Industrial Design in the Era of Information Technology

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Abstract. As an activity to meet human needs, industrial design has always been closely related to the scientific and technological conditions of its own era. In the 1970s, the information age dominated by information technologies such as the Internet and computers was launched. In the new era, design activities that have based on production levels and technology have also changed. Based on the background of information technology era, this paper explores the future development trend of industrial design from the dimension of technical characteristics, and based on information technology, combs the design process and proposes methods from design thinking to design practice, in order to meet the further needs of users.

Introduction

Industrial design is an innovative vision which meets human needs and creates production activities purposefully. Throughout the history of mankind, from the Stone Age, humans have consciously begun to make tools or polish stone, which is the prototype of the design. From the mid-19th century to the second half of the 20th century, after three industrial revolutions, industrial design has evolved from formation to maturity.[1] Every evolution has been accompanied by changes in production and manufacturing methods, from electrification, mechanization, and automation to informationization and intelligence. Therefore, the development of industrial design is closely related to the level of productivity and technology.[2] In the 1970s, the third industrial revolution based on computer and Internet opened the information age, and industrial design has undergone a qualitative change.[3] Based on the development of information technology, in 2011, the human society ushered in the fourth industrial revolution based on the information physics fusion system, namely Industry 4.0. Intelligent, interconnected and personalized became the new features of industrial design.[4] The rapid development of technology has made design no longer stop at creating products with physical functions only and made the design activities are no longer subject to traditional design thinking and methods. Industrial design has ushered in profound changes in the background of the information age.

Trends of Industrial Design in the Age of Information Technology

The industrial design in the information age is quite different from the traditional design. Whether the design is good or bad is lie in if it can conform to the trend of the times and meet the requirements of the times. The new historical background provides us with new opportunities. Fully understanding contemporary technologies knowledge and industry trends are the key to seizing opportunities. At present, industrial design as an interdisciplinary design activity involving many fields, such as technology, commerce, and service, understanding its development trend has important significance to providing a better life for people.

Design Interactively. Since the 20th century, information technology has been continuously developed with extraordinary speed. In the traditional industrial era, hardware products that use physical energy to drive mechanical structures have been concentrated on simple daily necessities, but nowadays the "machines" that use electronic information to drive functions have become an indispensable product in human life today. Sensing technology and control circuit technology have changed the relationship between people and "machines". The operating mode for these machines is no longer simply pressed buttons or rotary switches, machines have wisdom. The smooth

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communication between humans and machines is the guarantee for accomplishing purpose.[5] The machine with physical form and the control system for processing human input information constitute today's products.[6] The deep integration of hardware and software is an inevitable trend of future products. Industrial design is incapable and impossible to remain in the function, shape, color and other design of the product. Industrial design in the information age needs to pay more attention to human-computer interaction. How to make people quickly understand the way of operating and achieve goal and how to make the machine smoothly interpret human operation and meet the demand are the future direction of industrial design.

Figure 1. ATM

Design Digitization. In the information age, the Internet has spread to all aspects of social life. Also, the industrial design has undergone profound changes as a creative activity based on the background of the times. The traditional design method is that designers combine the personal experience with observation of social, and divergent thought, then designs. However, in the information age, the Internet can provide, share and apply large-scale data, which also provides new way for industrial design.[7] Designers can analyze and summarize the deficiencies of existing products by collecting big data, and predict the potential needs of users, and improve design, products, and user experience. In addition, computer-aided design, simulation experiments, electronic renderings, 3D printing and other technologies have made the design from idea, method to manufacturing to be more rigorous and scientific.

Intelligence Product. In the 1960s, artificial intelligence was first proposed as a new theory, method, technology and application system for simulating, extending and extending human intelligence.[8] Today, the research on artificial intelligence technology is beginning to take effect. Users no longer need to operate step by step. The current way is more like commanding employees. After issuing instructions, the machine with artificial intelligence technology as the core can make correct responses by analyzing people's order. Such as smart home, smart car, mobile phone intelligent voice assistant, etc. are the products of deep integration of virtual and reality. Xiaomi smart home, based on router, mobile phone and TV, provide users with application experience of simple operation and unlimited interconnection. Artificial intelligence technology is unstoppable, and product in the information age is bound to be intelligent. Therefore, industrial design must also evolve itself to apply artificial intelligence to the design.

Figure 2. Smart home system

The Internet of Things Product. The Internet of Things, is a network based on sensing technology, connects items to the Internet, completes information exchange, and conducts an information processing and command distribution. Generally speaking, the Internet of Things is a network connecting objects.[9] Unlike the Internet, the Internet of Things focuses on the interaction between "objects", but its goal is still to serve people. Nowadays, the Internet of Things has been used in many fields, from personal health to environmental protection, covering all dimensions of life. The Internet of Things will continue to develop steadily. In the traditional home environment, there may be household appliances such as thermometers, humidifiers, air conditioners, air purifiers, etc. Each type of electrical appliance needs to be controlled by the user. The Internet of Things technology will communicate with all household appliances and control them by one terminal equipment, such as mobile phone. Users can remotely or real-time control by simply taking out the mobile phone. Even the home appliances can be controlled by each other. When the thermometer detects that the temperature is too low, the air conditioner will be controlled to increase the indoor temperature. In the future, the product system based on The Internet of Things technology will continue to expand, and each product will have the function of communication and control. The deep integration between products is an inevitable development trend.

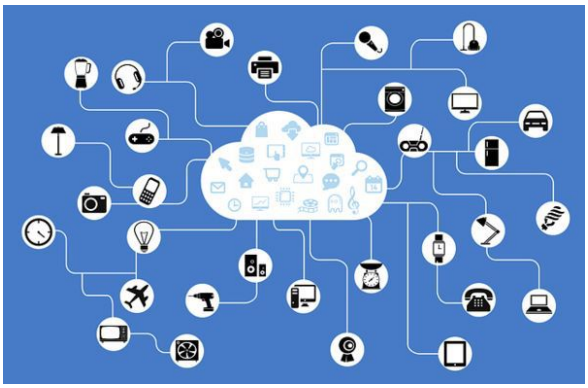

Figure 3. Internet of Things

Design Thinking of Industrial Design in The Age of Information Technology

Design thinking is a way of thinking that focuses on the problem and seeks solutions from a user perspective. [10]Today, with the rapid development of information technology, designers take more important responsibilities. They should have macro-level guiding ideology in order to spread more innovative ideas when implementing specific practices, which is more conducive to complete design tasks. The new era background requires designers think with new way to guide design practices. If designers stop feeding their minds, the design products will eventually be eliminated by the market.

Internet Thinking. The popularity of computers and the Internet, especially the mobile Internet, change the communication way of people with the objective world, including the way of human-to-human and human-to-product, from traditional forms to new mode based on information

technology. This model will continue to develop and become mainstream. Therefore, designers should have an Internet thinking, focusing on the three major information interaction systems of people, people and things, things and things, design from a broader perspective and improve communication way between people and products.

Big Data Thinking. Information technology has benefited all aspects of social life. For example, the Internet has a huge user scale, and each user will leave traces of data when browsing the web. These data are samples based on users' preferences, behaviors, and needs. Use this information to guide design activities can more accurately cater to users. Industrial design is not art. It is a multi-disciplinary profession. Design creativity depends on technology. Today, big data thinking makes industrial design more rigorous. From design creativity to design realization, data collection, mining and analysis can accurately discover the user's needs or the shortage of products. The scientific process greatly enhances the design efficiency and is more conducive to satisfying users' expectations for today's industrial products.

Intelligent Thinking. In 2016, AlphaGo defeated the human professional Go player as an artificial intelligence robot. From then on artificial intelligence entered the public eye. In the future, intelligence will continue to develop and penetrate all aspects of life, and industrial products are no exception. Artificial intelligence means understand human wisdom smoothly and response correctly which is the process that machine interpret and service human beings. The essence of industrial design lies in improving the quality of human life. Thus, intelligent design thinking undoubtedly can make design accomplish with half the effort. Designers should open their minds, re-examine product features and user needs, dig deep into user behavior, intelligentize existing products, or innovate unprecedented smart products to serve the public.

Design Method of Industrial Design in The Age of Information Technology

Thanks to information technology, transportation, biotechnology, manufacturing, communications and other fields are constantly developing. Undeniably, industrial design closely related to information technology has also benefited a lot. Throughout the design process, information technology plays an influential role from the creative stage, until the manufacturing, the role cannot be underestimated.

Design Creativity. In the creative stage, the traditional design creativity greatly depends on the designer's individual innovation ability. For example, throughout the history of industrial design, the classic seat design exudes light like art, but its essence has not changed. It is always a seat, just change a form or material. The design of the information age will subvert the tradition, and the existence of information technology has changed the way designers think, which provides inspiration under a specific background. For example, smart furniture is the product of applying new technology to existing items. The designer is no longer limited to whether the seat is comfortable or beautiful but focus on the whole process of use. The traditional furniture will shine with different charm. When and how do the furniture make a "smart response" to better meet the needs of today's users? Observing the surrounding environment with the question of "if this product can be intelligent" is undoubtedly a new way of creativity.

Design Assistance. Converting design concept to product need go through stage of hand drawn and model making which transform the abstract idea into a two-dimensional or three-dimensional model. For the different dimensions, the traditional methods are mainly hand-drawn and making physical scale model, which are time-consuming, materials-consuming and less effective. The popularity of computers and the development of information technology provide designers with new ways to offset the shortcomings of traditional methods. Whether it is a 2D or 3D drawing, it can be drawn in the computer. From color, material to structure, it can be expressed accurately according to the designer's intention. At the same time, it can be quickly modified which greatly improve the efficiency. In addition, whether the mechanical structure of the product can run smoothly can also be predicted by simulation software, and the cost loss of design failure is reduced.

Design Experiment. The initial product design or improvement process is often led by the designer or the team. Before entering the market, the user hardly participates from the stage of

creativity. It is impossible to ensure that the product function fully meets the user's needs or solves the user's pain points. Later designers recognized this problem and take steps to do user research, product testing, etc. But there were problems such as small sample size, insufficient representation, low data accuracy, much man-made influence, and long test period. At present, information communication is extremely efficient. In both physical and virtual design fields, products with short development cycles can adapt to high-speed operated society, and information technology makes it possible to shorten product cycles. In the design stage, designers can analyze the user behavior, find out the user's pain points and locate the user's needs through big data, collected through the network, or technical equipment, such as eye tracker. Using the data and technical equipment make the experiment has the advantage of wide application range and accurate data. Computer's computing power can quickly and accurately construct mathematical models and produce scientific results. To better meet the needs of users, products tend to Incrementally iterate. It is a feature of modern design to make timely adjustments based on users' feedback and market effects. At this stage, large amounts data provides a basis for rapid change. Modern technology based on Internet and sensor communication technology shortens the cycle of product design and improvement, comprehensively and deeply explores and meets user needs, improves enterprise production efficiency, makes design more scientific and rigorous, and protects benefits of both enterprises and users.

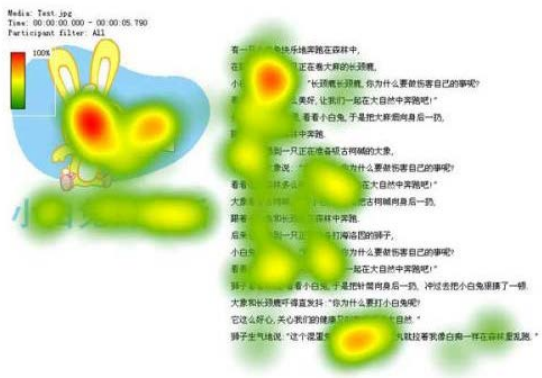

Figure 4. Hot zone map of eye movement test

Conclusion

Information technology is changing the traditional production and lifestyle with an unstoppable trend, which is a technological revolution. And design, as an innovation activity based on technology, can promote the progress of civilization. The transformation of technology is a foregone conclusion. How to grasp development direction, adapt to the trend, and play role is a problem that designers must consider today. Design thinking and design methods as the guiding ideology and operation means of the design process directly define the product attributes. The era of Industry 4.0 has arrived, the design is moving towards interaction and big data, and the products are constantly intelligent and materialized. It is the inevitable mission of the industrial designer that combine development trend, renew design thinking, have the concept of the Internet, big data and artificial intelligence, fully utilize technology, complete the design task efficiently and accurately.

Acknowledgments

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