ESTABLISHING A QUANTITATIVE EVALUATION MODEL FOR CULTURE-BASED PRODUCT DESIGN

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ABSTRACT

Recent years have seen a rapid growth in the cultural and creative industries worldwide. The design quality of culture-based products, however, is relatively low for a lack of reliable methods of designing and evaluating them. This paper is aimed to establish a quantitative evaluation model for cultural-based product design. Firstly, keywords of the comments on selected culture-based products were obtained through web crawler, text abstraction, and literature review. Secondly, evaluation indicators on extracted were acquired through card sorting by experts, and weight score was obtained through questionnaires. Finally, the quantitative evaluation model was obtained through logistic regression analysis. The model proposed in this paper is helpful for designers to understand the development trend of cultural creative design and the important factors influencing cultural creative design.
Keywords: Cultural-based product, Quantitative evaluation model, Web crawler, Logistic regression

INTRODUCTION

The cultural and creative industries have been expanding rapidly worldwide, yet the design quality of culture-based products remains at a relatively low level. The creative design of culture-based products is featured with subjectivity, uncertainty, and complexity (Chandrasegarans K, Ramani K, Sriramr D, et al. 2012). Designers, consumers, and producers have a different understanding of the design outputs, and the decision-making and communication of related stakeholders are separated (Kelly K, 1994), therefore it is urgent to have relevant evaluation model in the cultural and creative industry. The design evaluation model can be helpful for establishing unified evaluation criteria in the design process. Its strategic guidance and systematic plan of design evaluation model can effectively lead to a distinctive design image for culture-based products. Currently, relative researches in the evaluation model are insufficient in China. This research aims at establishing a quantitative evaluation model for culture-based products and providing effective guidance for cultural creative designers. This research adopts data from web crawler, then obtain 5 evaluative indicators by card sorting, finally put forward the evaluation model of culture-based products with logistic regression analysis.

LITERATURE REVIEW

Culture-based products reflect cultural extension and materialization. For cultural protection, more and more designers participate in cultural and creative design. Donald Arthur Norman (Norman D A, 2015) believed that the design includes three layers: external layer (product color, texture, and design), middle behavior layer (operability, security, and functionality) and internal layer (special meaning of product, storytelling, and sentient involved).

Based on his research, the three layers can be made as the design connotation of culture-based products. The expression of design connotation should use reasonable way, which should not only realize cultural inheritance but also adapt to modern people's sentiment in life. On the whole, the characteristics of culture-based products can be summarized as uniqueness, territoriality, innovation, and added-value.

Jones pointed out that the design was composed of analysis, integration, and evaluation (Jones, 1992). Rosenman thought that design evaluation needed to compare the product with the expected result, in order to understand how to improve the design outcome (Rosenman M A, 1990). The above two scholars verified the necessity of design evaluation, and they believe the design evaluation can advance the iteration cycle of culture-based products and the sustainable development of the relative industries. Currently, there are few pieces of researches on the design evaluation model. For instance, Xu Zhixian et al. (Xu Qi-xian, Lin Rong-tai,2011) selected the representative samples of Taiwan's culture-based products and adopt quantitative to understand consumers' preferences, and the result showed that consumers paid more attention to product performance, texture, fashion, creativity, sustainability, storytelling, and regionalism. Rung-Tai Lin refined the design process of culture-based products by studying cross-cultural product cases, so as to explore how to establish design evaluation models (Lin Rong-tai, Liu Bang-chu, LI Ying-jie, 2010).

The scholars established the evaluation models of culture-based products from different analytical perspectives. In summary, their researches focused on extracting keywords from the design process of culture-based products and the product samples. But there are a few shortcomings in the research, such as single sample category, insufficient samples, and limited geographical selection. In view of the above analysis, the research of this paper is to discuss culture-based products at home and abroad and propose the evaluation model based on sufficient data.

METHODOLOGY

Firstly, this paper used web crawler for data collection. Secondly, some experts with 5-10 years' experience extracted the keywords from the thesaurus with card sorting and then concluded the evaluation indicators. Then, experts were requested to grade the samples of culture-based products in the form of questionnaires according to different indicators, so as to study the relationship between variables and culture-based products. Finally, the binary logistic analysis was utilized to analyze the data results, and rank the weight hierarchy (Roozenburg N F M,1995) of evaluation indicators, and establish the framework of the evaluation model.

DATA COLLECTION

By analyzing the classification of creative products by UNESCO and UNCTAD (UNCTAD,2018), this paper divided them into 4 categories: culture-based gift, office supplies, home accessories, and native products (wine, tea, and medical materials).

The research selected culture-based products above 4 categories as the research objects, which were published by the Palace Museum, the Taipei Palace Museum and the British Museum, and popularly and influentially in the field of cultural creativity at home and abroad. By crawling user comment keywords with Python toolkit(Liu X, Hu W,2018), this research provides real data support for the establishment of an evaluation model.

A total of 32,897 comments were crawled from the user's comments over the past year. Subsequently, the keyword extraction was carried out through the CRF algorithm(Nikolaos Korfiatis a, Marios Poulos b ,2013). Keywords with high frequency and strong characterization were selected, and the meaningless words (such as modal words, auxiliary words, prepositions) were filtered. Finally, 78 comment keywords were available from the 5000 words crawled.

DATA ANALYSIS AND RESULTS

1.Abstraction of core keywords

Due to the different meaning of the comment keywords, the method of card sorting was adopted for clustering analysis.

First of all, 20 graduate students majored in industrial design and 10 designers experienced in cultural and creative design for over 5 years were selected. 78 Cards labeled with the keywords were randomly distributed to 30 design experts, and the experts classified the keywords according to the semantic category. Then the classification result was discussed repeatedly until no objection exists. The statistical diagram of the thesaurus was shown in Figure1.

Through the comparative analysis of the core keyword, 5 evaluation indicators were finally defined. The indicator differs from each other largely, which reflects the cultural, innovative, experience and design of the culture-based products.

To sum up, 5 semantic words were selected as the evaluation indicators, including storytelling, humor, elegance, craftsmanship and novel appearance.

2. Weight analysis of evaluation indicators

This article firstly selected 90 kinds of culture-based products randomly from the well-known creative stores and forum sites for making the questionnaire survey. According to the picture of each product which was labeled with their processes, material and design source in the questionnaire, 15 products which were considered to be innovatively needed to be selected. Evaluation questionnaires were distributed to 50 design experts and 100 consumers, and 144 valid questionnaires were collected. Depending on the evaluations of the experts and consumers, the top 15 and the bottom 15 were used for the evaluation indicator weight score questionnaire.

Distributed the questionnaire of "product evaluation indicator weight score" to 30 design experts, who were required to give scores to five evaluation indicators with the five-point Likert scale. Finally, 28 valid questionnaires with 742 sets of data were collected in total, and these data were integrated for binary logistic regression analysis.

Storytelling	Humor	Elegance	Craftsmanship	Novel Appearance
Archaic Chinese Rhyme	Special	Quietly Elegant	Refined	Novel
Primitive Simplicity	Amusing	Graceful	Textured	Unconventional
Retro	Fascinating	Restrained	Excellent	Chic
Classical	Divertingness	Delicate	Lean	Fresh
Lasting Appeal	Interesting	Pretty	High-quality	Original
Historical Feeling	Distinctive	Polish	Legible	Creativive
Literature	Unique	Historical	Durable	Stereoscopic
Artistic Style	Humorous	Pure	Masterly	Etherealize
Culture	Witty	Magnificent	Exquisite	Flexible
Cultural Deposits	Antic	Elegish	Practical	Innovative
Moral	Fantastic	Tasteful	Pragmatic	Extraordinary
Feelings	Weird	Gentle	Comfortable	Unusual
Propitious	Absurd	Artistic	Ingenious	
Connotations	Vivid	Beautiful	Massy	
Inheritance	Lively	Gorgeous		
Cultural Heritage		Pure		
Cultural Continuity		Attractive		
Auspicious		Demure		
		Gracious		

[Figure 1] Thesaurus clustering under expert evaluation

The selection and scoring situations of the culture-based products were detailed in Table 1.

High Rank							Low Rank						
Products	Storytelling	Humor	Elegance	Craftsmanship	Novel-Appearance	Average score	Products	Storytelling	Humor	Elegance	Craftsmanship	Novel-Appearance	Average score
	4.1	4.3	2.7	4.1	2.9	3.62		1.6	1.4	1.5	1.5	1.5	1.50
	3.7	3.9	3.1	4.3	3.2	3.64		2.1	1.6	2.0	2.1	1.7	1.87
	3.6	3.3	3.3	3.8	2.8	3.36		1.9	1.7	2.2	2.0	1.9	1.93
	4.2	3.4	3.2	4.4	3.1	3.66		2.1	1.6	1.5	1.7	1.8	1.72
	4.3	3.9	3.9	3.2	2.9	3.64		2.7	1.7	1.6	2.0	1.6	1.90
	3.8	4.1	3.2	4.5	3.2	3.76		1.7	1.5	2.1	1.6	1.7	1.72
	3.9	4.0	3.5	3.8	3.2	3.68		2.5	1.5	2.1	2.3	1.8	2.03
	3.9	3.0	3.2	2.7	3.0	3.16		2.3	1.5	1.7	2.0	1.5	1.70
	4.1	3.3	3.5	3.3	2.9	3.40		2.3	1.5	1.7	1.8	1.8	1.81
	4.1	4.1	3.8	3.1	3.5	3.72		2.1	1.9	2.3	2.0	2.5	2.16
	4.2	4.2	3.1	4.2	3.6	3.86		2.0	2.0	1.7	2.0	1.6	1.83
	4.0	3.0	3.2	4.1	2.9	3.44		1.8	1.5	1.7	1.8	1.5	1.58
	4.1	3.3	3.7	3.4	3.4	3.58		2.0	1.5	1.8	2.1	1.5	1.75
	4.0	2.7	3.1	4.2	3.0	3.40		2.3	2.0	2.3	2.4	2.3	2.24
	4.2	3.5	3.2	3.3	3.6	3.56		2.1	1.5	2.2	2.2	1.7	1.95

[Table1] Sample data of cultural and creative products

3. Results analysis

Take innovation as the dependent variable, storytelling, elegance, novel appearance, humor, and craftsmanship as the independent variables to establish a binary logistic regression model. The regression analysis results in Table 2. It can be seen that the P value of novel appearance is more than 0.05, which shows that novel appearance has an undistinguished influence on innovation, the P values of storytelling, elegance, novel appearance, humor as well as craftsmanship are less than or equal to 0.001 respectively, which indicates that these 4 evaluation indicators have a significant influence on innovation. Based on specific values of each evaluation indicator, the influence degree of evaluation indicator on innovation is ranked from large to small as follows, storytelling — humor — elegance — craftsmanship — novel appearance. Take into account this, the regression equation can be obtained, y=-10.276+1.438* storytelling +0.164*novel appearance+0.956*elegance +1.089* humor+0.535* craftsmanship.

In order to determine the credibility of the above 5 important factors affecting innovation, structured interviewees are conducted from the 30 scorers. All of them have been involved in the cultural and creative industry for 5–10 years. Three evaluation indicators are identified as having a great impact on the innovation of culture-based products by interviewees: storytelling, humor, and elegance. As they said:

	B	S.E	Wals	df	P	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Storytelling	1.438	0.187	7.689	1	0.000	4.214	2.920	6.080
Novel-Appearance	0.164	0.179	0.917	1	0.359	1.179	0.829	1.675
Elegance	0.956	0.186	5.129	1	0.000	2.602	1.805	3.749
Humor	1.089	0.161	6.782	1	0.000	2.972	2.170	4.072
Craftsmanship	0.535	0.161	3.332	1	0.001	1.707	1.246	2.338
Constant	-10.276	0.832	-12.354	1	0.000	0.000	0.000	0.000

[Table2] Dual logistic regression analysis of innovation

1). I like the product that embodies the cultural story so that people can feel what it express, as if to tell you a certain place, a certain time, what happened here. And they must be beautiful and interesting.
2). Designers pay more attention to the products' appearance, which is not only generous, elegant, beautiful but also cultural. Now the traditional handmade products are very few. After all, manual fees are very high, and handcraft is the best choice when the budget supports.
3). The prospect of culture-based products is getting better and better, and our own traditional skills used to promote innovation. Tourists often buy products with traditional patterns. They feel that the most primitive product present the most authentic taste of our place, and we should try our best to protect the cultural heritage.

4. Application verification

This paper selects another 3 culture-based products, and a questionnaire survey is carried out to verify the model with its scoring input regression equation. Based on market researches, the article gets the conclusion that 3 product score rankings are basically in line with their market response. Therefore, the model is reliable and practical accordingly. The calculation process of regression equations for 3 innovative products is as following Table 3.

Product Picture	Storytelling	Humor	Elegance	Craftsmanship	Novel Appearance	Model Score	Sales Ranking	Praise Ranking
	4.1	3.0	4.4	4.1	4.3	5.992	1	1
	4.2	3.0	4.2	4.2	3.6	5.883	2	2
	4.1	3.5	3.8	4.1	3.1	5.766	3	3

[Table3] Analysis results of model application for three products

DISCUSSION

This paper selected the representative products of Taiwan, Britain, and China as the research objects, and considered how to establish the evaluation model reasonably and effectively under the cross-cultural differences. The research method in this paper carried on quantitative investigation and interviews to support the research result. The result shows that storytelling, humor, elegance, and craftsmanship are important influence factors affecting the cultural creative design. Storytelling is an important design reference to product connotation, which sublimates the value of culture-based product. Elegance stresses the innovation output is elegant and unique, which give guidance to external form, texture, color, and strengthen aesthetic value. Humor gives more surprise to people, and the unique culture-based product can present the brand value intangible. Craftsmanship temperature is the important presentation

of the technical value of culture-based product, the institutional cultural symbol can arouse rich cultural memories and emotional resonance. Cultural creative design should pay attention to the rational expression of culture, not to the shape to attract attention, so the impact of novel appearance on the innovation of culture-based products is not high. However, novel appearance is also an indispensable factor in cultural creative design. The above-mentioned indicators can provide suggestions and guidance of design aspects for the designers.

But this research still exists with limitations: firstly, this paper only takes physical products as the main research objects. Due to the limitations of the questionnaire, APP, VR, and other new media products did not be contained in research. Secondly, the research conducts a questionnaire survey for design experts and consumers, however, craftsmen, producers should be included in the survey in order to improve the robustness of the research results. Finally, the sample size is less.

CONCLUSION

This paper adopts web crawler for data collection to analyze the culture-based product samples in the current market. Then, experts conducted card sorting and questionnaire to get indicator weight score data. Binary logistic regression analysis is used for data analysis to get the weight hierarchy: storytelling — humor — elegance — craftsmanship — novel appearance. Furthermore, the regression equation of evaluation mode can be obtained: y=-10.276+1.438* storytelling +0.164*novel appearance +0.956*elegance +1.089* humor+0.535* craftsmanship.

This paper systematically discusses the method and process of establishing the evaluation model, which provides a systematic reference to the relative studies. This paper proves that big data is an effective research method, which is useful for cultural creative design created in a cross-cultural context.

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