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Research on the Modeling of Series Lighting Products based on Natural Elements in Bionic Design

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Abstract: In modern lighting design, more and more designers use bionic design for product innovation. The article divides the bionic design into three dimensions: whole, part, and detail. On this basis, it proposes simplified bionic and structural redesign. Bionic and texture reorganization are three methods, and the feasibility of the three methods is confirmed through case studies. The simplified bionic method is applied to the actual series of lamps and lanterns design. Rhino and KeyShot are used for 3D modeling and rendering. The final design A series of lamps have been produced to confirm that the design method in the article is effective, and I hope it will be helpful to future lamp designers.

Keywords: Serialization; Modeling; Natural Elements; Bionic Design; Innovation.

1. Introduction

Fast-paced urban life and busy technical work make people more and more natural, simple, and relaxed air. In today's rich material life and various high-tech products, the home environment is full of natural atmosphere, making people feel fresher in nature. It is becoming more and more popular [1]. In modern times, biological simulation design has been formally established as a science and is also reflected in daily lighting design [2]. Bionic design of natural elements is a redesign in which designers observe and think about biological or non-biological factors in nature to simulate their unique journey in terms of structure, function, shape, color, etc. [3]. Nature has provided designers with inexhaustible creative materials. We should not be limited to simple appearance models but must analyze, select, propose, combine, and redesign through careful design ideas. Natural elements, and finally, develop personal imagination to create lamps. The whole design process needs to be constantly tried and modified. Only after counter-stimulation can natural ingredients be well integrated into the product.

2. Market Analysis of Serialized Lamps

2.1. Insufficient Awareness of Serial Lighting Design

Through the research on the lighting market, the article found that serialized lighting occupies a particular market share, but the design sense of serialized lighting is low. This type of lighting is usually manifested when the designer instructs to reuse the same design elements, only changing the color of the ingredients or directly connecting the lamps to the supporting parts of different types of lights, does not consider the aesthetics and coordination of the products, as shown in Figure 1 and Figure 2. The reason for these problems is that the designers need more awareness of the design of serialized lamps. Serialization also has a specific meaning in industrial design, which refers to the serialization of product shape, color, structure, and materials [4]. On this basis, it is necessary to redesign local elements, use the most distinctive parts of the design elements, make new adjustments and applications, and strive to ensure the relevance between series of lamps rather than directly transporting the same features. In the current lighting market, the lighting products sold do not have in-depth design considerations in appearance and cannot meet the serialized design standards. Therefore, designers need to improve their correct understanding of serialized lighting design.



Figure 1. Series lamps 1

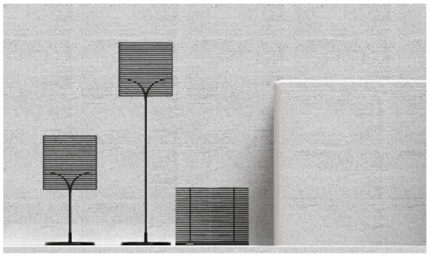


Figure 2. Series lamps 2

2.2. Price Advantage

Since lamps are not consumables and have a long service life, the price of a single lamp product will be reasonable, but most consumers in the market have a high demand for high-quality and cheap lamps, and series lamps can meet their requirements. The current series of lamps are divided into product categories but use the same accessories and processes in terms of shape, color, and material to assemble, which significantly reduces the production cost of lamps and has certain advantages in price. Single-product lamps have different forms and require additional accessories and processes in production. The production cost of the same type of lamps must be higher than that of series lamps, resulting in no price advantage for single products. Therefore, the series of lighting products not only meet the needs of consumers with high quality and low price but also has increased profit margins for lighting manufacturers, which is a win-win

situation.

2.3. Suitable for Quick Matching of the Overall Space

People choose lamps to give full play to their functions, and it may also increase the aesthetic feeling of the home space. However, there may be mixed matching after ordinary people choose their favorite lamps and put them in play. For example, if the user plans to decorate three bedrooms and one living room, the room needs at least 4-7 types of lamps, and it isn't easy to match the overall style completely. Because most people have yet to receive regular indoor matching courses, they cannot check high-altitude matching skills. Although a single lamp looks good, it shows that it cannot be harmoniously matched with each other in a relatively large space. How can we quickly make the overall length build a better effect in a short period? You can choose serialized products. Their general appearance is more unified and harmonious. You only need to select a series of lamps that meet the user's aesthetics to match the whole set of products. It saves time and effort and can meet different home spaces. Meet the needs of users.

3. Three Dimensions of Bionic Lamps

Designers often use natural elements, and thus many excellent lighting works have been created. But not all lamps can be successful. Some designers have spent a long time trying to achieve corresponding results. The reason is that they have not mastered the essentials of design. Design and learning are very similar, and bionic design needs to be used correctly and flexibly. The method can make the lighting products meet the basic functional requirements and enhance the lighting's emotional, practical, and cultural value [5]. Based on many bionic design research theories, the author tries to integrate the essence of bionic design methods and develops the innovation of bionic design methods from the three dimensions of whole, part, and detail. There are three design methods of bionic design and texture reorganization bionic, as shown in Figure 3. I hope it can help designers master this design method quickly and try to use it in their lighting products.

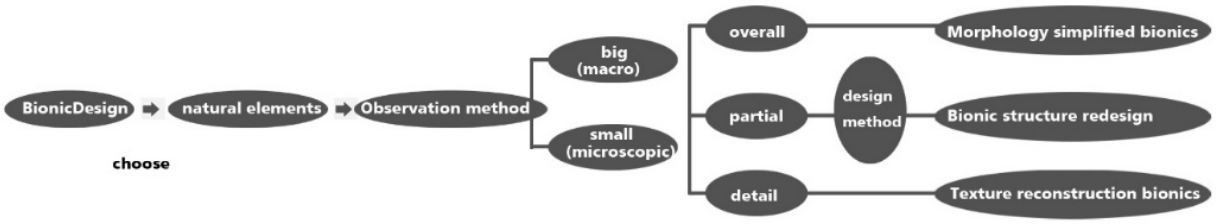


Figure 3. Three dimensions of bionic design

3.1. Morphology Simplified Bionics

Design according to the shape, shape, and pattern of creatures or plants in nature, and strive to reproduce and depict the images of animals or plants in nature most authentically, reflecting the designer's emotional sustenance for beautiful things in life [6]. It simplifies or optimizes the redesign of the most distinctive overall shape among natural elements. It requires a clear understanding of the shape, which can only be achieved in nature with excellent design capabilities. For example, the Perch series of lamps designed by Umut Yamac for the Moooi brand is perfect for the innovation of bionic simplification and is worth learning from. Figure 4. The bird inspires the shape of the lamp. The designer did not use its complex appearance directly, but without changing the whole, he geometrically processed the more complex feathers and feet and then transformed the simple geometry. The shape is restructured and redesigned to realize the highly simplified processing of the complex shape of animals. After simplification, the essential characteristics of the animal form should be more clearly and vividly reflected, and the product's functional and aesthetic properties can be better displayed [7]. At the same time, to make the whole more aesthetically pleasing, the designer integrated a small area of gold into the beak and tail that symbolize the bird. This ingenious design increases the decoration and makes the lamp more detailed. After creating a single light, it is also necessary to consider the practicability of the series of lamps in different usage scenarios. The designer combined the habits of birds and designed the lights on the simplified horizontal bar, just like a bird singing on a tree branch, with visual shock. Such an excellent series of lighting products can only be completed by designers with innovative design coordination ability, and this kind of creative thinking mode is also a bionic simplification and redesign of natural elements, which is worth learning from and learning from designers.



Figure 4. Perch series lamps of Moooi brand

3.2. Bionic Structure Redesign

lighting design can be innovated from overall simplified bionics to local structures. The visual change from large to small creates a new design direction for the shape. Regarding structural bionics, plants, and animals are generally the most studied [8]. Structural bionics refers to finding biological structures highly like the original designs in nature and constructing new systems based on the characteristics of physical prototypes [9]. Designers can try to jump out of the bionic thinking pattern of the overall structure and use the most characteristic partial form of the bionic object to carry out the design, which will eventually have different design effects. There are excellent cases in the creation of partial

systems, such as the LOLA of the Lzf brand Series of lamps; the lampshade is designed concerning the partial feather structure of birds. The feather structure is arranged gradually from large to small, with an orderly aesthetic feeling, as shown in Figure 5. It is easier for designers to use this feature directly, but making breakthroughs in design innovation is impossible. To innovate, you must grasp the main structural components of animal forms to achieve an ideal design effect [10]. Therefore, the designer borrowed the bird's feather structure and then innovated, showing an innovative X-shaped interspersed structure. This multi-level cross-design has an excellent overall effect and a sense of order. It can also make the surface of the lampshade more stable, realizing beauty and harmony. For coexistence of applicability, in addition to simulating the feather structure, the lamps abandon the feathers and replace them with thin wood chips, which continues the environmental protection of the lights. It is one of the classic cases that designers should learn from.

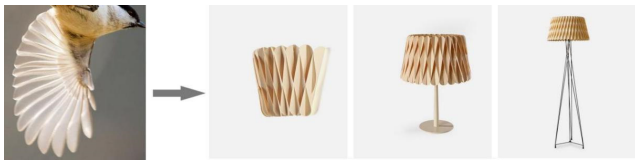


Figure 5. Lzf brand LOLA series lamps

3.3. Texture Reconstruction Bionics

Texture reorganization bionics is different from the previously mentioned modeling and structural bionics. It belongs to the bionic design of details. It requires designers to use keen observation to grasp the characteristics of natural textures and make these natural elements appear most appropriately through design. Some texture bionics still need ready-made materials, and new materials must be developed to show the best results. Compared with the appearance of the bionic design, the bionic texture design pays more attention to the material bionic of the shape and surface [11]. For example, the Italian SLAMP brand ACCORDÉON series lamps are inspired by the ocean's soft and changeable water waves. The designer applies the details of ripples to the design of the lampshade. For the texture effect of tides, a brand-new Lentiflex® fabric was developed, as shown in Figure 6. This material must be hand-shaped, presenting incredible beauty under the light. After unique materials replace the simple circular shape, it also has a visual effect that shocks the soul. Then, designers can try to jump out of specific modeling and structural bionic methods and apply technology to texture bionic design to enhance the design sense of products.



Figure 6. SLAMP brand ACCORDÉON series lamps

4. Serialized Lighting Innovation

4.1. Target Groups and Lighting Style Positioning

The target product positioning group is the urban population aged between 30 and 40 with a particular economic foundation and pursuit of life. According to the research, users have the following requirements for the series of lamps: have a specific texture and artistic conception, can beautify the family space, be decorative to the home environment, are low-key, and have connotations, and the appearance should not be too exaggerated. Based on the design requirements of the target group, the designer designed the lamps to be minimalist, and the shape tends to use the design direction of combining various elements in nature.

4.2. Selection of Design Materials

The lighting design needs the assistance of materials to complete, and the most efficient way is to collect materials with a plan and a clear purpose. First, it is necessary to determine the general direction of the design materials around the target group and the lighting style positioning. After collecting more than 200 materials such as natural scenery, plants, animals, flowers, grass, fish, insects, etc., the materials were shaped too. Complicated pictures that did not match the theme were screened, and images that met the design requirements were left. After two days of screening, two shots, pebbles, and morning dew, were finally selected as the source of inspiration for the lamp design, as shown in Figure 7. The two are simple, round, and have a high degree of element correlation. There are no redundant lines in the visual. They are the raw materials.

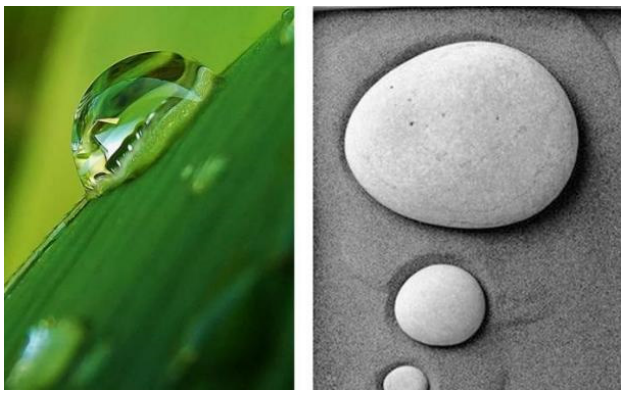


Figure 7. Dew and pebbles

4.3. Lamp Design Practice

4.3.1. Cobblestone Shape Design

The designer identified pebbles and morning dew from nature as design materials and tried to use the design method of simplifying the design form. After confirming the design materials, he tried reorganizing and innovating different shapes. Analyzing and extracting biological characteristics needs to fully grasp the structure, function, aesthetic feeling, and meaning of the physical form through the cognition of the physical form from the outside to the inside and from the outside to the knowledge [12]. First, the original shapes of the two materials are elementary. The cobblestone shape and its surface texture, the overall lines are round and lovely, and there is no need for too much decoration design, extracting the most characteristic arcs. However, it is difficult for designers to pull simple, aesthetic lines. It is necessary to maintain the characteristics of the stone itself and then draw lines with general aesthetics as the modeling material of the lamps.

4.3.2. Combination of Pebbles and Dew Elements

After determining the basic shape of the lamp and combining it with dewdrop elements, the breakthrough of lamp innovation lies in focusing on the original state of natural ingredients. After observation, it is found that

dewdrops of different sizes often appear on the leaves in the early morning. The whole is crystal clear and particularly beautiful. When the dewdrops are displayed, the lamps and lanterns will have a unique aesthetic feeling. To present the natural state of dew, the designer tried to integrate it into the light source and then dotted the light sources of different sizes on the lamps. After having the innovation point, it is necessary to draw many sketches, as shown in Figure 8. It has been proved that these two elements can combine many lighting schemes, and a design manuscript with design aesthetics can be found in them. To complete the first draft of the single-product lighting design.

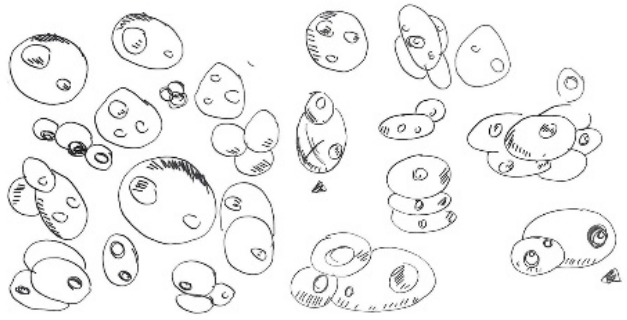


Figure 8. Hand-painted sketch of lamps and lanterns

4.3.3. Design Extension from Single Product Lamps to Series Lamps

The designer uses pebbles and dewdrops as the essential elements of the shape. Through uninterrupted attempts to recombine the details, it finally completes the design of the series of lamps. The completion of a single lamp means that the basic shape of the serialized lights is determined. On this basis, the extended design of the single lamps is also carried out, and the most distinctive elements are applied to the serialized lamps. The number of standard series of lights in the market is usually between 3-5 models, including table lamps, wall lamps, floor lamps, chandeliers, etc. Careful consideration should be given to the color of lights and lanterns because the product's color can produce the most potent stimulation to the human senses, and there is an intrinsic relationship between the color attribute of the product and the user's emotion [13]. Therefore, based on this, the overall color of the lamp is rose gold, and Rhino and Key Shot are used for 3D modeling and rendering. The effect of the light is very realistic, low-key, and luxurious, as shown in Figure 9.

The first one is a wall lamp. The light source uses small, energy-saving, and long-life LEDs as the light source. In the early design stage, it is hoped to show the crystal-clear texture of dewdrops. For home use, there is a need for soft light effects, and a double-layer lampshade is adopted. The first layer is made of white frosted translucent glass lampshade, and the second layer is made of fully transparent round glass, which is different from the market lamps and achieves a bionic shape on the visual effect of the light source, highlighting the unique texture of dewdrops. The second one is a table lamp (atmosphere lamp). According to market research, there are few atmosphere lamps in China, and the needs of modern consumers are gradually developing towards diversification. The light's color tone, brightness and darkness, and the surrounding application environment will bring different psychological feelings. User sentiment will fluctuate [14]. The designer applied intelligent dimming technology to adjust the brightness and color of the light through touch and added a Bluetooth speaker inside to combine light and music to meet people's needs for relaxation. The third one is the ceiling lamp, the overall shape remains the same, the ceiling lamp has specific lighting requirements, and the number of light sources is increased to 5 to ensure indoor illuminance. The designer uses different sizes to replace the original light source of uniform size and has the function of adjusting light and shade. So far, the form-simplified bionic method has been used in the design of lamps, thus verifying the technique's feasibility.

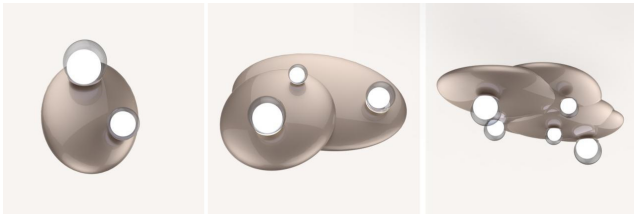


Figure 9. Series of lamps (wall lamps, table lamps, ceiling lamps)

After this series of lighting design practices, the author realized that in the design process, creating excellent lighting works requires innovative design methods combined with superior design case analysis and comprehensively applied to the scheme. Designers must have excellent results to broaden their horizons, learn from suitable materials and design methods and use them rationally. They must also have a unique insight to screen and refine helpful design elements. They need to jump out of the existing thinking mode and integrate After the design elements are combined and deeply understood, the bionic design is combined with the needs of lighting products.

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