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INNOVATIVE APPLICATION OF DIGITAL TECHNOLOGY IN DISPLAY DESIGN OF SCIENCE AND TECHNOLOGY MUSEUM

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Abstract. *The purpose of the study is to study the theory and concept of the application of digital technologies in the design of displays. This article discusses in detail the forms of digital display and modes of digital communication, as well as the process of their application in the design of displays of the science and technology museum.*

With the advent of the digital era, exhibition design is in an era of reconstruction of language, symbols and paradigms. The rapid development and popularization of information technology, while accelerating economic globalization and global informatization, are ushering in a new era.

The article classifies digital display technologies and highlights the advantages of digital display design, comparing them with traditional display methods. The design strategy of the digital display of the science and technology museum was proposed and an innovative design was implemented, which fully utilizes the new achievements of science and technology, maximizes the potential of designers and realizes unconventional design innovations.

Key words: *digitization, science and technology museum, innovation, display design, commercialization, education.*

Introduction

Digital technology is the use of computer and other technologies to objects or ideas into digital signals through digital means, and then through the computer to digital signals into our sense vision, hearing, touch and other identifiable technology. Since the beginning of the 21st century, with the use and popularization of computer networks, digital technology has been a comprehensive and rapid development, social economy and production and life have also undergone rapid changes along with the digitization process of information, and the interactive way of life has gradually become the dominant in people's life.

Museum display [1] refers to a group of exhibits formed in a certain space with cultural relic specimens as the main body and appropriate auxiliary exhibits in accordance with a certain theme, sequence and art form, which carry out intuitive display education, disseminate cultural and scientific information and provide aesthetic appreciation. Exhibition is the most important way for a museum to realize its social function, and it is also the unique language of a museum.

Analysis of the previous research

After the Industrial Revolution in the 18th century, museums began to fully open to the public society, and the social education function of museums began to take shape and get full play. People acquire more knowledge through museums. However, due to the space limitation of the museum warehouse, this exhibition space can not meet the

needs of visitors to visit and learn. In order to give full play to the educational function of the museum and accept more visitors, the museum began to distinguish the exhibition area from the storage space of the collection, which resulted in the production of museum exhibition.

In the early 20th century, the British Natural Science Museum improved the traditional way of display. On the basis of the original text display, it used pictures, annotations, models and other reasonable combinations to interpret the exhibits. In addition, Britain is also the first country to design and use standardized museum display cabinets. Through improving the materials of display cabinets, the utilization rate of display space can be improved. Since the 21st century, museums all over the world have experienced unprecedented development in terms of quantity, quality and variety. The rapid development of industrial technology and digital technology has provided more favorable conditions for excellent quality, high-end technology and more humanized display. Museum display is developing towards artistic sense, modern production, digital technology and humanized content, and museum display has entered a new era [2].

Objectives

From the perspective of display and display, museum display and display can be divided into two categories, namely traditional display and emerging display. Traditional display means the exhibition and presentation methods adopted by museums for a long time, most of which are static display methods. On the basis of cultural relics as the main body, pictures, words and other static auxiliary methods are used to express and interpret the contents of exhibitions. The emerging display mode is a new display mode that uses modern digital means to display the exhibition content and culture through sound, light, electricity and other high-tech technologies on the basis of cultural relics. With the progress of The Times and the development of science and technology, the means of museum display are constantly updated, and the traditional way of display can no longer meet the needs of museum visitors. Therefore, how to reasonably add digital technology to the display to make the exhibition richer and more attractive has become a problem that needs to be studied in the exhibition work of the museum at present.

Results of the research

In the digital environment, display design has changed a lot. In the design concept, design space, design research, design conception, design performance, design evaluation and other aspects presented new characteristics and advantages.

1. Design concept

Design concept dominates the design direction, different times have different design concept. When human beings gradually move from the post-industrial age to the information age, the concept of exhibition design naturally changes, which is mainly manifested in the following two aspects:

"Real" to "virtual"

A major shift from the traditional emphasis on the performance of real scenes to the digital focus on virtual scenes. Nowadays, the fast pace of modern life style, the traditional display way of fixed place and fixed time in the past, has been unable to meet people's needs for the rapid development of science and technology in today's

information age. In such a situation, the transformation of display design concept from "real" to "virtual" has become an inevitable[3]. The fixed form of display wall and display board in the former industrial age has gradually developed to the direction of virtualization, story-oriented, situational and scene-oriented in the information age, and there are operable and movable model institutions. With the gradual maturation of the technology, photoelectric technology can create unexpected special effects and some unique tricks, so that the audience in the virtual scene have the experience of being there. The forms, means and materials of exhibition have been greatly shifted in today's information-oriented world. Museums and science and technology museums do not need to build huge exhibition halls, and the objects to be displayed can be put in the depositary. They only need to use digital technology to produce their performances and store them in a virtual environment, and establish online museums through the network. Visitors can freely "visit" the exhibits, consult historical materials, and download them at will.

Moving from Static to Dynamic

Show the design concept from a static state to a state of motion. Before digitization, designers' intentions were expressed in the form of various engineering drawings and renderings, which were flat graphics that represented only the surface of the design. Although some design experts can make the scene realistic, the simulation is still the surface behavior of the static state, and they are in a passive position to be represented. In the information society, due to the fast pace of people's life, the traditional way of visiting a fixed place at a fixed time has been transformed to the pursuit of a more rich, flexible and flowing online way of viewing. The application of digital technology in the exhibition shows the design object incisively and vividly, showing every level and every detail of the object in the form of three-dimensional, and establishing a walking path to connect many Spaces in series, to show to the audience in the form of animation. Since there is movement, there is time, and there are four dimensional forms of expression. Objects are generated automatically in an instant, and their structure and motion modes are revealed in the process of generation, thus transforming from passive to active.

2. Design space

Design space refers to the space span formed in the respective locations when designers design a project in a certain period of time. The design space is an elastic space, the size of which changes with time. In the past, the design space was relatively small, mainly a city where the owner and design firm were located, but occasionally a region or a country. However, in today's digital environment, due to the emergence of network technology, the scope of design space has been greatly expanded, which is mainly reflected in the following two aspects:

Remote one-to-one design

That is, the owner of one country can use the network to invite the designer of another country to design, so that the design space becomes the space span between two countries.

Remote cooperative design

That is, designers from different countries can collaborate on a large project through the Internet. They send each other messages, plans and ideas through the

Internet, and can also ask and inspire each other through the Internet, and dig out their biggest creative inspiration, and all this is as convenient and fast as all the designers sitting in the same room.

Therefore, the design space has been greatly expanded in the digital age, from one city, one region or one country to the whole world.

3. Design research

The development of any design is inseparable from a comprehensive market survey. Design investigation: It is the investigation, analysis and research of design elements related to the exhibition theme. Since any display activity has a clear goal, the investigation, collection, sorting and analysis of the constituent elements is the basic premise of the display effect, which is a very important process in the display design program and has a significant impact on the following design steps. The more comprehensive, detailed and accurate the information collection and processing is, the smoother, easier and easier the design will be in the future. It can even be said that its quality determines the success or failure of an exhibition design. Generally speaking, the design elements to be investigated mainly include the following points: the reason for display, the content and form of display, how to display; The crowd, age and knowledge structure of visitors; The expected effect and time of display...

In the industrial age, the collection and processing of information are relatively slow, one-sided and fuzzy. In the information age, this process has taken a qualitative leap: it presents the advantages of being quick, comprehensive and accurate. This is mainly reflected in the following two aspects:

Information collection

First of all, with the popularity of the Internet, the network has gradually become the main place for digital display design creators to collect information. As long as the designer login to different websites, it is very convenient to obtain a variety of information, easy to create. Secondly, with the maturity of "information city" or "virtual community", when designers enter the "information city" through the Internet, they can quickly inquire the relevant information of the object of service -- visitors.

Easy to perfect the design. In addition, the previous written form of design questionnaire can also be networked: that is, through the way of E-mail design questionnaire.

Information processing aspect

After collecting a lot of data, designers need to process the information and find the rules. In the past, the designer had to do this by himself, which was cumbersome and inefficient. In today's information, due to the development of software technology, this work can be done by computer. In this way, designers can be freed from tedious and heavy repetitive work, so that designers have more time to display creative design. At the same time, it can greatly improve the speed of information processing and shorten the cycle of design research.

4. Design conception

After the designer gets a lot of first-hand information, the next step is to develop a concrete design idea. In this process, the designer needs to use the design sketch to record the design intention in mind and the fleeting creative inspiration. Designers used to draw sketches on paper with a pen. Now, thanks to the development of computer

hardware and software, design sketches can also be computerized: like the Hanwang Chinese writing pad, sketches can also be drawn with an electronic pen on a touchable electronic drawing pad. Not only does the device render designer sketches in real time on a computer, it also simulates the stroke, force and color of a traditional paintbrush very realistically. Indeed, digitalization has made it easier to express ideas in display design:

It is convenient to modify the sketch drawn by computer, which makes it easy for designers to transform and expand the scheme, thus indirectly inspiring designers to create.

The digitization of the design sketch makes the delivery of the sketch on the network more timely and efficient, so that the remote design tends to be more perfect.

The design sketch image can be inserted into AutoCAD to become a base drawing with fuzziness, which brings convenience for drawing AutoCAD engineering drawings.

5. Design performance

Design expression is the process of expressing the final design scheme and visualizing and embodying the designer's design thinking. Through color renderings, plane layout, top layout, interior elevation expansion, section, node diagram and other means to reflect. Its purpose is to allow the owner to further understand the designer's design intention, as well as the construction of workers when the construction basis. In the past, these drawings could only be drawn freehand on paper. Therefore, the whole design expression is not only tedious, inconvenient to modify, and the cycle is too long, the expression is not complete. But in the digital environment, design performance has changed dramatically:

Due to the development of computer technology, in the past, hand-painted plane layout, top layout, interior elevation diagram, section, node diagram, etc., fully available two-dimensional software AutoCAD to draw. With 3D software 3DStudioMAX, the 3D model can be built in the computer first, and the function of the camera in the software can be used to carry out multi-angle modeling. All-round observation, finally render the effect drawing. Therefore, the design performance presents the advantages of simple, fast, easy to modify, intuitive, complete.

With the maturity of Network Virtual Reality technology, designers can use Cult3D, Pulse3D, Ser, 3DML and other network 3D software to conduct 3D modeling, so that owners and related personnel can conduct multi-angle and all-round observation and evaluation of the design scheme through the network. In this way, it provides technical guarantee for remote design.

6. Design evaluation

The ultimate goal of design activities is to obtain an optimal design scheme. The optimal design scheme must be obtained through design evaluation. Compared with the past, great changes have taken place in the design evaluation under the digital environment, which are manifested in the following three aspects:

1. Evaluation procedure

In the past, design evaluation generally consists of two steps:

The first step: the designer selects 3 or 4 schemes from numerous design sketches through preliminary evaluation, and then carries out in-depth design;

The second step: the designer and the owner jointly evaluate the design scheme selected in the previous step from different perspectives, so as to obtain an optimal design scheme. In today's digital environment, with the development and maturity of the design evaluation system, before the second step evaluation, the computer evaluation system will be used to screen out 3 or 4 schemes in the first step for computer automatic evaluation, and as the reference basis for the second step evaluation.

2. Evaluation depth

In the past, the evaluation of the scheme was static, but in the digital environment, the design evaluation is a combination of dynamic and static: the animation function of 3DStudioMAX can be used to realize the dynamic evaluation of the design space.

3. Evaluation method

In the past, when the evaluation entered the last step, the designer, the owner and related personnel had to be organized at the same time. This is not only time-consuming and laborious, and evaluation inconvenience, evaluation cost is relatively high. But in the digital environment, thanks to the development of network technology, designers can bring their designs together through the network. In this way, designers, owners and related personnel can log in to the Internet through personal computers, express personal opinions and suggestions on the scheme, and make timely modifications. Thus, design evaluation becomes rapid and economical, and finally shortens the design cycle and reduces the design cost.

Digital display not only reduces the distance between ordinary people and science and technology, but also plays an important role in the education of young people. Specifically, it can attract their attention, make them have a strong interest in scientific research, and to some extent affect their future study, life and interests. Digital display is not a traditional still life but a dynamic thing that can connect with the audience more easily, that is, digital display is a display means to reinterpret and interpret the exhibits from a new Angle [4]. The differences between traditional display means and digital display means are compared and analyzed from various factors (Table 1), reflecting the advantages of digital display and the necessity of application.

Traditional exhibition means require a lot of time and manpower to arrange the exhibition according to the exhibition hall structure, which consumes time and energy, and limited by space or technical means, may not be able to show the full picture of scientific and technological level. In addition, the exhibition hall of traditional exhibition means is slow to update, and the exhibition idea is generally to display the exhibits according to the historical context of technological development, and the audience can only follow the set order to visit. And it is impossible to imagine the links between technologies and the key points of development. The addition of digital display technology makes rapid progress in display means, which can more vividly show the mutual relationship between the principles of science and technology and technology, and can be directly presented to the public through multimedia communication channels such as the Internet. The display ideas can also be personalized customized and information pushed according to the theme of everyone's interest. VR and AR technologies provide users with visible and tangible scientific and technological civilization and richer interactive experience. In general, digital display

not only expands the dimension of information display, breaks the barrier of time and space, effectively balances the contradiction between past space and display demand, Narrows the distance between science and technology and the public, and plays an important role in communication and education for visitors of science and technology museum and the public in an interesting and entertaining way.

Table 1 - Comparison between traditional display and digital display

Contrast factor	Traditional display	Digital display
Display environment	Mainly for science and technology museum, museum, art gallery and other indoor exhibition hall or outdoor space	Devices such as computers, digital interactive screens, mobile phones and multifunctional glasses
Display mode	It mainly carries solid objects in the display case, assisted by pictures and texts	Internet display, holographic projection, virtual tour
Time period	Affected by the opening and closing time of science and technology museums, etc.; Exhibition renewal is slow	Online 24 hours non-stop exhibition, not subject to time, geographical restrictions; The new speed is fast at the exhibition
Show ideas	Often according to the theme of the exhibition hall or the time sequence of the exhibition, the idea presents the characteristics of narrative and linear	Personalized services can be displayed according to user interests or technical relevance, and the ideas show the characteristics of divergence and curve
Audience range	Mainly for the visiting general audience, research scholars and related practitioners	It is socially oriented and covers people from all walks of life who are interested in science and technology, including offline field visits and online visits to the public. In addition, it has educational, popular science and guiding significance for young students.
Interactive experience	Most of them are appreciated through glass display cases, and the audience cannot touch them. The immersion is weak and the experience is crossed	Various means of interaction, rich visiting experience, knowable, can feel, touch
security	More uncertain factors, easy to damage, low safety	Digital document, permanent storage, high security
sharing	No sharing, no replication, no secondary processing	It can be copied, reprocessed, and collected and shared via the Internet
Communication channel	The channel is single, the scope is limited, the speed is slow	It is easy to spread through social platforms or mass media, with a wide range and fast speed
Show benefits	Subject to time, space or technical factors, may not be able to show all	Not limited by time and space, it can show the technical principles by means of virtual or modeling

With the increasing popularity of digital technology, more and more science museums are applying it to actual exhibitions. The emphasis on digitization of science and technology in science and technology museums is exciting, but the digital display is not perfect. At present, most museums have the same application form, similar means

of use, poor content, and do not highlight the characteristics of their own science and technology museums. After contact for a period of time, the audience will reduce their interest due to the high degree of similarity of display means, resulting in fatigue, thus affecting the communication effect. In addition, even if the digital model can restore the real object very lifelike, it still cannot meet the audience's pursuit of "authenticity". Therefore, although the application effect of digital display technology is better than that of traditional means, it should not be over-relied on and blind following should be avoided. It should be fully realized that the relationship between traditional display and digital display is the combination of virtuality and reality, complementing each other rather than replacing or replacing each other. Traditional display is the foundation of digital display, while digital display is the extension of traditional display content and form[5]. Whether it is digital or traditional, content is always the core of exhibition. Appropriate exhibition forms and means should be selected according to different exhibition purposes and types of cultural relics, so as to meet the visiting needs of various groups and realize the optimization of exhibition benefits.

Although the expressive force of traditional display design is very full, it is limited by space, time, materials and processing technology, and cannot achieve information transmission at will. Its means should be said to be relatively passive. Digital display design is a computer simulation of the three-dimensional environment, the user can be immersive, and control each object in the system, but also has the hearing, touch, smell of multimedia functions. Its "real-time" graphics rendering function makes digital display more diversified and proactive. The so-called "real-time" is a real-time random graphics rendering technology. It enables users to change their visual observation according to their own needs when viewing three-dimensional scenes and obtain the desired information. Such information acquisition behavior is completely active. What the designer should do is to guide the audience to enhance their interest in visiting, so that the audience can go where they see, and can personally become the operator of the latest design, from which they can get endless fun. And all this is done only by shaking the mouse in your hand, which is the biggest difference between it and the traditional display design, but also its biggest advantage.

With the development of CAD, human-computer interaction, multimedia, virtual reality and other technologies, high and new technologies have been added to the display design, breaking through the past exhibition wall, exhibition cases, pictures, text and lighting and other traditional means. The digital display design is more in line with the reading way of people in the information age, which is deeply loved by people from all walks of life. Just as industrial civilization relegated manual civilization to museums, digital civilization will replace industrial civilization to dominate our lives. Today, with the rapid development of science and technology, on the basis of information technology, digital display design represents the development direction of modern display mode, towards the direction of digitalization, integration, networking and intelligence [6]. At present, the concept of digital display design is confused, there are digital display, digital display and other terms. This shows that the digital display design is still at the initial stage of development, and there is still some ambiguity about the nature and content of each work. In terms of its research scope, digital display design is divided into two aspects: digital physical display and virtual display.

In today's world, any country that wants to gain an advantage in comprehensive national strength must gain an advantage in science and technology, especially in the innovative design and development ability of high-tech products [7]. Otherwise, it will be difficult to survive and develop under the pressure of strong international competition. In the creative and inventive exploratory design and innovative design, digital display design makes full use of the new achievements of science and technology, gives full play to the maximum potential of designers, and realizes the unconventional design innovation. In the information technology as the representative of the high-tech application, make full use of a variety of emerging technologies, emerging materials, well combined with market needs, to achieve another milestone in the history of display design.

Literature research method

Through the library, the Internet and other ways to collect a wide range of domestic and foreign books and literature related to the subject.

The advantages and shortcomings of the existing research results, explore the subject direction that can be further studied, and provide theories for the development of the project.

Field investigation method

Field survey of several science and technology museums, analysis and comparison of the application of digital technology in various science and technology museums and combined with the status quo of science and technology museums in Shandong Province into an appropriate digital application strategy. Concealed observation was carried out on the visitors to the Science and Technology Museum of Shandong Province. Pictures and written records were made of the visitors' visiting behaviors in the science and Technology Museum without disturbing them, so as to excavate the users' pain points and provide strong data support for the subsequent design practice.

Demand analysis

Through questionnaire survey, the public's demands on the content and functions of the mobile application of science and technology museum for digital display experience were collected, users' psychology and habits were understood, and users' operation process and product framework were sorted out.

Usability testing

The interface design of the prototype is verified by heuristic evaluation, and user testing of the prototype is carried out, focusing on users and the tasks they complete, obtaining user feedback to find design problems, improving the usability of the interface, and facilitating subsequent optimization and iteration.

Summary and conclusions

This paper introduces interdisciplinary knowledge of communication and computer technology, comprehensively analyzes the digital display form, digital communication mode and elements of science and technology museum, puts forward the digital display design strategy of science and technology museum and the interactive experience design principle of science and technology museum, and realizes the path innovation of the digital research of science and technology museum display design.

Based on digital technology, this paper transforms the theory into a practical case. Centering on the explicit and implicit needs of the audience for field visits to science and technology museums, this paper proposes a new digital display design strategy for existing domestic science and technology museums, completes the display design practice of science and technology museums, and extends the interactive design paradigm with extensibility. It has positive reference significance and practical value for the digital display design and the construction of communication mode of scientific and cultural achievements.

This article on the state of the construction of science and technology museum. First of all, at the policy level, the state supports the construction of more Limin Science and technology museums to serve the people's growing demand for science and technology and culture. Secondly, through investigation, it is found that the existing science and technology museum has problems such as unreasonable classification of exhibition disciplines, similar exhibits and lack of innovation in display forms. Therefore, in the future construction of science and technology museum, we can learn from the successful exhibition design cases of foreign science and technology museums, use digital technology to enrich the display forms, highlight the characteristics of exhibits, and hold online personalized customization strategies. After that, the relevant theories and concepts of digital technology are elaborated, and then the design process of digital technology in display design and the classification of digital display technology are described. Finally, the characteristics of digital display design are highlighted by the comparison with traditional display methods, and then the necessity of this research topic is reflected. Finally, it is proposed to formulate a new exhibition design strategy based on the needs of the audience in the process of browsing the science and technology museum, and the effectiveness of the design strategy is verified through practice.

It also analyzes the application of digital technology in science and technology museums from the two aspects of "full use" and "partial use". Science and technology museums with full use of digital technology not only inject fresh and modern power into traditional museums, but also make the connection between audiences and museums closer. However, some specific things cannot be fully expressed by digital technology. Its historical charm and humanistic feelings need the audience to empathize with them. Moreover, digital technology talents also have high requirements on financial resources, exhibition content and exhibition venues, so it is not widely applicable to every museum. Some science and technology museums that use digital technology can display the contents of exhibitions more truly, enhance the interaction of exhibitions, and have great feasibility. Compared with the exhibition way that uses digital technology completely, this way saves more financial and material resources.

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