Research on digital display of intangible cultural heritage

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Abstract. This paper studies the digital display of intangible cultural heritage, which is helpful to the protection and inheritance of intangible cultural heritage. From the perspective of the integration of technology and culture, this paper first analyzes the reasons and necessity of digital exhibition, and then proposes that traditional, emerging, multi-technology integration applications and other digital technology means should be adapted to different types of ICH exhibition, in order to accurately, truly and comprehensively display and disseminate information, and finally establish a two-way channel for information flow.

Keywords: Intangible Cultural Heritage; Display Design; Digitalization.

1. Introduction

The intangible cultural heritage (ICH) contains the cultural essence of our country and embodies the strong cultural creativity and social vitality of our people. As an important means of cultural reconstruction and dissemination, the exhibition is one of the ways of appearing in contemporary society. With the continuous adjustment and transformation of urban and rural structures in China and the rapid development of digital technology in the Internet era, the original space on which intangible cultural heritage depends has been affected and destroyed, and much ICH is even on the verge of disappearance and loss, and its protection and publicity work is also difficult. On the one hand, due to the low educational level and poor economic conditions of some inheritors, young people go out to work and lose interest in ICH, resulting in no successors; on the other hand, due to the single means of interpretation, display and dissemination of ICH, the participation and experience of the display are not strong, and it is difficult to attract public participation in modern society with rich entertainment activities.

In addition, the COVID-19 epidemic has forced the closure of many ICH exhibition halls and exhibitions, which has greatly impacted the spread of ICH, and the traditional ICH exhibition and dissemination has been unable to operate well. To achieve steady progress in the severe environment, we must break the technical barriers and improve the online and offline display forms.

From the perspective of the integration of science, technology and culture, this study explores how ICH exhibitions can effectively use the form of intelligent digital and the thinking of interactive design, and by means of digital technology and the Internet, realize the digital interpretation of cultural content from the aspects of the online and offline association, virtual and real integration, global interaction and personalized experience, and so deeply tap the interactive potential between ICH and the public, and maximize the cultural and social service advantages of ICH.

2. Current status of digitalization of ICH exhibitions

In 2003, UNESCO promulgated the Convention on the Protection of the Intangible Cultural Heritage (hereinafter referred to as the "Convention"), formally defining the concept of ICH, and proposed "various measures to ensure the vitality of intangible cultural heritage, including the identification, filing, research, preservation, protection, publicity, promotion, inheritance and revitalization of all aspects of such production"[1]. The protection and dissemination of ICH have attracted much attention in various countries. Our government has also invested a lot of manpower, material and financial resources in this field, and has promulgated the Opinions on Strengthening the Protection of China's Intangible Cultural Heritage and the Law of the People's Republic of China on

Intangible Cultural Heritage. The Ministry of Culture, the Ministry of Education and other national ministries and commissions have also supported the protection and dissemination of ICH in the field of scientific research, and scholars in many fields have begun to focus on this research. However, there are still many difficulties in the protection and inheritance of ICH in China, so it is urgent to use digital technology to assist in ICH display and integration and preserve and disseminate ICH projects.

2.1. Lack of mining the connotation of ICH

At present, the ICH digital display has gradually become the mainstream means of ICH display, but due to the lack of cooperation and guidance of professional ICH curators, display designers and digital designers in some pavilions and museums, and the superficial taste of cultural research, to a certain extent, ICH and digital technology are rigidly grafted, showing a simple and crude "technical experience".For example, a Peking Opera exhibition uses face capture technology to randomly cover different Peking Opera masks on the viewer's face on the LED screen. The viewer experiences the fun of interaction but does not understand the details of the masks and Peking Opera. At this time, "ICH exhibition" has become "technology exhibition", and the profound connotation of ICH has not been explored and can not be reflected, which not only loses the essence of the ICH exhibition but also makes the viewers unable to touch the core value of ICH.

2.2. The mental crisis caused by digital technology

With the popularization of 5G, big data, cloud computing and artificial intelligence, human beings have entered the era of "digital intelligence".Immersion and scene are influencing and penetrating the field of display design, and constantly promoting its rapid innovation and upgrading. The traditional physical display can no longer meet the needs of the audience. Major technology companies, cultural and tourism bureaus, museums and exhibition centres have launched virtual exhibition services such as cloud exhibition hall, online immersion experience, full illusion and so on. On the other hand, the overall algorithmization of human emotion, spirit and body has resulted in the rupture of time and space and the emptiness of meaning. The spiritual crisis, cultural crisis and pan-entertainment brought about by science and technology have plunged the protection of non-relics and their display and dissemination in modern society into another dilemma. For example, the 3D printed "clay figurine Zhang" clay sculpture, the digital printed "Yangliuqing New Year Painting" and the online "Guangdong Lion Dance" game have brought great commercial value to non-legacy, while the excessive industrialization has also made it lose its cultural meaning[2] .

2.3. The concept of digital display design is backward

The innovation of display form is not equal to the innovation of display concept.Because before the advent of the digital age, the focus of exhibition design is mainly on the collection, and the material form of exhibits is the main way to disseminate information, and this concept will exert a subtle negative impact on the digital display of non-heritage, that is, curators or exhibition designers will directly output ICH content in digital form, ignoring the effective transmission of information and the viewer's experience.At the same time, new technologies play different roles in the exhibition of different types of ICH projects, which will have an impact on the concept of ICH digitalization. Therefore, it is necessary to conduct in-depth research on the connotation and extension of different types of ICH projects in combination with changing technologies, which is the basic issue affecting the research and practice of ICH digital exhibition[3] .

3. Reasons for the digitization of ICH exhibitions

3.1 Digital Technology Enabling ICH Exhibition Design under Normalization of Epidemic Prevention and Control

The COVID-19 epidemic has caused exhibition halls and museums that have not undergone great changes in their exhibition modes for many years to launch online digital exhibitions one after another. In 2020, the State Administration of Cultural Relics urgently deployed to launch more than 2000 online exhibitions in a month, with more than 5 billion visits, reaching more than four times the annual number of visitors to national museums[4].As a result, the reform of domestic display mode has begun an unprecedented large-scale experiment, and the combination of online and offline display forms has been further practised Since then, it has become a trend for cultural heritage exhibition halls to shift from field to online.Related VR, AR, 5G and other technical media are gradually integrated with display design, and the Palace Museum and the National Museum of China have joined the wave of digital exhibition, becoming pioneers in the context of the meta-universe.

3.2 The transformation of ICH display mode driven by technology

Technologies such as 5G, big data, cloud computing and artificial intelligence have become popular, and human beings have entered the era of "digital intelligence". Immersion and scenario are constantly influencing and penetrating the display field, and constantly promoting its rapid innovation and upgrading. As a result, the exhibition design will enable the realization and application of immersive narrative experience from the aspects of the full-scene flow of exhibition space, online and offline association, integration of virtual and real, global interaction, personalized experience and real-time storage, breaking the age, space-time boundaries, class distinction and racial differences, so that ICH has more possibilities of interpretation and communication. The promotion of the quality of ICH exhibitions by digital technology no longer stays in the imagination and efforts of a few people, making it possible for the offline exhibition with poor quality to be replaced by the digital display combining online and offline, and making the ICH show better display and dissemination in the participation of new technologies, new media and new platforms.

For example, holographic image technology breaks the barrier between the virtual image and material world, increases the dimension of virtual and real interaction between virtual and reality, and extends the space-time scope of display; Audiences can freely choose the distance and perspective of the exhibition, freely magnify or weaken a certain display element, interact with each other in the form of holographic images within certain regulations, become part of the exhibition, and even switch scenes according to their wills, which are the reconstruction of the display behaviour and narrative mode at the audience level. It also shows a new coexistence mode between the audience and the exhibition.

4. Overview of the digital display of ICH

The digital display of ICH takes ICH as the display content, uses digital technology as the display means to store, process, convert, restore and other digital regeneration forms of ICH, and then displays and disseminates them through various media platforms or digital media platforms, so as to ultimately achieve the protection, dissemination and inheritance of ICH, and produce cultural impact and economic value. This is shown in Figure 1 below.

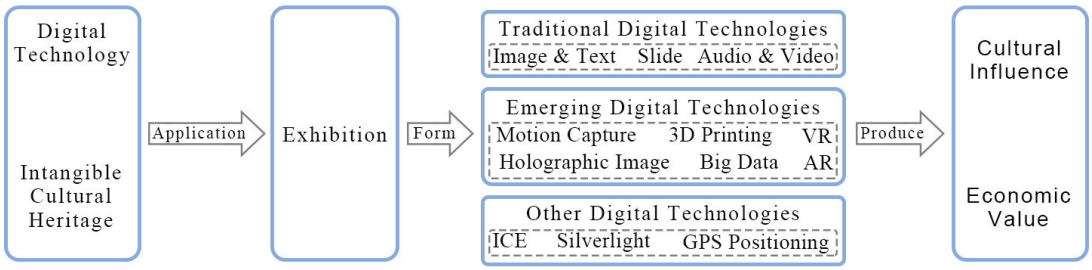

Figure 1 Overview of Digital Exhibition Ideas of Intangible Cultural Heritage

5. Digital media for ICH exhibition

There are many kinds of ICH resources. According to the forms of expression and value orientation of ICH projects, Yang Hong divides ICH into four categories: traditional performing arts, traditional arts and crafts, traditional production, life knowledge and skills, and traditional festivals and ceremonies[5]. Based on this classification, this paper analyzes different categories of ICH, studies and summarizes their adaptive and differentiated digital display forms and strives to display and disseminate information accurately, authentically and comprehensively.

5.1 Traditional Digital Technology

The digital display of ICH is based on the traditional display media[6] , that is, the collection, collation and display of ICH through basic digital technologies such as graphics, slides, audio and video.Audio and video technology has become an important means of cultural heritage protection and dissemination as early as before the popularization of other sophisticated digital technologies. National Geographic, NHK, BBC and many other internationally renowned radio stations have broadcast a large number of ICH documentaries.However, in 2006, CCTV broadcasted the first large-scale ICH documentary series "Archives of China's Intangible Cultural Heritage", which takes inheritors as the first perspective and shows nearly 20 ICH projects such as dough sculpture, and clay sculpture and traditional Chinese medicine in an artistic form.In recent years, there has been an explosive growth of audio-visual works on the theme of cultural heritage in China, with a series of high-quality documentaries such as "I Build Cultural Relics in the Palace Museum", "Hand-made China" and "Inheritance"[7] .

5.2 Emerging Digital Technologies

Since 2003, the Convention has encouraged the protection of ICH in terms of scientific, technological and artistic methods, and digital technology has gradually penetrated into the protection of ICH. With the continuous development and application of science and technology, new digital technologies such as motion capture, 3D printing, virtual reality, holographic projection, Internet of Things, big data and intelligent application terminals provide new technical means and curatorial ideas for ICH exhibitions.

5.2.1 Performance ICH-Exhibition Space and Motion Capture Technology

Traditional oral literature as well as language, music, dance, drama, quyi and acrobatics as its carrier belong to ICH projects of performance[8], and the main carrier is the inheritors of related projects, especially the relevant methods, knowledge, wisdom, skills and spirit of the inheritors[9].Performance projects rely on people's deduction, and actors use sound stage tables (sometimes physical props) to perform and spread culture. Its development and inheritance mainly rely on the unique performance form of the inheritors to teach by words and deeds. It can be said that the inheritors are the soul core and inheritance carrier of the project.Performing ICH projects do not exist as physical objects or facilities but rely on the deduction of inheritors, which is a living specimen of performing ICH projects.

The traditional way of the exhibition is relatively single, mostly in the form of documents, pictures, objects or models, and the way of information transmission is mainly static display by arranging and processing the same group of information, which makes the performance project lose its core attraction, and even makes people feel boring.Therefore, in the exhibition of ICH projects of performing arts,an appropriate stage or stage should be added, including the storehouse for storing costumes and props and the dressing room for actors, as well as the display space for cultural relics with certain protective measures, additional interpretation texts or related cultural relics to witness history.

In recent years, the dynamic capture system led by Leap Motion has become more and more popular. For performances that are difficult to record effectively, dynamic capture technology is an indispensable and powerful tool in exhibition design. It can provide a "one-stop service" for audiences interested in such art performances to understand, appreciate, learn and experience. For example, the display of a certain kind of musical ICH is to track, simulate and recognize musical gestures through dynamic capture technology, and visualize them, so that the audience can not only understand the performance process of the ICH but also participate in it and create it[10]. This form of ICH communication is not boring preaching and popular science, but a strong combination of artists and scientific and technological experts, curators, designers, and film and television directors who know how to communicate effectively with modern audiences, using multi-dimensional display language to explain the charm of ICH.

5.2.2 Traditional arts and crafts-hand-made space and 3D printing, virtual reality technology

Traditional art and calligraphy ICH belong to the type of projects with relatively low exhibition requirements, most of which are exhibited in the form of related physical works, cultural relics and historical sites, and recorded documents, but the static form of the exhibition will intangibly affect the dialogue between the public and ICH, and it is difficult for viewers to generate enthusiasm. In recent years, the domestic ICH museum has adopted the method of adding hand-made experience space, so that artists can have their ICH studio in the museum, and visitors can experience the production of handicrafts, in this process, inheritors can vividly display the charm of non-heritage so that people can enjoy it. At the same time, they can also get more inspiration in the process of displaying, explaining, guiding and watching the works of the experiencers, and visitors will also have a profound exchange with ICH in the process of an interesting experience. For example, the Museum of Arts and Crafts in Hangzhou has set up an artist's studio on the second floor. Every afternoon at four o'clock, pupils from the school will enter it. Although their study of ICH may not be in-depth, their frequent visits will lead to the potential spread of traditional handicrafts.

Digital display technology transforms, reproduces and restores ICH into a shareable and renewable digital form, and interprets, preserves and utilizes it from a new perspective[11]. Among them, digital technologies such as 3D printing technology and virtual reality technology provide new display means and methods for traditional arts and crafts. High-precision 3D digitization technology can provide practical solutions for many specific problems in the protection, display and dissemination of ICH, such as Tibetan "Zetie" and Regong Thangka, which use 3D modelling technology to display the production process through 3D animation and share it on the network platform[12]. Virtual reality technology (VR) has also become an important tool for cultural heritage research, which constructs multi-dimensional virtual cultural space through the material collection, scene modelling, interactive design, etc. Users interact with the system in a variety of ways, such as gestures, and actions, to achieve an immersive experience of ICH. For example, the digital display of Quzhou Yingbai Porcelain, an ICH of traditional arts and crafts, should not only present the material, shape and pattern of the objects, but also the production process and handicraft characteristics, which can not only be analyzed by 3D printing technology but also be used by virtual reality technology and wearable equipment to make the audience feel when firing. Through the combination of material elements and non-material elements digitization, it reflects the relationship between traditional skills and people's lives, better preserves and displays ICH, and disseminates the knowledge, information and cultural values contained therein.

5.2.3 ICH of traditional production, life knowledge and skills-digital experience space

Because most of the traditional ICH projects of production, life knowledge and skills need more complex processes and longer completion time, it is not suitable to set up the whole process experience space of such ICH projects in the exhibition hall, which leads to the viewer's tour like a leopard in a tube, which can hardly produce profound experience and perception. For such ICH projects, it is very important to add digital experience space in the museum by using holographic projection, an online database, somatosensory interaction, sound motion capture and other technical means. With the help of multimedia technology, the audience can show the complete process of ICH skills and pay attention to the steps they are interested in selectively. The interactive experience device enables the audience to complete the interactive experience through the touch screen, motion sensing and other multimedia, and cooperate with the surrounding real scene devices so that the audience can get an immersive experience. It can not only receive the information and spirit that the museum wants to convey in a short time, but also change the single visual experience into an interactive comprehensive experience.

For example, the virtual rain scene set up in the Chinese Umbrella Museum shows the dripping raindrops and diffused water mist through phantom imaging technology, and the interactive curtain of human body induction can not only see the ripples of raindrops but also produce ripples at the foothold when people pass by, with the sound of rain and the white walls and grey tiles created in the museum, so that the viewer can see them. It can also produce a simple and gentle emotional experience of oil-paper umbrellas.

5.2.4 Traditional Festival and Ritual ICH-Periodic Activity Space and Public Cultural Platform

Traditional festival and ritual ICH projects include ceremonial ceremonies and festival activities with relatively fixed times and places, such as temple fairs, fairs, etc. The periodic characteristics of these projects inevitably require that periodic and flexible exhibition space be added to the exhibition space and that the functional zoning of the exhibition area is rationally planned to avoid the waste of space on weekdays. In addition, because some activities need certain learning and exhibition space, or need special props, such as torches, firecrackers, etc., this requires designers to consider the safety of space when designing relevant personnel activities and performance space, and add corresponding off-site activity space when necessary. Because of the ICH of traditional festival ceremonies, interactive facilities such as holographic images, touch screens, virtual reality and dynamic capture can not only be used to enhance the audience's sense of experience but also to realize the full scene flow of the display space through the Internet and public cultural platform, so that information and images can be stored in real-time. It integrates a more interactive experience into the exhibition process, greatly improves the speed and breadth of ICH transmission, and achieves the goal of displaying and disseminating excellent traditional Chinese culture.

6. Other methods and means of digital technology

In addition to the above mainstream digital technologies, targeted technology development and the integration of various technologies are also one of the current trends of the ICH display. For example, in 2010, the Palace Museum, Microsoft Asia Research Institute and Peking University jointly developed the immersive digital sound and picture display project "Entering the Qingming Shanghe Tu", which is based on Microsoft's ICE and Silverlight technology, aiming at the spatial modelling characteristics of the three-point perspective of "Qingming Shanghe Tu". The original 3D layout recovery algorithm and virtual environment organization method are developed. According to the plot of the scroll, 54 scenes were arranged, and more than 700 dialogues were simulated, which vividly reproduced all the details of the original work[13].In the process of visiting, the audience can not only interact with the exhibits through the multi-touch screen but also guide the audience to complete the immersive experience of Bianliang's local conditions and customs according to the

audience's browsing position and dynamic real-time synthesis of the characters dialogue, scene sound effects, background music and so on.

With the PC network platform as the display medium, the display form that combines high-precision GPS and VR technology to bring the audience a simulated and operable panoramic experience is also becoming popular[14]. In 2018, the Digital Research Center of Dunhuang Research Institute released a three-dimensional panoramic view of Dunhuang Grottoes on Tencent Map, realizing the integration of online and offline, virtual and reality, and promoting the construction of intelligent scenic spots of Mogao Grottoes.

In addition, as a comprehensive technical means of human-computer interaction, virtual reality, big data and cloud computing, the game engine has become one of the important means of ICH display. For example, in 2018, the Palace Museum and NetEase Game developed an interactive narrative game "Huizhen Miaobi Qianshan" based on "Qianli Jiangshan Tu", which creatively transformed "Qianli Jiangshan Tu" as the original painting of the game, with Chinese classical musical instruments as the background music, and used ICH as props or script plots throughout the main line of the game, such as Taiji Eight Diagrams Array, tenon and mortise, paper money, etc.[15]. Through role-playing and exploring behaviour, players can interact with ICH information in roles or processes, to maximize the understanding of ICH cultural content, historical origin and connotation.

7. Conclusion

To sum up, ICH needs to integrate traditional and modern exhibition methods. The traditional exhibition is mainly embodied in the form of ICH artefacts or models of artefacts, pictures and texts, and performances of inheritors; Modern exhibitions mainly include traditional digital technologies such as audio and video, slide show and emerging digital technologies such as 3D, AR, AI, big data, cloud computing, as well as non-digital forms such as hand-made experience, stage performance and visitor participation. This is shown in Figure 2 below.

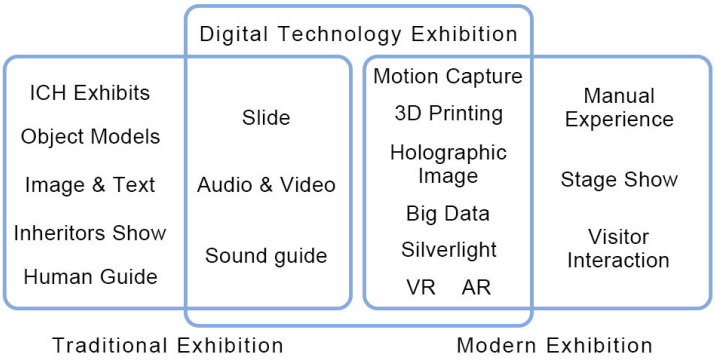

Figure 2 Analysis of ICH exhibition methods

The digitalization of ICH display design has become an inevitable trend of the times, and digital technology and scientific and technological means have become an important means of ICH display. From social networks to public cultural platforms, from visual experience to multi-sensory immersive interactive experience, from passive acceptance to active participation, digital display forms have played a positive role in promoting the protection and dissemination of ICH. However, digitalization is not a panacea for non-legacy survival, and the core of digitalization is the spiritual core and cultural significance of ICH, so we should not only pay attention to the application of technology but also to ICH itself, to avoid the risk of cultural connotation variation.

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