Research on the Strategy of Product Ecological Structure Design under Global Ocean Pollution

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Abstract. Serious pollution problems in the global offshore area are caused by a large number of municipal wastes from land. The reason is that there are many unenvironmental structure designs in the product design, which brings a lot of waste of resources and environmental pollution and other problems. Based on the principle of 3R, this article integrates the thought of ecological structure design into the "human-machine-environment" ecosystems; establishes the ideological system of product ecological structure design; confirms the feasibility of product's ecological structure design with analysis of relevant design cases. Then to establish the assessment system of the economical system to evaluate the ecology of the product structure design.

1 Introduction

In the continuously developing society, there are a lot of material wealth, but there are also more and more household garbage. Because the ocean locates at the low-lying area of the whole biosphere, it becomes the destination of global garbage.^[1] Victor Papanek, the American critic, proposed the ethic ideas of design in his book *Design for the real world* which was published in 1971, he holds that designers should have sense of social responsibility, and design products with the consideration of ecology and environment protection.^[2] So we are supposed to have ecological structure design thinking, reduce waste of resources and garbage pollution in design.

2 Marine pollution and product ecological structure design

2.1 the problem of global marine waste pollution

Achim Steiner, the executive director of the United Nations Environment Programme, has publicly stated that 80% of marine pollution is derived from land. In 2015, scientists from University of Georgia published research in the Journal of science, which further presented the problem of marine garbage pollution. This report was the first global data assessment after 1970. It shows that, at present, in the top 20 countries with the most serious marine waste pollution, there are 19 developing countries, and the main elements of the coastal waste are daily waste.

2.2 Product ecological structure design

Product ecological design could consider from the aspects of environment and commerce. From environment aspect, designers should try to minimize the resource consume in the using process, reduce the cost and make product become more competitive. From commerce aspect, according to product's function, site and space, product structure can be divided into external structure, core structure, space structure and system structure. Through different design methods to reach the highest utilization rate of resources, so as to realize the sustainable application of products.

3 Product ecological structure design strategy

3.1 Ensure the ecological structure of the external structure of products

Product external structure refers to some additional structures to products, for instance, the packaging structure of products is one kind of external structure. As ecological structure design, product packaging should firstly reduce the volume, material and simplify the structure, to decrease unnecessary material waste in the packaging process. It ensures that the packaging function remains unchanged and realizes the recyclability of products. For example, figure 1.

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Figure 1. Packaging design of porcelain. (web)

Secondly, choose the materials that can be recycled many times rather than disposable material. The small parts of product external structure should emphasize the replaceable design, minimize the type and quantity of parts and ensure the unity of structure. For example, figure 2.

Figure 2. Butter packaging design. (web)

Finally, product's packaging structure should have additional function, ^[3] to simplify products' using steps, make products more convenient and humanized. Additional functions of product packaging structure can be divided into three categories: auxiliary function, circulating function and collection function. Besides, designers should also make a guiding structural design, guiding users to use them and play products' additional function better. For example, figure 3.

Figure3. Packaging design of the cans. (web)

3.2 Ensure the core structure of the product is ecological.

Product's core structure refers to product's own core function structure. Kenya Hara, a Japanese designer put forward that product design should focus on quality, not quantity. Therefore, design of product's core structure should firstly guarantee the basic structure and avoid unnecessary complicated structures to reduce material waste. For example, figure 4.

Figure 4. Air cleaner design. (web)

What's more, we should consider the application of collapsible structure in product structure design .at present, products with Single function can't satisfy people's daily needs. designers begin to explore and design "multifunctional" products.^[4] Product's folding structure can not only make product more functional, satisfy daily needs, but also reduce the cost of transportation and storage, and then reduce the waste of resources. For example, figure 5.

Figure 5. Design of folding paper cup. (web)

Finally, we should pay more attention to the design of product's circular structure. Through redesigning the waste products, give them using function, so as to reduce the garbage amount, and reduce the threat of waste products to the ecosystem. For example, figure 6.

Figure 6. Small sprayer design. (web)

3.3 Ensure the ecology of products spatial structure.

The spatial structure means how to use appropriate product structure design to solve the problems of products' space placement. Through structural design adjustment, maximize the use of space and save products' materials. Because there are many corners in the indoor space can't replace ordinary products, it wastes lots of space and makes the action space narrower. Therefore, the design of space structure is mostly made of custom-made structure. After observing the whole space, the designer will rationally plan every corner, reduce the product parts, achieve the purpose of saving materials and space resources. For example, figure 7.

Figure 7. Packaging design of porcelain. (web)

3.4 Guarantee the ecology of product system structure.

Ecological design can be divided into broad sense and narrow sense. Narrow sense of ecology refers to design itself, while broad sense of ecological design refers to human-product-environment. Therefore, design should consider ecology and environment system. By design methods to realize the harmonious development of human-machine-environment (both of natural environment and social environment). [5] So, product structure design should depends on users' behavior, specific environment and usage scenario to define the specific design. In other words, designers are supposed to not only consider users' daily situation, but also the special situation they may encounter.

Figure 8. human-machine-environment schematic diagram
 (The ecology of design)

The "oneself" in figure A is looking out, and the "oneself" in B can be viewed from outside of the picture. So, it can also be defined as the environment. It's not only looking at the surrounding environment, but to look at the part that we didn't see. Figure B has integrated oneself into the environment and become a part of it. In figure B, environment and people are integrated into a whole, [5] which is system structure.

Design of the system structure can start with ecological psychology, the core of it is affordance, which points out the possibility that the environment can be provided to biological behavior. The similarity between design and affordance is that it's impossible if we want to design by ourselves. We must find out an appropriate boundary, like the outline between two objects to achieve the ecological system of human-product-environment. [6]

Figure 8. Umbrella design. (The ecology of design)

As shown in the left of Figure 9, the designer made an unusual structure, he dug a crack on the flat ground. When the guest come, they will subconsciously place their umbrellas in this crack. The water will go out along the crack, which achieves designer's original intention. Water will not affect the tidiness of the whole floor, everything is in order. In this system, the most critical structure is this special crack on the ground.

4 The implementation of the product ecological structure strategy

4.1 Cultivate the ecological consciousness of the designer

Training designers' awareness of ecological design can be considered from colleges and society aspects. Colleges and universities should set up relevant courses about ecological design, cultivates students' consciousness of ecological design and sense of social responsibility. In addition, lectures should also be organized to enable students to know the frontier knowledge of ecological design. The society mainly target at in-service designers, and design companies should set up special ecology design teams. When design companies communicate with Party A companies, designers are supposed to pass on the concept of ecological structure design to attract the attention of the whole industry and related industries, and then promotes the people's awareness of ecological structure design.

4.2 establish the evaluation system of product ecological structure design

Enterprises should set up professional departments to conduct ecological assessment of product structure, and use 3R principle to evaluate from two angles: environment and commerce:

(1) By comparing with the traditional related product structure, we can see whether the environmental and economic benefits of new products are better than traditional design.

(2) Whether the product meet the company's pre-defined ecological structural design objectives and whether it can bring benefit to the company and society.

The ability and cooperation of project members and their communication with other relevant parties, as well as whether project members completely understand the product's ecological structure.

In view of these above problems, we can sum up a report on the evaluation of the product ecological structure project, and invite relevant users, environmental protection experts, professional designers, and government environmental protection personnel to evaluate the ecology of the product structure again, to guarantee the ecology of product structure.

5 Conclusion

The ocean covers 2/3 of the earth's area. Global marine pollution will definitely affect the whole environment and the quality of people's lives. We must protect environment, reduce current environmental pollution, so that people can live in a healthy space. Therefore, ecological design is an important trend in contemporary design. The concept of environmental protection should be designer's basic quality. Designers should use different ecological structure design strategies for different product structures, to save resources, reduce waste pollution. In that way, designers can be called be responsible for every product and be responsible for the homes we live on.

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