IMAGE TRANSFORM FROM THE CHINESE PREHISTORIC "POTTERY GUI-TRIPOD" TO CONTEMPORARY BIRD-SHAPED TEAPOT: APPLY CEZANNE'S "CYLINDER, SPHERE AND CONE" IN PRODUCT DESIGN

Lu, Chi-Chang

ABSTRACT

A pottery Gui-tripod is the most unique in form of ceramic implement in ancient Chinese craft history, and it is also the source of bronze Jue-tripod, Jia-tripod, and He-tripod - the important instrument for sacrificial ceremonies in the Bronze age. The creativity of pottery Gui-tripod came from the imitation of bird forms; moreover, it represented the worship of sun - the spiritual power that ancient people relied on, and relating totems. In this article, the author wants to create a bird-shaped teapot transferred from the Pottery Gui-tripod. Besides the traditional Eastern charm, how can it has the style - the Modern fashion is the preoccupation. The research results show: shape extracted through Cezanne's "Cylinder, Sphere and Cone" theory not only be able to achieve the goal of fashion, but also conducive to the implementation of computer-aided design tools.

Keywords. Pottery Gui-tripod, teapot, Cezanne, fashion, Product design.

1. INTRODUCTION

The Gui-tripod is a very unique and attractive pottery in Chinese Late Neolithic. It widely distributed in the Yellow River, the middle and lower reaches of the Yangtze River, and even more border zone, such as Sichuan, Guangdong, Gansu, Liaoning and other places also have sporadic discovery.

Because the author wants to research the significance of the erect stems of Bronze Jue-tripod and Jia-tripod, and eventually entered for a comprehensive study of Chinese Neolithic Pottery. Due to the large amount of information and the breadth of extending research, the author spent a total six years to get concrete results and write a book: The secret of Bronze Jue-tripod and Jia-tripod: from prehistoric Pottery Gui-tripod to the origin and dating Problem of the Xia and Shang Culture (Lu, 2007). This book reveals the important position in Chinese history and craft history of Pottery Gui-tripod series objects (Pottery Gui-tripod, Bronze Jue-tripod, Bronze Jia-tripod, Bronze He-tripod,), are outlined below:

a. Pottery Gui-tripod Series objects are symbols of the bird totem belief transforming by Chinese ancient worship of the sun.

b. The form of Pottery Gui-tripod Series objects were imitated from birds, and consequently developed the Three-legged bird to represent sunbird.
c. The totem faith of Three-legged bird is the common of Xia and Shang dynasty in ancient China. The Bronze He-tripod and Jia-tripod, the descendant of Pottery Gui-tripod were just the two dynastic ancestor worship ritual.

d. Pottery Gui-tripod Series objects had gone through nearly four thousand years of development, and throughout more than one-third of Chinese territory, especially in the traditional center area.

e. Pottery Gui-tripod Series objects have different shapes performance in various stages or geographic, but all proportion beautiful and full of dynamic sense, is a masterpiece of traditional Chinese Plastic Arts.

f. The shape of Pottery Gui-tripod possess double characteristics of bionic and abstract, it fully reflects the "impressionistic" tradition of Chinese art.

g. The relation of Three-legged bird and sun had a long history in ancient China, until the Qing Dynasty still as a symbol on the emperor robes decorated.

h. The belief of the Three-legged bird also spread to Japan and Korea, such as the logo of Japan's national soccer team, and got the maximum recommended in the vote on the proposal in the ROK National Seal handle.

Whether from historical and cultural significance, or outstanding performance in the plastic arts, Pottery Gui-tripod enough to be one of the most objects of the representative in the history of China. Therefore, the author in an bird-shaped Teapot project design, Pottery Gui-tripod as a reference for the basis of shape, trying to develop a teapot with excellent functionality, and can present the qualities of modern fashion styling.

2. RESEARCH PURPOSE

This bird-shaped teapot design case is targeted to both of the important tourism resources – birds and the distinctive culture of tea in Taiwan. This study adopted the shape of Pottery Gui-tripod, the author most familiar to design a teapot with practical functionality and integration of traditional charm and modern fashion aesthetic. Its purpose and expected results are as follows:

a. possess the shapes characteristic elements of Pottery Gui-tripod and traditional oriental flavor.

b. possess contemporary characteristics with both the style of abstractionism and minimalism.

c. in addition to the image of the performance, but also have a utility function.

3. LITERATURE REVIEW

3.1 The "function" and "aesthetic" with Pottery Gui-tripod

(1) The Functional Design of the Pottery Gui-tripod

The Usage of the Pottery Gui-tripod is generally considered to boil water or warm wine. If we combine their descendants, Jue-tripod, Jia-tripod, He-tripod to investigate, it should be used as wine vessel.
In addition to simulate the shape of a bird, the Pottery Gui-tripod also has a very superior design function. About its functional elements, is described as follows:

a. spout: Its practical purpose is to guide the dumping of liquid substances. The majority of the spout is located on the relative position of the handle, but the early artifacts maybe with a 90 degree angle because they also have drinking function.

b. three legged: The Pottery Gui-tripod was made into a solid or hollow form of three-legged, but hollow bag shape was the mainstream. The Pottery Ding-tripod is the earliest three-legged artifacts, its lower space between three legs have utility function to place timber and burning. Most of the unearthed Pottery Gui-tripods also have the smoke dust, as a cooking function is for sure. For the liquid substance, a hollow bag shape leg can increase the contact area of the contents and the fire stream, so that the thermal efficiency is more improved.

c. handle: Increase the degree of stability of the hand grip.

(2) The beauty of the Pottery Gui-tripod

The shape of the Pottery Gui-tripod was very unique in prehistoric artifacts. It not only extracted the abstract forms of the birds, but also very prominent on the dynamic performance of the simulated creatures. Its perfect combination of practical function and bionic form is also outstanding from the perspective of the present.

Its impressionistic performance just is the traditional Chinese aesthetics emphasized - "Wonder from the Similarity and Dissimilarity", full of oriental charm.

3.2 Abstract, minimalist - modern fashionable style

Abstract trend of Modern Art began with Cezanne and developed into cubism and abstract art. They followed rationalism and used geometric shapes and minimalist color to extract the performance of objects. These features were just in tune with the requirements of mass production and considered to be the best choice for machine production. Modernism design is born on this basis and became the most stable, most influential style in the First half of the 20th century.

Although Modernism design had been criticized by Post-modernism and leaving the design style to become more diverse. However, the trend that the shape and decoration of abstract and simplify is already taking shape, not possible to go back to the old ways of the traditional complicated fine decorative.

3.3 Cezanne's "Cylinder, Sphere and Cone"

Cezanne's famous quote: "treating nature by means of the cylinder, the sphere, the cone." (traitez la nature par le cylindre, la sphere, le cone) It is often cited as the Declaration of Western art began to move toward the abstract structure. However, why is the implication of the famous words scholars have different views. "an attempt to express his consciousness of structure beneath the colored surface presented by nature." (Rewald, 1986, p.226) "made
merely to introduce the one on perspective. "(Reff, 1977, p.47) "This meant that he wanted to capture those features of nature that one regular and constant, independent of chance arrangement." (W. Tartakiewicz, 1980:284) "He presumably meant that he should always keep these basic solid shapes in mind when organizing his pictures." (Gombrich, 1995, p.574)

Regardless of the original intention of Cezanne, art history gave the honorific title of "father of modern art" to him. This is definitely his "treating nature by means of the cylinder, the sphere, the cone", that is the influence of modern art. Cubist painter claimed: "who understand Cezanne will come to understand Cubism (Osborne, 1979). Ideological inspiration by Cezanne famous quote, cubist painter tried to create structure beauty in the painting. Subsequently, Western art is inevitably toward abstraction. The Cezanne's phrase Declaration is also becoming more and more famous.

4. PRACTICE OF THE WORKS

4.1 Consideration of the Work Function

Teapot is generally with body, mouth, spout, handle, lid five basic elements. Body is the container for accommodating the tea leaves and tea. Mouth is the import and export of tea. Spout is the institution to guide tea outflow. Handle is used to grip. Lid has dustproof and insulation functions. Pottery Gui-tripod is a practical Stemware in prehistoric period, also with the basic elements of body, mouth, spout, handle, and some with the lid. Therefore, capture the shape of Pottery Gui-tripod transformed into a teapot is a convenient application.

4.2 Consideration of the Work Form

Pottery Gui-tripod is the ancient Chinese works, shape style tend to Oriental traditional organic form. In order to give this teapot with Modern Fashionable Style, try the father of modern art - Cezanne's theory to construct the basis for the development of design. Therefore, extract the Pottery Gui-tripod as a combination of the sphere, cylinder to get in line with contemporary fashionable abstract, minimalist style. Geometry is also conducive to the operation of 3D computer software to complete the design of the product.

In addition to emphasizing the modern minimalist style, freehand traditional Oriental plastic arts - "Wonder from the Similarity and Dissimilarity" should always take into account. Pottery Gui-tripod's shape originally had this trait, but also be designed in accordance with this principle as a return of the other possible additional features, such as bird's eye and crest.

4.3 Practice of Cases: Computer-aided design

a. construct the teapot body with perfect circle spherical.

b. construct a three-legged symbol of the bird-foot with cone.

c. perform the operation of the single axis stretched for the entire body.

d. establish spout.
e. hollowed out the teapot body, and coupled with the handle.
f. dig holes at the top of lid to make a groove to accommodate the button.
g. complete the lid button model file construct through the reverse engineering of 3D scanning technology.
h. combine button with lid.
i. conduct visual simulation and model output.

Figure 1  Digital 3D stereoscopic construct and model output

5. THE EVALUATION OF THE FEATURE OF FASHION

5.1 Development of Questionnaire

Table 1  Questionnaire samples

<table>
<thead>
<tr>
<th>No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The creation of fashion feature is the goal of this design case. For this issue, the author proposed final design results as a sample. A questionnaire survey was conducted to evaluate its degree of fashion. Questionnaire was developed jointly by nine doctoral students of the Graduate School of Creative Industry Design, National Taiwan University of Arts. At first, each person selected three fashionable products in line with their own subjective conception, and then described the attributes of fashionable with at least three terms of abstract meaning, and concrete meaning, respectively. The second step is to choose totally nine fashion crafts after aggregation and discussion (Table 1). Finally, twelve terms of abstract meaning and concrete meaning respectively were confirmed. Thus, this fashionable craft analysis questionnaire was completed including nine samples and twelve abstract attributes and twelve concrete attributes.
a. abstract attributes: (1) primitive simplicity, (2) low-key luxury, (3) stable noble, (4) natural and fluent, (5) fresh meaningful, (6) upright excellence, (7) introverted, (8) wonderful workmanship, (9) simple crisp, (10) relaxing, (11) gorgeous noble, (12) back to nature.

b. concrete attributes: (13) neat and exquisite, (14) easy to clean, (15) perfect proportion, (16) excellent function, (17) gentle material, (18) smooth curved surface, (19) compact size, (20) safe and secure, (21) sturdy and durable, (22) ECO and Energy-saving, (23) available glamorous, (24) easy to use.

In addition to the above attributes, there is an overall performance evaluation including three indicators: "attractiveness of people put it down", "sophisticated ideas of design sense", and "classic of modern craft". And for personal preference, add a favorite product options.

Participants were asked to evaluate each stimulus sample with the twenty-four attributes and three overall evaluations based on a five-point Likert scale, and to choose only one for the favorite from nine samples.

### 5.2 Test of Questionnaire

A total 133 undergraduate students volunteers participated in this study. Gender as measured by 108 females, 25 males. Participants were divided into three groups with different background, 51 subjects with product design related background, 23 subjects with other design related background, and 59 subjects with non-design related background.

### 5.3 Analysis of the reliability and validity

a. Factor analysis: Twelve questions of concrete attribute were divided into two groups after conducting an exploratory factor analysis. The first group includes question 13, 15, 16, 17, 18, 23, and 24 can be referred to the attribute of Appearance except that question 16 (excellent function) and question 24 (easy to use) are related to the function of a product. The second group includes 14, 19, 20, 21, and 22 can be referred to the attribute of Function. Considering the "component scores" of question 16 and 24 are the lowest in the first group, these two questions were assigned to the second group.

b. Validity analysis: to analysis the validity of two dimensions and 24 attributes as follows:

1. Abstract dimension: 12 attributes of eigenvalue (7.987) were found to explain 66.557% of the total variance, and factor loadings started from .742 to .883.
2. Appearance attributes of concrete dimension: 5 attributes of eigenvalue (3.690) were found to explain 73.791% of the total variance, and factor loadings for each question started from .773 to .898.
3. Function attributes of concrete dimension: 7 attributes of eigenvalue (4.660) were found to explain 66.574% of the total variance, and factor loadings started from .749 to .898.

Overall, exploratory factor analysis identified the two dimensions and 24 attributes with eigenvalue which greater than 1, and the factor loadings of each topic was greater than 0.7. The above data shows this scale has well construct validity.
c. Item analysis: The internal correlation between the research dimension and the total scale are .956, .927, .885, .887. All of the items are reach the level of significance of P <.001.

d. Reliability analysis: The alpha value of all dimensions and sub-dimensions are .954, .909, .916, .919, respectively. Whole scale is 0.974. These data reflected well reliability for this questionnaire.

5.4 Subjects were differences in data analysis for the evaluation of the overall feeling

T test and ANOVA analysis were executed for three overall evaluation: "attractiveness of people put it down", "sophisticated ideas of design sense", and "Classic of modern craft". As the subjects are all university students, the only two measures are "gender" and "learning background".

The analysis showed that 9 samples related no significant differences in "gender". The affected by "learning background" samples are (1) butterfly chair, (2) the bird-shaped tea filter, (3) blue and white decorated car. The rest were also no significant differences.

Therefore, the design of bird-shaped teapot does not produce significantly different because of the "gender" or "learning background" differences.

5.5 Analysis of the Influence of Demographic Background on the preference for stimulus samples

Chi-square test for "favorite works" and "gender" has not significant differences.

Correspondence analysis (CA) for "favorite works" and "learning background" show significant differences (Chi Square = 36.807, p <.01, df = 14). Multiple correspondence analysis charts are shown in Fig 2. Three learning background roughly formed three clusters: "product design related background" with sample 1,4,5,6, "other design related background" with sample 2,7 and "non-design related background" with sample 3,4,8.

No.4 is the bird-shaped teapot which is the only sample that preferences across two background population.

5.6 multidimensional scaling

In order to understand the correlation between the bird-shaped teapot and all attributes, multidimensional scaling (MDS) was used.

First analysis the "concrete dimension" of the questionnaire, Kruskal's Stress = .11015, RSQ = .96826. The former is slightly larger than 0.1, the latter close to 1. It shows the two dimensions sufficient to describe the spatial relationship of the nine samples with 12 attributes.
The visual perceptual space of "concrete dimension" shows: the indicators at quadrant IV all belong to the "function". The two samples – No.6,7 located in this quadrant take the design function as the premise of the product. Quadrant I is not only "easy to clean", but is also the indicators of "appearance". This result shows that the distribution in this quadrant of the samples make attention for its fashionable appearance. Bird-shaped teapot is located in this quadrant, which certainly achieved the goal of appearance in this design case. Bird-shaped teapot and the other two samples in this quadrant in "preference - favorite works" evaluation are also ranked as the top three.

Second, to analysis the "abstract dimension" section of the questionnaire. Kruskal's Stress = .07895, RSQ = .96827. The former is less than 0.1, the latter close to 1. It shows better status than "concrete dimension" in visual perceptual space of MDS.

Because the "abstract dimension" also focuses on the impression which the shape appears as the main measurement, so we tried to combine them with the sub-dimension "appearance" into "appearance performance" for analysis.

The perceptual maps of "abstract dimension" and "appearance performance" are very similar. Therefore, we choose "appearance performance" which has wider coverage to make illustration. The "available glamorous" as well as "gorgeous noble" are both at quadrant III, which almost located in the opposite direction with "back to nature". Observing from the meaning of the word, the two attributes show reverse explanation with each other. Bird-shaped teapot in the evaluation of these two indicators of "available glamorous" and "gorgeous noble" less than or close to the middle value, it does not belong to this style. Excluding these two indicators, "back to nature" and "upright excellence" poles constitute the fan-shaped region of 113 ° (37 ° to -76 °). Bird-shaped teapot is at the middle position in the fan-shaped region (-19.5 °), which also be at the furthest location to the original point than other samples in this area. Therefore, the bird-shaped teapot was recognized as the most modern design products by questionnaire subjects.
6. DISCUSSION AND CONCLUSION

6.1 The trend of fashionable evaluation emphasis on the "appearance"

The factor analysis of the data showed that the "concrete dimension" can be distinguished into two sub-dimensions: "appearance" and "function". Observing the perceptual map of "concrete dimension", the differences of quadrant I and IV is very obvious. The samples located in Quadrant IV tend to be a functional product, while the products in Quadrant I tend to be emphasized on appearance. This situation with the statistical scores of "preferences - favorite works", three samples located in quadrant I evaluated as the top three in the rank. Relatively, two samples in quadrant IV are only ranked as the fifth and eighth. This result shows that peoples' fashionable cognitive and preference focus take "appearance" as the main consideration.

Referencing to the overall feel indicators: "attractiveness of people put it down", "sophisticated ideas of design sense", "Classic of modern craft". The average score in quadrant I three samples were obtained 1st, 3rd, and 4th, only the quadrant IV sample 7 obtained the second. This result also showed the "appearance" as the main consideration in people's fashionable cognitive.

In this case, the bird-shaped teapot was designed based on its appearance as the main measurement. The questionnaire analysis showed that this was the right direction, and subjects also affirmed.

6.2 Fashionable cognitive tends to present low-key, tendency, simple, fresh and elegant performance

In the perceptual map of "appearance performance", the best of the four samples all located in the fan-shaped region (37° to -76°) that constituted by "back to nature" and "upright excellence" poles. Being relative "available glamorous" and "gorgeous noble", which located out of the fan region, the 15 properties in the area biased in favor of low-key, simple, fresh and elegant performance. This result was in accordance with previous literature analysis: "the trend that the shape and decoration of abstract and simplify is already taking shape". Contributed to this trend is the "Modern Art", originated in Cezanne's "Cylinder, Sphere and Cone".

The result of the bird-shaped teapot of the questionnaire instructed that object extracted mode by Cezanne's theory can effectively reach a fashionable trend.

6.3 Bird-shaped teapot case shows the feasibility of the Cezanne's theory in product design applications

Based on analysis of the questionnaire, the bird-shaped teapot designed by Cezanne's theory can be considered successful. From the experience of the process of practice, the author analyzes the successful reasons and the focus should be noted as follows:
a. Cezanne's theory is the pioneer that guides the modern Western art to the abstract structure. It not only leaded the trend of modern art, but also affected the design industry. The Modernist design had been criticism by the so-called "post-modernism", which led the design style becoming more diverse. However, generally speaking, the shape and decoration of abstract and simplify trend still dominate the development of the fashionable design route. Therefore the products design through Cezanne's theory approach the trend of contemporary style easily.

b. While 3D computer construct being used as the main mean for the based design, Cone, sphere, cylinder to implementation of the design is a very efficient way.

c. Geometry is the mainstream of traditional Western styling. It gives people simple and certainly feeling, however it is also lack of stimulus. The organic form is a traditional oriental aesthetic taste which presented a natural and hazy mood. How do we give more organic form to the geometry shape had been thought in this case, and also be noted through this theory to design Oriental style product.

The success of this case display Cezanne's theory as a model of modern design is a practicable method and worth to continue exploring. It based on modern art theory, and accordance with the fashionable style of abstract and minimalist. Moreover it also meets the trend of technological development in the design and production process to achieve the goal of the pursuit of efficiency and cost savings.

ACKNOWLEDGEMENTS

This study was supported by the National Science Council, Taiwan, (NSC99-2622-H-144-001-CC3). The authors are grateful to this support.

REFERENCES