the website, and then participants' evaluations on 12 design elements were designed respectively in the questionnaire. The participants were required to select the attractive elements and expressed their agreement with some statements of design elements. Each selection and agreement would gain the value of 1 respectively. For the

result, the elements would be graded based on the sum of final data.

C. Identifying the Relationship between Web Usability and Visual Attractiveness

In this part, only designers were invited to interview. 6 questions about web usability were developed to find out the causal link among design elements. Which factor of usability was strongly decided by aesthetics design? The questions were related to the 5 points of usability, and the options for each question were same, all including 12 design elements (text, image, icon, menus/list, link, video, button, line, form, layout, space, style). The designers were needed to select the related elements for each question. For each question, the selected element would gain the value of 1 individually. The purpose of this part was to discuss the relationship between the 5 points of usability and the 12 interface elements of visual attractiveness.

IV. RESULTS

From the interview, it could be seen that participants were aged from 24 to 30, and the life of Internet usage was lasted from 5 years to 14 years. The participants were all familiar with the Internet. The demographic information was consistent with that of original design. Hence, no one's response was removed in this research.

As the measures mentioned above, the usability of Phoenix's website was firstly assessing; each point of usability owned a score from 1 to 5. From Table I, it could be seen that the largest mean was 4.65 which showed in learn ability; the learn ability of Phoenix's website gained the highest agreement by participants. The next sequence is effectiveness, satisfaction, efficiency and error tolerance. The error tolerance gained the lowest agreement among these 5 points; the mean value only reached to 3.18, and the minimum (1.50) also represented in error tolerance. Concerning the fluctuant degree, participants' comments on learn ability were more consistent than that on other 4 points, the standard deviation (SD) of it gained the lowest score: 0.40066. Contrary to learn ability, the comments on error tolerance were most diversity from users, the SD arrived at 1.23837.

TABLE I. THE SCORES OF 5 POINTS OF USABILITY

Usability	Minimum	Maximum	Mean	Standard deviation
Effectiveness	3.33	5.00	4.40	0.47929
Efficiency	2.67	5.00	3.72	0.70207
Satisfaction	2.50	5.00	3.98	0.81878
Error tolerance	1.50	5.00	3.18	1.23837
Learn ability	4.00	5.00	4.65	0.40066

After the assessment, the sequence of usability was found out through the comparison. Table II displayed the important and dispensable points distinguished by participants. The largest mean represented the most important factor of usability for users. Through the mean value, the effectiveness one was the highest, but the dispensable vote of efficiency gained 0, while that of effectiveness gained the value of -2.33. What's more,

Means of effectiveness and efficiency were higher than that of the remaining three points. Hence, it was suitably defined the effectiveness and efficiency as the same importance for users, and also the most concerns were both effectiveness and efficiency in web usability. The satisfaction and learn ability were the second important for users; the error tolerance was the most dispensable one.

TABLE II. THE COMPARISON BETWEEN IMPORTANT AND DISPENSABLE POINTS

Usability	Important	Dispensable	Mean
Effectiveness	12.33	-2.33	10.00
Efficiency	9.00	0.00	9.00
Satisfaction	3.00	-2.00	1.00
Error tolerance	2.50	-3.50	-1.00
Learn ability	2.50	-1.50	1.00

Concerning the visual attractiveness, the first impression by users was expressed based on two questions: whether the design style of website matches with the characteristic of Phoenix town or not? How the design style is interested by users? From Fig. 2, "A" presents the result of the first question and "B" presents the second one, it seems that participants were commonly satisfied with the aesthetic design of Phoenix's website; the website owned the certain visual attractiveness. There were 11 people said "yes" with the consistency between the design style and the features of Phoenix town; 9 people were interested in the design style. On the contrary, no one disagreed with the consistency, only 3 people were not interested in that. Specific to the assessment of design elements, Fig. 3 displayed the final result. As the method mentioned above, each selection and agreement from users would gain the value of 1 respectively. According to their values, the design elements were graded into 3 groups. The highest one included the image, icon, link, button, menus/list; the range lasted from 9.5 to 16. It represented that most participants approved the design on image, icon, link, button and menus/list. The second selections were composed of text, layout, space, form; these four elements were generally liked by users. The attractiveness of line and video gain the lowest score, 1 and 2 respectively.

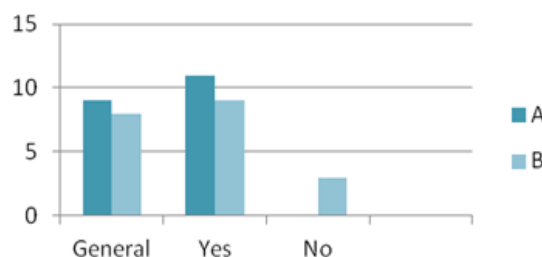


Figure 2. The assessment of visual attractive in general

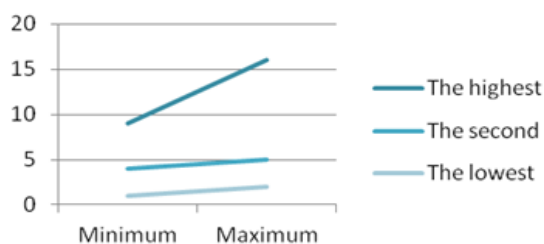


Figure 3. The assessment of design elements

After the evaluation of web usability and visual attractiveness, the relationship between these two factors of website interface was explored. In Table III, each score of elements was displayed here; it represented the degree

of influence on effectiveness, efficiency, satisfaction, error tolerance and learn ability. The highest value means the strongest relationship between the element and usability. Because there were 8 samples, the value less than 4 represented the weakness relationship in this research; only the value of element over the half of 8 samples was available. If the data were all less than 4, the maximum was selected. According to this principle, the design on text and image had the major impact on effectiveness, while the efficiency was mainly decided by the image, icon and design style. What's more, the link design is the main responsible for the satisfaction and error tolerance. The learn ability has the strong relationship with the menus/list, link, button, layout and style.

TABLE III. THE RELATED DEGREE BETWEEN USABILITY AND VISUAL ATTRACTIVENESS

Elements	Effectiveness	Efficiency	Satisfaction	Error tolerance	Learn ability
Text	4.0	3.0	2.0	2.0	2.0
Image	4.5	8.0	0.0	3.0	2.0
Icon	3.0	4.0	1.0	2.0	2.0
Menus/list	2.0	2.0	2.0	0.0	4.0
Link	2.5	2.0	3.0	5.0	5.0
Video	0.5	3.0	0.0	0.0	1.0
Button	2.5	0.0	1.0	3.0	4.0
Line	0.5	1.0	2.0	0.0	0.0
Form	2.5	0.0	2.0	0.0	0.0
Layout	2.5	1.0	1.0	0.0	5.0
Space	0.0	0.0	1.0	0.0	0.0
Style	1.0	4.0	0.0	0.0	4.0

To sum up, it can be found that the usability of Phoenix's website was generally satisfied by participant. Each point of usability gained the score over the half of maximum. The learn ability and effectiveness received the relatively high agreement. It presented that the interface of website was easy and simple to operate and these participants could find the information accurately on the website. On the contrary, for users, the interface design of Phoenix's website is less helpful to recover from the error. Concerning the necessity, the effectiveness and efficiency were the most important in a tourism website; finding the information accurately and quickly was the major requirement for users. About the assessment of visual attractiveness, participants were commonly satisfied with the aesthetic design of Phoenix's website; the website owned the certain visual attractiveness. Specific to the visual elements, image, icon, link, button and menus/list gained the high comments.

V. CONCLUSIONS

This research provided a theoretical method to evaluate the interface design of website. Through a framework, the web interface was divided into usability and visual attractiveness. In the result, 20 participants were generally satisfied with interface design of Phoenix's website; the usability and visual attractiveness were both acceptable. Particularly, participants could operate the website simply and find the wanted

information. About the visual comment, the designs on image, icon, link, button and menus/list were largely liked by users. Through the interviews by designers, the relationship between usability and visual attractiveness were identified. The abundant and clear design on image and text would improve the accuracy of users' activities on website, while the speed of users' activities was affected by the image, icon and design style. For the error tolerance and users' satisfactions would be benefited from the moderate links. The easy operation for a website was determined by its navigation, link, button, layout and design style.

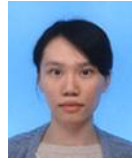
For the website interface, the makers can reference the evaluated way from this research. It benefits to improve the interface design, which may promote the consistency of interface design between users and web makers. Moreover, what interface factor is mainly responsible for the effect on website usage was identified through the relationship discussion. These principles from the result could be the design experiences followed by designers; designers may use these principles to adjust the work focus, the principles are not only suitable for tourism website, but other kind's websites. In addition, this study also enriches the related literatures about web interface design, including the experience of interaction and visual attractiveness.

About the limitations, it's also possible that the results could be somewhat different if more data are collected. In this research, 20 people were invited to be tested; the number was not relatively large. However, Nielsen (2000)

has proclaimed that 5 users were possibly to catch 85% problems on website [9]. Hence, 20 users seemed enough in this research. For the future work, other factors of visual attractiveness could be adopted to test the interface design, such as the balance, symmetry and so on. On the other hand, more websites may be selected to discuss the relationship between usability and visual attractiveness; the discussion can be compared with the result of this research.

#### REFERENCES

- [1] S. Krug, *Don't Make Me Think*, 2nd ed. U.S.A: New Riders, 2006, pp. 10-191.
- [2] Phoenix's Website. (June 2012). Available: <http://dtrc.sd.polyu.edu.hk/phoenix.html>
- [3] J. Hartmann, A. Sutcliffe, and A. D. Angeli, "Towards a theory of user judgment of aesthetics and user interface quality," *ACM Transactions on Computer-Human Interaction*, vol. 15, no. 4, pp. 15, 2008.
- [4] A. Altaboli and Y. Z. Lin, "Objective and subjective measures of visual aesthetics of website interface design: The two sides of the coin," *Human-Computer Interaction, Lecture Notes in Computer Science*, vol. 6761, pp. 35-44, 2011.
- [5] G. Sherson, "Website design principles: Researching and building a website evaluation tool," M.S. thesis, the School of Communications and Information Management, Victoria University of Wellington, 2002.
- [6] R. Benbunan-Fich, "Using protocol analysis to evaluate the usability of a commercial web site," *Information and Management*, vol. 39, no. 2, pp. 151-163, 2001.
- [7] W. Quesenbery, "The five dimensions of usability," in *Content and Complexity: Information Design in Technical Communication*, 2003, pp. 81-102.
- [8] F. Alsudani and M. Casey, "The effect of aesthetics on web credibility," in *Proc. the 23rd British HCI Group Annual Conference*, 2009, pp. 512-519.
- [9] J. Nielsen. (2000). Why You Only Need To Test With Five Users. [Online]. Available: <http://www.useit.com/alertbox/20000319.html>.



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