Research on the Application of Computer Ergonomics in Industrial Product Design

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Abstract. Computer ergonomics is to design and optimize industrial products according to the structure and skill characteristics of human body, to realize the effective combination of products and human activities in the use process, and to accelerate the effective promotion of product experience and interaction. Based on this, this paper first analyses the standards and principles of industrial product design based on computer ergonomics, and then studies the utilization of computer ergonomics in industrial product design, including the influence of human factors, environment and social factors on industrial product design and specific utilization strategies.

Keywords: Computer Ergonomics, Industrial Product Design, Utilization

1. Introduction

With the iterative maturity and progress of computer tech, it has obtained extensive and in-depth research and popularization in many fields, especially the utilization of computer tech represented by ergonomics in the field of industrial product design, which greatly accelerates the development and amelioration of product design level [1]. As a representative discipline and professional research method that integrates many aspects of human physiology and psychology, ergonomics mainly aims at the design and optimization of industrial products according to the structure and skill characteristics of human body, and focus on the design from the dimension structure, center of gravity and body surface area of the product, so as to realize the effective combination of the product and human activities in the use process, and accelerate the effective amelioration of the sense of experience and interaction of the product.

Ergonomics will also carry out research on people's psychological state and psychological factors in the process of using industrial products, ameliorate the use efficiency of products, and establish an effective connection between the scope of use activities and the use of products [2]. Using the ideas
and methods of ergonomics for reference in industrial product design not only helps to enhance the scientific and experiential nature of products, but also helps to better meet the aesthetic, human mechanics and consumer psychology characteristics of users and consumers, so as to accelerate the establishment of stronger competitive advantage of products in the market competition. Through the integration of ergonomics, ameliorate the level of humanization of industrial product design, more in line with the daily needs of users and consumer psychology.

In addition, through the use of ergonomics, industrial products have more humanized settings, showing the functional value, practicality and economy of industrial products. The utilization of ergonomics can also reduce the potential problems of products, optimize the design of products, and accelerate the functional amelioration of industrial products [3]. On the other hand, with the increasing awareness of environmental protection, people put forward higher requirements for the environmental friendliness, safety and green pollution of industrial products. In this context, with the help of ergonomics can also effectively accelerate the ecological value of industrial products, and accelerate the design of more green environmental protection.

In a word, ergonomics can establish the organic relationship among industrial products, users and environment, accelerate the harmonious coexistence among them, and help to realize the construction of green economy and green industry [4]. Through the organic integration of several elements as shown in Figure 1, ergonomics can effectively meet the needs of people's life and production, and organically coordinate the relationship between industrial products and ecological environment. The utilization of ergonomics in industrial product design helps to realize the humanized, ecological and scientific goals of industrial products. It can not only achieve comfortable, efficient and safe operation, but also meet the needs of people's spiritual function. Therefore, it is of great practical value to study the utilization of computer ergonomics in industrial product design.

![Figure 1. The integration elements of ergonomics](image)

2. Industrial product design standards and principles based on computer ergonomics

2.1. The connotation of computer ergonomics

Computer ergonomics is the utilization of anthropometry, human mechanics, labor physiology, labor psychology and other disciplines of research methods, to study the human body structure and functional characteristics, provide the size, weight, body surface area, specific gravity, center of gravity of various parts of the human body, as well as the relationship between the various parts of the human body in the activity and the accessible range of human body structure characteristic parameters. Secondly, computer ergonomics also provides the human body function characteristic parameters, such as the output range of each part of the human body, and the habit of action, to analyze the
functional characteristics of human visual, auditory, tactile and skin sensory organs [5]. In addition, computer ergonomics will analyze the physiological changes, energy consumption, fatigue mechanism and adaptability of people to various labor loads, and explore the factors that affect people's psychological state at work and the influence of psychological factors on work efficiency.

2.2. Design standard of computer ergonomics

Computer ergonomics is the study of anatomy, physiology, psychology and other factors in a certain working environment, the study of the interaction between human and machine and environment, and the study of how to consider work efficiency, human health, safety and comfort in work, family life and vacation [6]. The design standard of computer ergonomics is mainly reflected in whether the size, shape and force of industrial products match with human body, whether the industrial products are easy and convenient to use, and whether it can prevent the accidental injury and the danger of misuse when users operate. In addition, the design of computer ergonomics is also reflected in whether the operation units of industrial products are practical, whether the components can be placed so that their significance can be identified without doubt, and whether the products are easy to clean, maintain and repair.

2.3. Design principles of computer ergonomics

Industrial product design based on computer ergonomics should follow the principles shown in Figure 1 below. Among them, in the level of standard principle, the humanized design idea of people-oriented means to embody the design principle of people-oriented in industrial product design, so that the center of industrial product design always revolves around the needs of users [7]. According to ergonomics, environmental psychology, aesthetic psychology and other disciplines, it could scientifically understand people's physiological characteristics, behavioral psychology and visual experience, so as to design products full of human nature. Specific to the level of industrial product design, it mainly focuses on the humanization, practicability and ease of use of industrial product function, size, shape, material and color.

![Figure 2. Industrial product design based on computer ergonomics](image)

Secondly, in the aspect of safety and reliability principle, as an important part of the performance index of industrial products, the safety and reliability of products are related to the use safety of products, so it is necessary to ensure the normal and good performance of industrial product system. In addition, at the level of convenience principle, the design of industrial products should consider the
The embodiment of human factors in industrial product design includes anthropometry, work space design, human sensory system, human motion system and human psychological factors [9]. Among them, anthropometry is used in industrial product design according to the size of the human body to design. In industrial product design, based on the principles of limit design, adjustable design and dynamic design, human body design directly related to human body structure is carried out. Secondly, in the design level of work space, the ergonomics of human body size work reference on the design type. In addition, at the level of human sensory system, it includes several sub-levels as shown in Table 1 below.

In addition, at the level of human motion system, it is necessary to have a general understanding of human motion system to design products in line with human motion system in industrial product design. At the level of human psychological factors, it includes domestic psychological factors represented by perception, cognition and motivation, and external social factors represented by family, community, society and culture. In industrial product design engineering, full consideration of these factors is helpful to design industrial products that conform to people's psychological characteristics.

| Human sensory  | Product design influences                                                      |
|----------------|-----------------------------------------------------------------------------|
| Hearing        | The temporal features of hearing and difference of sense.                   |
| Vision         | Important channel to connect with the surrounding world                     |
| Tactile sense  | Used in the design of visual and auditory overload work                      |
| Taste          | Avoid product harmful smell to people's health or disgusting                 |
| Pain           | Rare to use pain to transmit signal in design                                |

3. Utilization of computer ergonomics in industrial product design

3.1. Utilization of human factors in industrial product design

The consideration of human dimensions in industrial product design mainly includes functional dimensions and structural dimensions. In the functional dimension, it mainly refers to the dynamic human body size. Considering the functional dimensions of the product can help solve many problems with space scope and location. Functional dimension includes the space of human self-activity and the space of combination of human-machine system, which can be divided into the size of limb activity and the size of body movement [10]. For most industrial product designs, functional dimensions may have a wider range of uses. When using functional dimensions, it is emphasized that each part of the
human body is a coordinated, coherent and active whole. In addition, in the aspect of structural dimension, it mainly refers to the static human body dimension, which is measured when the human body is standing still or sitting in a fixed standard state. The structure size mainly provides design basis for the design of industrial product working area size, product interface components and auxiliary facilities used by people.

### 3.3. Utilization of environmental factors in product design

In the computer-based ergonomics system, environmental factors can be regarded as a kind of interference factors. A proper working environment can not only ameliorate efficiency, but also maintain good working mood and reduce workload. For industrial products, designers need to consider the applicable environment of products when designing products. Products play a better role in the appropriate environment and ameliorate the utilization rate and service life of products. Physical environmental factors mainly include several levels as shown in Table 2 below. The impact of these factors on the use of products is a comprehensive utilization process.

**Table 2. Contents and influence of environmental factors in product design**

### 3.4. Utilization of social factors in industrial product design

The processing of industrial products should not only meet the needs of functional use and material level, but also have certain humanistic and cultural attributes to meet the needs of material beauty and spiritual level. Secondly, industrial product design should also be able to coordinate with the environment, to be appreciated, and to please human nature. In addition to the basic functions of industrial products, the most important thing is the interpretation of its cultural meaning, including the cultural debate of natural science and social science. Therefore, designers of industrial products should fully consider the social and humanistic factors in the process of product design, and ameliorate the cultural accomplishment of users. As an important part of modern cultural civilization, product design, in the process of industrial product development, pays attention to human factors, plays a human power, can better match and adapt to the requirements of the times and society.

### 4. Conclusion

In summary, the utilization of ergonomics in industrial product design helps to realize the humanized, ecological and scientific goals of industrial products. It can not only achieve comfortable, efficient and safe operation, but also meet the needs of people's spiritual function. This paper analyzes the connotation of computer ergonomics through the research of industrial product design standards and
principles based on computer ergonomics. Through the analysis of the utilization of computer ergonomics in industrial product design, this paper studies the influence of human factors, environmental factors and society in industrial product design and its specific design considerations.

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