Appearance–Behavior–Culture in Creating Consumer Products with Cultural Meaning Meant to Evoke Emotion

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Abstract. This paper aims to describe an attempt to develop a design process for the enhancement of cultural factors in product design. Appearance–behavior–culture (ABC) theory was applied to construct the six design processes. To test the processes, a collaborative project designing a glass teapot was used, following the six developed design processes step by step, and each step is described. The discussion covers designer and client feedback during the design stages. Designers specifically commented positively on the use of 3-D printing technology as an efficient tool for effectively and quickly checking ideas.

Keywords: Culture · Product design · Development process

1 Introduction

Products with cultural meanings can add emotional value (Desmet et al. 2001) when users perceive the meanings of those products. Most products used in our daily lives are connected with cultural matters, and product semantics are frequently adopted to convey the cultural meaning of a product and embed that meaning into the product's design (Krippendorff and Butter 1984), which evokes consumers' emotions and increases the product's success in the market (Bloch 1995; Creusen and Schoormans 2005; Crilly et al. 2004). Therefore, cultural design is becoming critical in developing new products. However, it is important to understand the types of cultural elements that can be used and the application of these elements into designs to understand how they are integrated into the complete design process. The aim of this study was to develop a design process that can be applied to glass objects by designers to further evoke consumer pleasure.

This research adopted the appearance, behavior, and cultural (ABC) attributes based on Leong's (2003) and Lin's (2007) culture theories (see Fig. 1), while Desmet's (2002) emotional appraisal theory was used to explain how cultural meaning evokes users' positive emotional responses. Leong (2003) organized culture into three special levels: the outer "tangible" level, the mid "behavioral" level, and the inner "intangible" level. Similarly, Norman (2004) argues that there are three levels of product emotions in design: visceral design, behavioral design, and reflective design. In sum, both Leong's and Norman's theories are adopted to support the ABC concept in this study, which applied it for the fulfillment of a complete design process with regard to

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materials, behaviors, and the spiritual needs of humans. In other words, the three sides of the cultural triangle address major aspects of human needs, including physiological and psychological needs, and it is expected, according to Desmet's (2002) emotional appraisal theory, that accomplishing this task of integration in product designs will evoke users' emotions because of the fulfillment of their cognitive understanding of cultural elements (e.g., represented meaning).

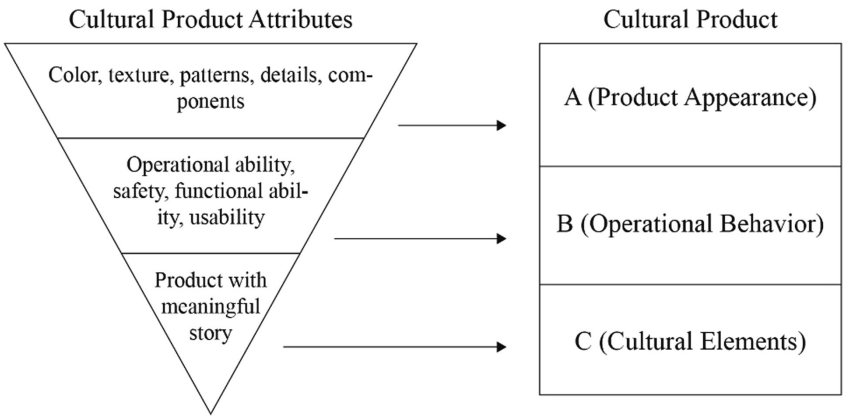

Fig. 1. ABC cultural product (Adopted from Lin's (2007) cultural product attributes)

2 Image Boards as a Vehicle for Enhancing Cultural Content

As mentioned, cultural objects involve three special levels. Among the outer tangible and inner intangible levels, cultural products are frequently interpreted through the cultural appearance that is formed by elements such as patterns, symbols, legends, and ritual information. Thus, users can perceive the typical cultural characteristics when using the item. It is, therefore, the case that products with cultural characteristics are realized by using visual components to enhance those characteristics. For this reason, mood boards and image boards have been broadly used for brainstorming of ideas during product development (McDonagh et al. 2002). Style boards have also been used for this purpose. (McDonagh and Storer 2005). In particular, mood boards and image boards are frequently used for finding and communicating design concepts and creating further valuable ideas. The image board was, likewise, adopted in this study. During a group brainstorming process, an image board can provide a clear and valuable means by which designers can observe images and discuss ideas easily and effectively. These boards allow designers to display images powerfully and communicate concepts easily, particularly those that are hard to describe in text or verbally. The great benefit of using image boards is that they allow participants to obtain personal inspiration, describe their feelings and opinions individually when communicating with team members, and develop valuable ideas quickly and effectively (Wu and Chang 2009). The current study used image boards to explore and identify cultural meanings through patterns, shapes, colors, materials, stories, legends, rituals, and so on.

3 The Development of the ABC Method and Design Processes

In this study, the six design processes were developed based on two categories of research: the product development process (Ulrich and Eppinger 1999) and cultural theories (Leong 2003; Lin 2007). Technically, image boards and 3-D printing technology were used as tools to assist designers in realizing designs that integrate cultural meaning into aspects of the product's appearance and operational behavior, and cultural meaning. In this research, the ABC attributes and six design processes were constructed for the development of products with cultural meanings for the purpose of further enhancing users' emotional responses. Brainstorming and cultural image boards were suggested as design tools for inspiration during the ideation processes. The ABC attributes represent three important dimensions: appearance, behavior, and culture. Appearance represents the product's appearance, emphasizing form development in terms of physical patterns, visual components, and shapes. The behavioral attribute incorporates studies of users' operational behaviors, including ergonomics (i.e., human factors) and usability considerations. Culture brings in the cultural contents, including tales, stories, and meanings behind the patterns or elements that communicate cultural meaning.

To emphasize the ABC attributes in effectively achieving cultural product designs, six processes are developed. These processes include (1) collecting related material, including content and images; (2) analyzing and synthesizing material through display on an image board; (3) the ideation stage, meaning brainstorming and rough sketching of ideas; (4) making sketch models and creating 3-D form models; (5) finalizing ideas and printing a 3-D model; and (6) confirming the final design with the client and making a final prototype. The details of the processes are explained in the following.

The ABC concept was utilized for the enhancement of cultural product development. ABC stands for A = product appearance, B = operational behavior, and C = cultural elements. Specifically, ABC is a concept for creating cultural products. ABC attributes are involved in the six design steps, where each step incorporates the ABC attributes on different levels during-design activities. In Fig. 2, the bottom row shows the enhancement of each attribute during each design step. For instance, step 1 may focus more on the appearance and cultural content studies and less on behavior in terms of ergonomic concerns, while step 5 may focus on all three attributes. However, in reality, designers should be more open to the application of these attributes, given that creativity is not limited in any aspect.

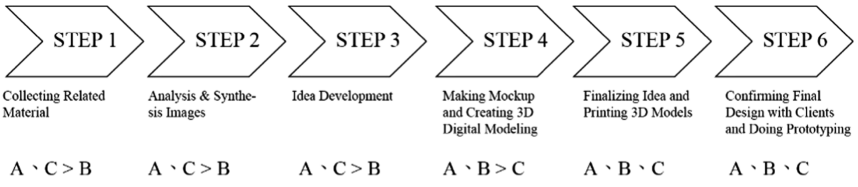

Fig. 2. Six development steps

4 An Example of a Cultural Product Development

To test the six design processes, a collaborative project was performed to create a glass teapot incorporating a Chinese cultural style. This particular project was accomplished in cooperation with a traditional glass manufacturer that is an expert on "Lazurite," an ancient Chinese colored glass style. Facing a competitive global market, the manufacturer wanted to create a new line of functional glass products rather than traditional ornaments and gifts. According to the results of marketing research, they asked designers to create a glass teapot set that would fit the east-meets-west style. To accomplish this inclusion of cultural meaning in a product, a specific approach to the six design processes were used as described below.

- Step 1. Collecting related material

We started with collecting material, including Chinese patterns, related images, and legends. For instance, we looked for objects covered with ancient Chinese decorations, teapots, vases, and vessels, anything that may be associated with teapots and that would be able to effectively invoke the appearance and cultural contents of teapots.

- Step 2. Analysis and synthesis of images

The image board was a powerful tool in this project, used for arranging images and information according to their purpose. For instance, one image board displayed information along a modern Western style–Eastern classic style axis and an abstract–concrete axis, as shown in Fig. 3. These images identify teapots with Western and Eastern styles. The other image board, shown in Fig. 4, displayed information on the two axes of ornamental–traditional vessels and abstract–concrete designs, providing a variety of images that served to enhance the shape value of a new teapot during the ideation phase.

- Step 3. Idea development

In this step, designers attempt to create as many ideas associated with cultural constructs as possible at the base of an image board, adding sketches to show a variety of visual impacts for the enhancement of ideation (see Fig. 5). Observing the visual elements on an image board, designers may be strongly inspired by the unique cultural elements and tend to integrate those elements into their ideas in order to have their design display strong cultural characteristics. At this stage, cultural visual elements show great influence over the development of cultural products. In this project, this step does not demonstrate the operational behavior much because the focus was on visual elements. But, step 5 made up for this missing part, and 3-D print modeling allowed for a usability test.

- Step 4. Making a mockup and finding potential ideas

In step 3, 2-D idea sketches focused on the development of ideas visual aspects. At step 4, a 3-D sketch-model allows designers to visualize 3-D forms to detail rough designs effectively. In other words, a sketched model can provide a sort of physical interaction, which allows designers to observe the form and check operational behaviors for its functions. However, there are some limitations in checking usability because of the rough quality of the model. For instance, in this project, it is not easy to

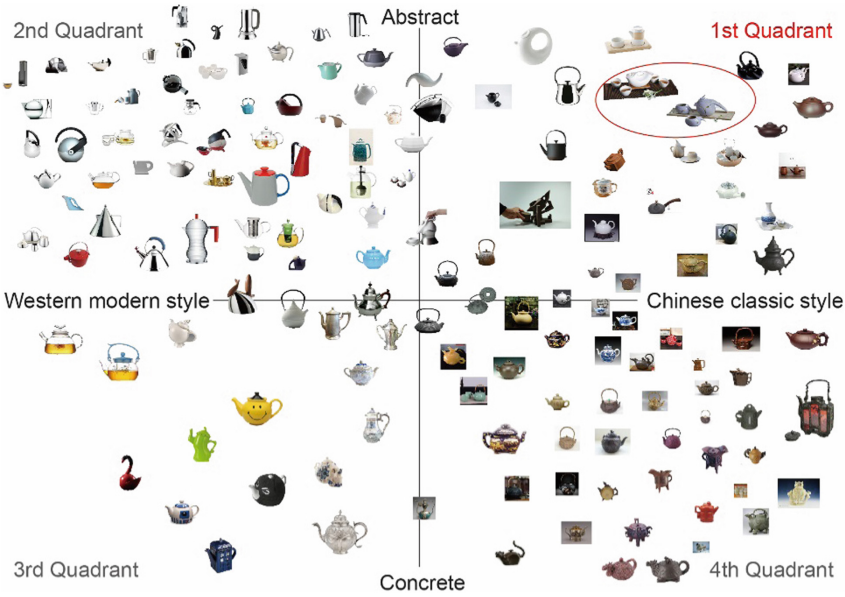

Fig. 3. Image board for style determination

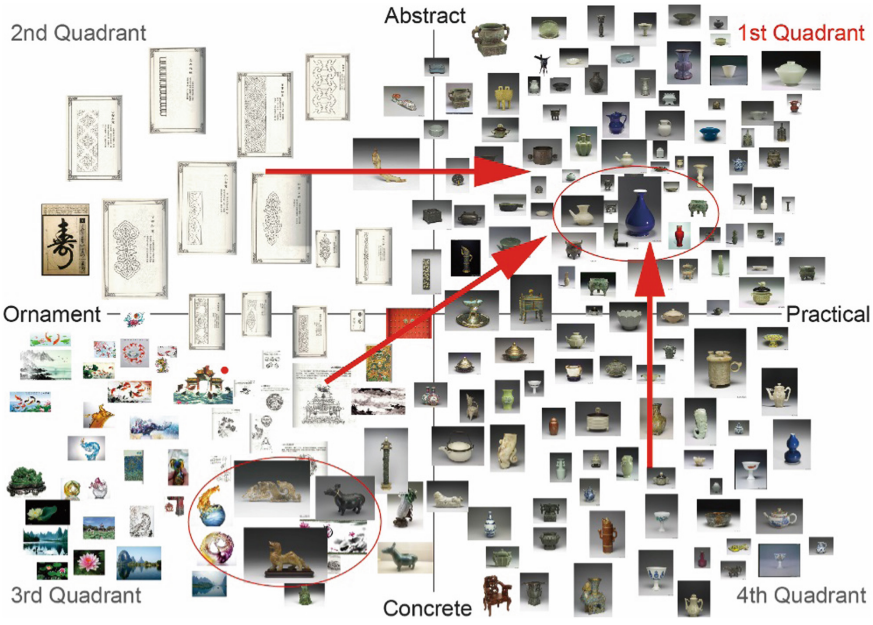

Fig. 4. Image board for inspiring ideas

Fig. 5. Examples of idea sketches

evaluate the weight balance of a glass teapot or to simulate how it feels for a user to hold the heavy glass teapot and pour tea into the cups. Technically, this problem can be solved seamlessly at the next step.

Fig. 6. 3-D digital modeling

Fig. 7. 3-D printed models for design visualization

- Step 5. Creating 3-D digital modeling and printing 3-D models

Some potential ideas were selected from among the sketch models to be built using 3-D digital modeling with computer software (see Fig. 6). In this project, designers played around with a variety of forms and cultural patterns on the computer screen. The great advantage of creating a digital model is the ability to push potential ideas one step further. By doing this, designers can have a 3-D model on hand immediately to examine its dimensions, ergonomics/usability, and physical appearance. For instance, designers can put water into the model and check the gravitational balance when holding the handle and pouring tea. In this design, we noted the problem in a 3-D model when the teapot's cap kept falling off during testing. The problem was solved by moving the dragon handle to a perfect position that stopped the cap from falling while pouring the tea (see Fig. 7). Instead of having to make a glass model, a 3-D printed model provided an actual product (see Fig. 7) to more efficiently and effectively examine the teapot's usability and functions.

- Step 6. Confirming a final design with the client and making a prototype

As mentioned, 3-D print modeling can help a designer visualize all of a product's design aspects, which enables designers to confirm a final idea with clients and assure the overall design (see Fig. 8). Furthermore, having a 3-D digital model, a manufacturer can utilize it to make a prototype for future mass production (see Fig. 9). This is more cost-efficient than traditional design processes.

Fig. 8. Printed 3-D model

Fig. 9. 3-D prototype

5 Discussion and Suggestions

The ABC attributes were utilized to support six design steps when strategizing ideas for a cultural product. At the beginning, in the idea development stage, image boards were utilized to enhance ideation activities, specifically, exploration of cultural components. To assure validation of the design steps, a collaborative project was performed to assure effective design processes. The results show that the six steps are an effective process for designing a product with cultural meaning. There are some discussions and suggestions that this project brought to light, as detailed below.

1. The image board is a very powerful and useful tool for enhancing idea development, and cultural objects rely very much on visual formation and elements to express cultural style and meaning. Thus, image boards with cultural elements were applied in the design process to inspire lateral thinking while performing ideation in search of creative ideas with cultural aspects.
2. In this way, designers can freely observe images while brainstorming with teammates to come up with as many ideas as possible. Observing the cultural contents on the image board, designers are able to more easily incorporate these cultural elements and integrate their meaning into the product. As metaphors, the cultural elements of a product should automatically stimulate users' cognitive understanding and make sense to them.
3. Sketched models can help designers visualize an idea and interact with the model. In this case, designers were able to check the overall volume in terms of 3-D shape exploration and playing with graphic and pattern layouts.
4. 3-D printing technology has changed the design process by speeding it up. Compared with traditional computer 3-D model development, 3-D printing technology enables rapid production of a model, which allows for nearly immediate checking of an actual physical model. In this case, designers can precisely check product usability and modify the design details back and forth more quickly and efficiently. 3-D printing technology has, in particular, created a breakthrough in the development process when compared to traditional glass (e.g., Lazurite) prototyping.
5. An extremely important factor is that 3-D printing is a low-cost technology that saves significant amounts of invested money compared with traditional model-making. During the prototyping stage, traditional glass design required building many prototypes by hand in order to illustrate the complex forms in a perfect condition during the form development stage.
6. On the other hand, 3-D printing technology allows the building and modification of a 3-D form in a quick and efficient manner. In other words, the 3-D printing model is an effective process for checking all aspects of an idea before processing the complicated 3-D metal tooling. However, the printing material technology is still limited by the few printing materials currently available, which include polylactic acid (PLA), acrylonitrile butadiene styrene (ABS), polyethylene terephthalate (PETT), and a few others. Although PETT material has a semi-transparent appearance, it is still unable to completely represent the clear visual sensation of glass material. Thus, the development of pure transparent materials for 3-D printing would benefit glass-related design work by more closely simulating transparent objects.

Overall, the client was satisfied with the result of this project, and designers are optimistic about the design processes developed. For the next stage, the client suggests conducting a survey to assure market acceptance of the design's quality, which includes the product's style, pricing, and cultural meaning. We expect that the product will be able to evoke consumers' pleasure in using it while observing the included cultural elements.

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