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Research on Product Reverse Design Method in Industrial Design Based on Technological Evolution

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Abstract

Facing the severe fact that the product development cycle is shorter and shorter and the functional requirements are more and more complex, how to use the thinking and methods of reverse design to tap the application potential of reverse design in new product modeling design is an urgent problem to be considered at present. Therefore, based on technological evolution, this paper studies the method of product reverse design in industrial design. Build a new design pattern that incorporates reverse design organically into industrial design. Practice has proved that the proposed reverse design method has good practicability in industrial product design. Moreover, the reverse design method used in modern industrial designers to design the product design will have the characteristics of high starting point, low cost, short cycle, easy modification and easy innovation.

Keywords

Technological evolution, industrial design, product reverse design.

1. Introduction

The forward design is a process of "from scratch". Generally, the shape prediction of the product is not enough. It is necessary to test its performance through multiple experiments, and the cost is high [1]. The traditional development model has been difficult to adapt to the new changing needs, and the establishment of a rapid market response technology platform has become an important magic weapon for enterprises to remain invincible in the market competition. However, this design method has a longer product design cycle and higher cost [2]. Technological development and market demand urge designers to play many different roles. They should have both continuous innovative design ability and extraordinary speed, and be able to surpass competitors in time, especially when designing consumer products [3]. The initial models of these products are generated digitally by making wooden or clay models in advance [4]. Forward design is a process from scratch. In general, this design method is poor in predictability comparison of products, and its performance must be tested through many experiments, with high cost. At present, the technology has been widely used in home appliances, automobiles, toys, light industry, medical treatment, aviation, aerospace, national defense and other industries, and has achieved great economic benefits [5]. The process of redesign and reconstruction optimization from physical samples to digital models plays a good role in improving the appearance quality of products and speeding up the research and development of products.

In product design, the common design method is to obtain the initial shape and parameters of the product through demonstration and analysis, and then to conduct performance tests through a large number of experiments to gradually improve the product, which is a process from scratch [6]. With the development of science and technology, computer software and hardware technologies are changing with each passing day. The research on modern industrial design theories and methods has

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been significantly improved with the development of computer aided design, computer graphics, virtual reality, multimedia and the gradual deepening of CAD/CAM application [7]. With the advent of the information age and the gradual formation of a unified global market, product and technology exchanges are increasingly frequent. In recent years, reverse design of traditional forward design has been proposed in industrial product design [8]. Due to the openness of information, people have fully experienced the latest design concepts and design products, and consumers' psychology of products has long been aligned with good design [9]. In recent years, the product design has gradually matured to form a reverse design method. The use of reverse design ideas is quite extensive, especially in some industrial designs with complex designs. This design idea has a certain driving effect on product development speed and aesthetic improvement [10]. General products are not in the best condition at the beginning of their work. After working for a period of time, they are effectively meshed by the mechanism. In this way, the ideal working condition can be achieved, and the geometrical dimensions and geometrical tolerances of the various parts of the product are the pursuit of the design.

2. Introduction to reverse design

2.1 Definition of reverse design.

The so-called reverse design means that people in the product development process take the opposite angle from traditional design to think about the problem, guide the inspirational thinking, and develop products that meet people's needs. If the output surface does not meet the design needs, you need to switch back and forth between the two software platforms, and the physical and assembly operations cannot be achieved. People's pursuit of different lifestyles has indeed created a new situation for design, but it also increases the depth and difficulty of industrial design. Since the reverse design of product modeling has the characteristics of high starting point, low cost, short cycle, easy to change and easy to innovate, it has attracted the attention of modern industrial designers since its appearance. Compared with forward design, reverse design is an advanced and innovative design method, which is a process of design optimization from physical objects to digital models. However, there is a certain difference between the product and the original design at this time. It is necessary to use reverse design to obtain the data under the current ideal working state in order to improve the design and realize transcendence. On the other hand, with the continuous development of technology, on the basis of information technology, the product design mode is bound to develop towards networking, digitalization, integration and intelligence. Generalized reverse design includes shape reverse design, process reverse design and material reverse design.

The process of reverse design refers to the relevant digital processing carried out by the product designer from the surface of the product, such as data collection and data processing. At this stage, data preprocessing, data blocking, data smoothing, triangulation, data optimization, multi-view merging, noise filtering, topology establishment, feature extraction and other work should be generally carried out. In reverse design, first of all, the physical model needs to be scanned by using a three-dimensional laser scanner to obtain various parameters of the product and build a digital model. The traditional product design process usually goes from concept design to drawing, and then manufacturing the product. From a process to a process, we call it forward engineering or forward engineering. Reverse engineering of products is based on physical parts or prototypes. Although the software used for reverse design is very numerous, they are essentially the same, using the various tools provided by existing software. According to a certain reverse thinking, the modeling strategy, the analysis of the structure and the design process are combined to better complete the design of the surface.

At present, the number of research related to reverse design is increasing, which shows that this kind of research projects are being paid attention to by the majority of scholars. Figure 1 shows the trend of research quantity in recent years.

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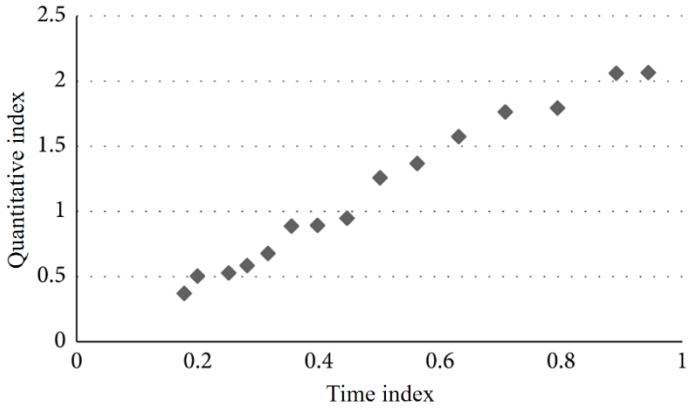

Fig. 1 Quantity trend chart

2.2 The scope of application of today's reverse design.

The present world is an open world. The economic and technological exchanges between countries in the world are getting closer and closer. Throughout the development trend, the development direction of modern product design patterns includes: intelligent design, parallel design, collaborative design, virtual design, agile design, full life cycle design and other design methods. Combined with the actual situation, the paper takes a sports car sludge model as an example to analyze the reverse design process of industrial products in detail. China is a developing country. How to absorb, digest and improve some advanced technologies abroad is of great significance. The operation of the scanning method is relatively simple, and relatively complete model data can be obtained, and the data splicing is not required, and the scanning efficiency can be ensured. After the completion of the line architecture, the corresponding smoothness check needs to be done. The main purpose is to find out the flaws in the loop. When removing the dead pixels, you can also modify and adjust some of the data points in the curve. In addition, as software and hardware tools for expressing ideas and product modeling are changing with each passing day, designers can save a lot of time when realizing their inspiration or creation. In the past, industrial designers focused on improving the external artistic quality of products, but now they have to make real interaction between users and products to meet multi-dimensional needs, such as visual perception, use level, etc. The contact method has no requirement on the color and illumination of the surface of the object, so the measurement of the boundary of the object is relatively accurate, but it has poor adaptability to soft materials and slow speed. Due to the different objects of reverse design, reverse design can be divided into three categories: physical reverse design, software reverse design and image reverse design. In recent years, with the rapid development of photoelectric technology, microelectronic technology, computer technology and other related technologies, a variety of sample surface digitization methods have emerged.

3. Specific Application of Directional Design in Industrial Design

3.1 Basic Thought and Process of Retrograde Engineering Application.

The basic idea of reverse engineering applications is to preserve the main features and overall style of the original product, through changes to the material, structure and shape of the product. Add some new design elements to the original products to design new products with more perfect functions and more beautiful appearance. Specifically, you should first construct two mutually perpendicular planes, map the plane to a face of the global model, and then click Align to Global in the menu to select the XY plane. Then float to select a plane and create a matching pair with the Create Pair option. However, if you want to create a product that has its connotation and can be accepted by the masses for a long time, you must accurately grasp the trend of the product, keenly feel the trend of the market, as well as novel ideas and understanding of production technology. China should continue to carry out national culture and ontology education in the field of design. The processing result of the data will ultimately affect the quality of the product. In the data processing stage, the data will be preprocessed,

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the data will be blocked, the data will be smoothed, the data will be optimized, and the feature extraction of the model will be performed. In the future, design will no longer be the personal behavior of designers, and cooperative design is the inevitable trend of development. However, the non-contact method (non-contact three-dimensional surface data acquisition method using laser as medium) has a fast acquisition speed when acquiring surface data of a physical model, and can form "point cloud" data. Disadvantages are lower precision and higher requirements for sample surface and illumination. For example, in the field of vehicle design, real-scale models are widely used to evaluate whether the aesthetics and engineering of products are in conformity with batch production. At this time, reverse design will play an important role. In order to copy samples in reverse design, corresponding data information is required. Data acquisition is the starting point of reverse design and the basic activity of reverse design.

Since the industrial revolution, facing a large number of machine tools, the focus of design is often how to improve the efficiency of the machine. The result is only to increase labor intensity, and the essential difference between human and machine behavior characteristics is fundamentally ignored. As shown in table 1.

Table 1 Comparison of Machine Elements and Human Elements

Comparison items	Human factor characteristics	Characteristics of machine factors
Durability	Have the ability of self-recovery. Memories and skillful results have decreased.	It is well maintained and can withstand long-term use. Even if it is not suitable for living environment, it is not afraid.
Reliability	Proficiency depends on the conditions.	It depends on the design materials and other technologies.
Information output	Although there are words, actions, expressions, etc., but the capacity is very small.	In order to fully increase the output, parallel output devices, mapping technology and transmission lines are used.
Other	It takes about 20 years to become a standard adult.	Products are mostly produced in large quantities.

3.2 Research on Products and Markets

Analysis of existing products or design schemes in the market, analysis of their design styles and characteristics, comprehensive and in-depth analysis of advanced and mature products popular in the market, and listing of competitive products in the market. The "global coordinate axis" is opened in the display, and the position of the object can be viewed in combination with different views, so as to judge the accuracy of coordinate system alignment. This not only enables the operator to regard the design department as an embodiment of competitiveness, but also means that the design department's self-awareness and personalized design features are continuously strengthened. From a design perspective, designers use professional training backgrounds such as planning, analysis, innovation, technology, engineering, management and other professional integration. Providing technical knowledge and innovative services to the industry not only improves product innovation and added value, but also helps to enhance the competitiveness of enterprises. These people are not really eager to be foreign, but are interested in any new things. This makes our design more capable of integrating everything in the world, that is, the world trend. The coordinate measuring machine is a highly efficient and highly accurate measuring instrument. It adopts the principle of coordinate measurement, and completes the three-coordinate data acquisition of existing products under the control and driving of computer software. It organically combines digital control technology with computer software technology for data collection.

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4. Summary

The article describes the concepts and methods of computer-aided industrial design. In particular, rapid prototyping has been valued and applied in industrial design fields such as molds and home appliances, and has become an important means of development and design. Reverse design is relative to the forward design. With reference to the physical model, data acquisition and surface reconstruction can be used to obtain a new digital model to improve the product and optimize the design. This pitch error can be plotted as an error curve in the width direction of the pressing roller, and is decomposed into several error-divided curves of different wavelengths to study the causes and corrective methods. Looking ahead, with the development of computer hardware and software technology, the advantages of reverse design method, such as high starting point, low cost, short cycle, easy modification and easy innovation, will become increasingly obvious. This method will certainly become one of the preferred methods for modern industrial design designers to realize product design. It is believed that reverse design will reach a new height in the near future, bringing unexpected effects to industrial design and meeting the increasing demands of the market. Looking ahead, with the development of computer hardware and software technology, the advantages of reverse design method, such as high starting point, low cost, short cycle, easy modification and easy innovation, will become increasingly obvious. This method will certainly become one of the preferred methods for modern industrial design designers to realize product design.

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