

Interaction Design Research of Home Integrated Ceiling Based on Neo-Ergonomics

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Abstract. With the emergence of intelligent home furnishing concept by the Internet and Internet of things, different industry convergence is increasing. As interactive environment products, the furnishing integrated ceiling established on the neo-ergonomics will bring the new psychological experience which make the environmental layout, space function, interpersonal communication, environmental value different from the traditional kitchen plane ceiling. Bandura's "reciprocal determinism" provides theoretical basis for the primary three dimensional interactive design concept in neo-ergonomics. And the environmental factors in interactive innovation will become more and more importance, which make the product innovation work tremendous effect.

Keywords: Interaction Design, Neo-ergonomics, Integrated Ceiling.

1 Introduction

Integrated ceiling which originated in China is a burgeoning industry. The industry has developed from kitchen top to the whole house top space and wall. At present there are about 800 integrated ceiling production enterprises in China and nearly 1000 brands with the production value of about 20 billion Yuan each year. The Value of integrated ceiling products is to create a comfortable home furnishing environment for users through the overall product module innovation design and terminal home furnishing design. Because of the characteristics of good quality, convenient construction, recyclable use, integrated ceiling products have been included in the "national comfortable housing demonstration project".

With the rapid development and fierce competition of integrated ceiling industry, product innovation design of necessity will change from product styles to the user experience. Interaction is the core of experience. If we has a good interactive products, then it will must bring good user experience. As environmental products, the integrated ceiling must be considered from the whole bedroom environment when we do the interaction design research.

2 The Theoretical Basis of Neo-Ergonomics — Reciprocal Determinism

American psychologist Bandura has put forward the "reciprocal determinism". He argued "behaviour, human factors, environmental factors were in fact determinants as mutual connection and interaction to generate function". Bandura criticized behaviourists' environmental determinism, who thought that the behaviour (B) was affected by the environmental stimuli (E) control to the organism and the formula was: $B=f(E)$. He also opposed to humanist personal determinism, who thought that the environment depends on the individual how to produce effect and the formula was: $E=f(B)$. He believed that these were unilateral determinism.

Bandura's theory is unique in the behaviour characteristic, who distinguishes the person's behavior and cognitive factors. Then it pointed out the the role of cognitive factors in determining behaviour. In addition, it considers that the environmental, behavioural, cognitive factors are the mutual decision factors and pays attention to the person's behavior and cognitive factors impacted on the environment to avoid the mechanical environment of behaviourism. [1]

Therefore the interaction design focuses on people. But the main research methods of traditional ergonomics is based on physiology, psychology, anthropometry. Researchers pay more attention to relationships between the interaction of "people - object" in the narrow interaction design study in traditional ergonomics. Because the interaction design study early was in the light of interaction between human and computer, which limited the development of interactive design. And the new ergonomics is different from the traditional and pay more attention to new cross disciplines involved human factors engineering, sociology, anthropology, economics, environmental science and so on, whose concept have new extend and formed new different special research and the corresponding conclusion.

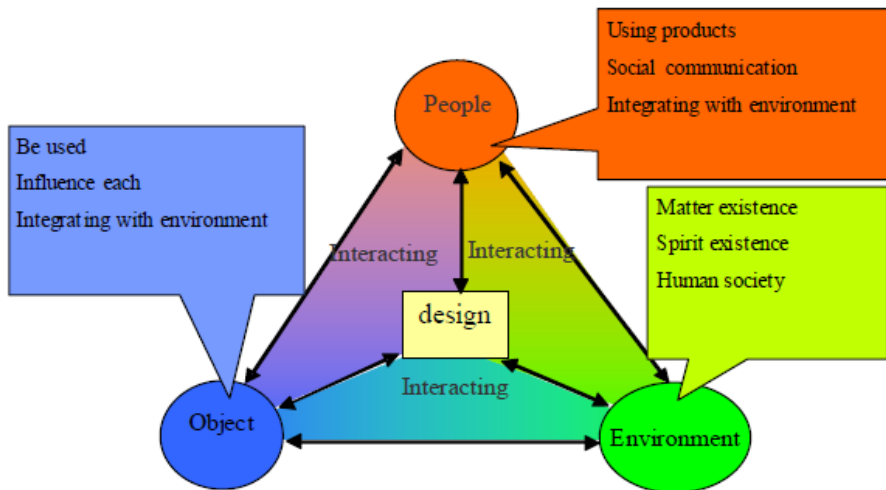


Fig. 1. The theory of "Three-in-One", the primary three dimensional interactive design concept

Today much traditional ergonomics research still focuses on digital products between people and network interaction. The study of the environment is only used as an auxiliary element. But the environment's importance can not be ignored as one of the basic elements in the model of "Three-in-One". The three elements human-object-environment constitute the basic design contents and subjects. And the interactive relationship between them and design constitute the theory of "Three-in-One", the primary three dimensional interactive design concept. Thus the object is not just "matter" itself, but also includes the relationship between people and object, between people and people, people and environment, object and object, object and environment, environment and environment as shown in figure 1.

3 The Important Basis for Interactive Environment Product Design — Neo-Ergonomics

The relationship between people and environment is the topic never out of date. The neo-ergonomics explores the principles and methods of product interaction through analysing environment psychology. And it researches the relationship between people and the surrounding material and spiritual environment from ecological, culture, language, social, psychological and other aspects in the complex human and environment interactive system. It also follows the principle of interaction research approach; advocates the research principles of real life environment, multiplicity methods selection principle, multiplicity interactive interpretation principles; explores the value of design objects; create new products which make people's psychological needs be reflected in the environment.

Therefore the neo-ergonomics can use some basic theories of psychology methods and concepts to study human activity in the environment and human responses to the environment and feedback to the related product design. It also attaches great importance to people's psychological tendency living in the artificial environment and combines environment selection and creation.

As the environment design, the basic focus of integrated ceiling products design always is to make people or families living with them have a good indoor top environment, psychological security, fields and privacy. The neo-ergonomics can help the designers to plan for the top space on purpose, to design interface, color and light pertinently, to engender indoor environment harmony and comfort creatively in which people can enjoy the pleasure from the integrated ceiling products.

Then the compound integration ceilings show a sense of hierarchy, scattered low, get rid of the visually monotone to bring people's sense of emptiness in traditional plane ceiling. The different compound integration ceilings divide the whole indoor space into different function area in which people can do their own things just with the shape, material, color, lighting, atmosphere change. At the same time the compound integration ceilings can created psychologically independent private area to make people gain respect, have free safety with light and function hiding processing so as to create a safe and comfortable indoor environment.

With the emergence of intelligent home furnishing concept in the Internet and Internet of things industry, the integrated ceiling product function will also be affected into the big Internet.

In addition to the basic spatial structure features, the integrated ceiling personalized will must be varied with the development of home furnishing industry integration. And the continuous innovation ,such as more interesting visual experience and boundary functions, will also make the room internal environment becomes more human. So the neo-ergonomics brings us a lot of inspiration in the integrated ceiling product innovation:

1. The Environment Is an Important Factor to Decide to Design Object

The environment has a decisive influence to design object. But it can play this role only when the environment and human factors has been combined and activated by appropriate matter". This effect depending on specific analysis is not only before "matter" into the environment, but also after. Designers can find the events' rules surrounding people based on user and environment interaction experience before the "matter" into the environment and foresee the results under some circumstances to adjust the design direction and target. They can gain experience not directly through contacting with "matter" on this ability, but observing through the user's behaviour to adjust their own design and details.

2. The Interaction between People and Environment Determines the Design Object (Matter)

People are neither completely passive reaction controlled by environmental; nor completely free entity who can do as one pleases. The Human-object-environment effected the design process and results through the three dimensional interaction process. So it is useful to concern for the environment to the design system construction and self adjustment function and makes the system improve and develop the self reactive capacity when the design object into it.

3. The Design Direction Is the Interreaction of Three Dimensional Interaction

The relationships and interactions between environment, human and design object is an interactive decision process. Human factors, object factors and environmental impact generate function by connecting each other's determinants in the design behavior. This process is the interaction between the three's interaction, but not the two or two-way interaction. It is easy to exaggerate the role and ignore other factors and cause conclusion partial barge to discuss alone on one or two elements.

4 The Case Analysis of Integrated Ceiling Design

The integrated ceiling innovation based on neo-ergonomics must be as a result of specific design ideas finally. As shown in Figure 2, it is a kind of compound ceiling in the corridor of the bungalow style by innovation design. This design studied the human-object-environment relationship in the corridor based on the neo-ergonomics, so the overall style is simple and generous. The top flower plate embossed forms echoing relationship with the wallpaper patterns and the intermediate strip module can be conveniently replaced by other buckle or appliances. It is easily to mix a variety of home furnishing style by direct and indirect light complementary, dot and surface

light combination. The ceiling is very suitable to join at the top near the entrance to solve the smoldering problem by changing shoes or shoe cabinet in a lot of home to keep the indoor air to fresh and lasting.



Fig. 2. Compound ceiling in the corridor of the bungalow style



Fig. 3. Compound ceiling in the dining room of the new classical style

The restaurant compound ceiling of new classical style shown in figure 3 is a very good work, which thoughtfully considered the human relationship. So the overall effect is neat and elegant, color and buckle design full of tension. The designers well consider the human relations with environment in compound ceiling design of study room in fig 4. The ceiling ,the wall and the ground formed a good corresponding relationship, in which the curly vines pattern with strong artistic atmosphere gave a psychological sense of serenity to users. A large area of dispersed light was used for creating a relaxed atmosphere in which people could read or think very comfortably. And the lamp module design around can play a good role of lighting crafts, antiques and other items.



Fig. 4. Compound ceiling in the Study of the bungalow style

5 Summary

The living environment is a multilevel large system. As one of the three basic elements (ceiling, ground, wall) in the interior space, the future product competition of integrated ceiling will must be paid attention to the high level of user experience. If we can create living environment to meet people's psychological demand based on the neo-ergonomics in product innovation, the development of products will be more competitive and help enterprises to upgrade the brand to achieve a win-win with customers.

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