

An Investigation of the use of Digital Interactive Art in Museums preserving Intangible Cultural Assets

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Abstract. As science and technology advance, museums of intangible cultural heritage have made significant investments in network and digital development. As a new art form, digital interactive artworks have gradually emerged. To realize the innovative development of intangible cultural heritage museums, literary and art workers need to make full use of the background of the meta-universe and related technologies to create museums empowered by new technologies, and use new technologies to help the construction of digital cultural relics and interactive exhibition halls. This paper mainly analyzes the characteristics of digital interactive art within the framework of meta-universe, from the development status of digital museums and the technical means of digitally empowering intangible cultural heritage museums. Through case analysis, this paper discusses the advantages of digital museums in display form and interaction. Finally, in the application of digital interactive technology, the author puts forward the strategy of building an interactive learning platform of ‘entertaining and entertaining’, creating a museum characteristic IP empowered by new technology, and constructing an immersive narrative scene of virtual and real symbiosis. Future developments of museums specializing in intangible cultural heritage can draw inspiration from the application strategies of these three digital virtual reality technologies in museums.

1 Introduction

With the continuous development and progress of Chinese society, people are no longer limited to material needs, but start focusing on spiritual pursuits. From the ‘museum fever’, it can be seen that individuals are becoming increasingly conscious of national cultural relics and museums. Programs containing Chinese traditional culture, such as ‘Only This Green’ and ‘Tang Palace Night Banquet’, have also won the love of the general audience. In recent years, under the guidance of technical support and policy, museums have become an important part of the cultural industry. According to the data, during the 13th Five-Year Plan period, the number of museums in the country increased from 4692 to 5788, with an average of one museum built and opened every two days [1]. The annual number of visitors to the museum has increased from 700 million to 1.2 billion, with an average annual increase of 100 million [1]. By the end of 2021, the total number of museums in the country has reached 6183 [1].

In the past few decades, digital technology has penetrated various fields and changed the way people acquire, process and exchange information. The introduction of the concept of ‘Yuan Universe’ in 2021 has spawned many emerging industries and business models. The digital world has become an important part of people’s life and work, from computers to the Internet, and now to new technologies such as cloud computing,

big data and artificial intelligence. The construction of the smart museum in the Yuan Universe will enable the museum to move further into the future on the existing basis, and then realize the integrated intelligent operation of the museum, which will become a new trend in the construction of the smart museum [1]. Among them, digital interactive art and digital museum, as a product of the digital age, have injected new vitality into museum exhibitions. In addition to being a valuable tool for promoting traditional culture in the cultural sphere and applying to a wide range of business industries in contemporary society, this embodiment can also provide people a glimpse into a scientifically and technologically advanced way of living [2].

As an emerging art form, digital interactive art combines technology with art, providing audiences with a new artistic experience and feelings. At the same time, as an important place to display and inherit the heritage of intangible cultural goods, the digital museum, with the support of the rapidly developing meta-universe and its related technologies, digitizes the display content of the traditional museum through digital technology, transcends the confines of space and time, and provides the audience with a more convenient and rich appreciation experience. Through the use of virtual reality, augmented reality, and other technological tools, the digital museum can also reconstruct the historical setting and context of cultural artifacts. This can offer visitors an immersive experience, improve their comprehension of intangible cultural heritage, and

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present significant growth opportunities for both the museum and the cultural tourism sector. However, how to digitize the display content of traditional museums, how to combine digital technology with traditional display methods, give full play to the advantages of digital museums of intangible cultural heritage, and apply digital virtual reality technology to museums is also a problem worthy of in-depth discussion by literary and art workers.

The purpose of this study is to hope that with the continuous development of digital technology, the use of interactive technology will make greater contributions to the protection and inheritance of the art field and intangible cultural heritage. Therefore, this paper will take examples to study the development trend and application prospect of digital interactive art and digital museum, and provide useful reference and enlightenment for the research and practice in related fields by integrating and analyzing the literature.

2 The characteristics of digital interactive artworks

2.1 The concept of meta-universe

The meta-universe is not a new technological invention, but a new concept. It is derived from the science fiction 'avalanche' created by the science fiction writer Stevenson in 1992 [3]. It is a virtual and digital universe composed of countless virtual worlds, virtual spaces and virtual objects. Based on this concept, Internet technology has extended the meta-universe. New technologies such as blockchain, cloud computing, and digital twins, have created a virtual world and digital living space that maps and interacts with the real world, making the concept of the meta-universe concrete [4]. After Baidu, Microsoft and other large Internet companies entered the field of meta-universe, various fields began to find entry points in the meta-universe. Starting from the field of art, people can create and express through digital interactive art. This art form is not limited by physical space and can be infinitely expanded and innovated.

2.2 Features of Digital Interactive Art

A contemporary art form is digital interactive art, which combines technology and art to make artistic creation interactive, virtual and interesting. In digital interactive art, the audience is no longer a passive recipient, but a participant in artistic creation. Through their behaviors and choices, they give new possibilities based on the artists' creations and affect the display of artistic works. Digital interactive artworks provide the audience with a new artistic experience and feeling, and become an art form that has attracted much attention and admiration in the field of contemporary art. For example, Li Haozhe, an artist who used to be an interactive designer in Team Lab studio in Tokyo, his hand captures the interactive work 'ink marks' [5]. The audience's hand can touch and

control the behavior of ink droplets on the screen of the work. The shape, depth and direction of each ink line will be controlled to produce different changes. Besides, the artist set up antique background music. The audience can not only interact with the works, but also experience the traditional ink painting presented by digital media, which is more interesting than the single display works.

However, with the diversity of exhibitions, the audience's interest in artworks is getting higher and higher, and the immersive interactive experience space has become a hot spot. This requires the work to design a virtual art area and scenario using virtual reality technology, so that the audience can interact and experience in the virtual world, and feel the unique experience of the work. By mobilizing the five senses of the audience, digital interactive art enables the audience to produce instant artistic feelings under the stimulation of immersive virtual scenes.

3 Digital museums and intangible cultural heritage

3.1 The form of traditional intangible cultural heritage museum

The Museum of traditional intangible cultural heritage (intangible cultural heritage) is a cultural institution with the main task of displaying, protecting and inheriting intangible cultural heritage. For example, the National Intangible Cultural Heritage Museum of China has been dedicated to displaying and protecting China's rich intangible cultural heritage since its opening in 2011, such as traditional skills, performing arts, folk music, and folk dance. Each exhibition space contains the history, skills, inheritors and other information of various intangible cultural heritage projects, which can make the audience better understand and experience the intangible cultural heritage culture. However, the display forms of these traditional intangible cultural heritage museums are usually relatively simple, mainly based on physical exhibitions and items, and then pass on the connotation and value of intangible cultural heritage culture to the public through interpretation and other ways, which is relatively lacking in interaction with the audience. The effectiveness of museum exhibitions can be significantly impacted by this passive information intake, which can quickly lower audience engagement in viewing and cause some viewers to give up on the later viewing process or experience the exhibition in a horse-watching manner [6].

3.2 The development status of digital museum

With the rapid development of digital technology, digital museums have gradually become a new way of inheritance and display of intangible cultural heritage. In 2011, after the digital Dunhuang Museum became popular, a series of digital museums were gradually established. For example, in 2012, Baidu Encyclopedia Museum plans to go online, and has successively

launched digital cultural exhibition areas, VR panoramic experience areas, and digital collections [7]. In 2018, it also launched the ‘China Cultural Museum Digital Achievement Exhibition’ to show the beauty of Chinese cultural museums with a variety of technologies [7]. In 2016, the digital exhibition hall of the National Museum was opened [7]. By 2022, a total of 75 digital exhibition halls will be online [7]. With the help of VR panoramic technology, many important offline exhibitions can be reviewed online [7]. The digital museum uses virtual reality, augmented reality and other technical means to digitize the display content of the traditional museum, so that it can be disseminated and displayed through the Internet, mobile devices and other carriers. It solves the problem of the single exhibition form in traditional intangible cultural heritage museums and provides new ways and possibilities for the inheritance and promotion of intangible cultural heritage.

3.3 The technical means of creating digital intangible cultural heritage space

Digital intangible cultural heritage space is a virtual space created by digital museums to display intangible cultural heritage. Digital intangible cultural heritage space uses digital technology to combine the traditional skills, performances, customs and other contents of intangible cultural heritage with digital interactive art through three-dimensional modeling, virtual reality technology and other means, and presents them in digital form, so that the audience can experience and feel the intangible cultural heritage culture through the Internet or virtual reality equipment. One of the representative examples is the project of Xiangyuan Kang Wei Painting Digital Museum launched in 2020 [8]. Its creative concept is to use digital reproduction to reproduce the ‘living space of Kang Wei Painting’ [8]. Through the collection of wind and data, the representative natural environment, residential buildings and folk scenes in Xiangyuan area are selected [8]. Finally, the digital museum of Kang Wei Painting with Taihang Mountain culture, Xiangyuan characteristic residential buildings and folk scenes as the carrier is created [8]. It can be seen that the digital intangible cultural heritage space transforms the culture from a single presentation to a digital presentation, from a physical display to an interactive display, and then combines with audio-visual and LED large screens to create a new way in the dissemination of culture.

3.4 The advantages of intangible cultural heritage digital museum

From the recent phenomenon of ‘museum fever’, it can be found that young people are interested in museums because they are touched by the historical stories behind cultural relics. The audience has emotional resonance with the ancients in the cultural experience. The origin of cultural relics and Chinese civilization has aroused people’s thirst for knowledge, and its advantages of openness, richness and interactivity have been

highlighted.

The digital museum is open. As the ‘panoramic world’ developed by the Palace Museum, through the form of virtual exhibitions, audiences can visit and learn intangible cultural heritage culture anytime and anywhere through the Internet and digital technology, without time and space constraints, and can also visit museums without tickets.

The digital museum is rich. Such as Suzhou Intangible Cultural Heritage Museum, emphasizing Suzhou characteristics and intangible cultural heritage time and space, dynamic and static combination, listening to sound, setting immersive multimedia interactive display and live performance, touch screen to understand the intangible cultural heritage, interactive experience, AR augmented reality interactive game, sound capture induction, infrared capture interactive touch table, multi-screen interactive digital touch sand table, human body induction interactive screen, rich display means, enhance the sense of participation and interaction of offline audience [7].

The digital museum is interactive. Like Team Lab’s ‘DIVERSITY’, the experiencer can interact with the images presented on the waterfall by simply touching the screen [9]. In the interaction with the audience, the works not only show the Japanese food culture in front of the audience, but also bring them a very interactive interesting experience.

It can be seen that the openness, richness and interactivity of the digital museum make it more prominent than the traditional museum in the form of display and interaction, providing a variety of possibilities for people’s travel and choice, making the digital museum more attractive and influential in today’s society. It is also very promising in the future development trend.

4 The application strategy of digital virtual reality technology in museum

The application strategy of digital virtual reality technology in museums has attracted more and more attention. It not only improves the display effect of museums, but also brings a new visiting experience to the audience.

4.1 Build an interactive learning platform of ‘edutainment’

In recent years, the form of educational communication in museums has been constantly changing, and the textbook-based teaching model has become increasingly difficult to be accepted by museum audiences. Instead, it has been replaced by interactive learning that ‘teaching with entertaining’. Visitors are immersed in the exhibition through VR to see historical stories, street scenes, etc [10]. The picture displayed by VR makes history ‘out of’ textbooks, out of archives, out of museums and become three-dimensional [10]. For example, the digital art exhibition ‘Journey Through the Silk Road’ in Shimao Maritime Silk Road Museum in

Fujian Province, its curatorial and implementation process is a joint effort of museum exhibition, education, cultural and creative, publicity and other departments, as well as creative planning and production teams, which is the key factor for the success of the project and the continuous extension of value [11]. Among them, the exhibition adopts the ring screen projection technology, with the cooperation of the surround stereo system, according to the digital multimedia technology to make the audience immersive, fully demonstrate the 'Silk Road Landscape Map' donated by Shimao Group to the Palace Museum, and experience the visual beauty of the Silk Road. Similarly, there is a super-large animated version of 'Qingming Shanghe Tu' displayed in the China Pavilion of Shanghai World Expo. The characters in the picture can act at will with technical support.

Therefore, to build an interactive learning platform of 'entertaining and interesting', it is necessary to do a full investigation and analysis to determine the appropriate virtual reality technology, such as three-dimensional modeling, augmented reality and so on. Secondly, according to the content of the exhibition and the needs of the audience, curators need to develop technology based on ensuring the authenticity of the content and academic value, and pay attention to user experience and interaction design. Finally, the joint cultural and creative and publicity departments promote the interactive learning platform, and apply the digital virtual reality technology to the museum in the 'online + offline' publicity mode. This can not only solve the problem of single display of single works, but also provide a more intuitive participation experience for the audience by making use of digital virtual reality technology, and increasing the interactivity and interest of artworks.

4.2 Create a new technology-enabled museum feature IP

These days, museums are developing in an ever more varied way. Various museums rely on their display themes to meet the multi-level spiritual and cultural demands of various groups and to bring more and more distinctive products that are both cultural and creative to the market. As a result, each museum can leverage its current cultural artifacts to develop a unique intellectual property that is enhanced by modern technology.

First of all, the identifiable IP can attract more young people and technology enthusiasts to visit the museum, increasing the visibility and attraction of the museum. For example, the representative of the Forbidden City, IP 'The cat of the Forbidden City', the Forbidden City relies on rich collections, uses the popular orange cat in the palace as the material to create, and combines cultural relics to convey the cultural accumulation of the Forbidden City for six hundred years. Secondly, through the use of new technologies, digital interactive artworks can enhance the museum's display effect and interactive experience, so that visitors can have a deeper understanding of exhibits and historical culture. Furthermore, establishing a distinctive intellectual property can open up new financial prospects for the

museum. In terms of design, the cultural and creative products of the Forbidden City focus on the deep excavation of cultural relics elements, giving the products a unique aesthetic sense of oriental characteristics, realizing the unity of cultural value and aesthetic value, and then using the Internet to carry out online and offline sales mode, giving the museum new vitality with new business opportunities, so that cultural relics 'live' up [12].

However, to create a new technology-enabled museum feature IP, it is necessary to make the past serve the present. Once the cultural relics' background and characters have been thoroughly understood, the cultural connotation is visualized and additional design innovation is implemented to give the artifacts fresh meaning. Any museum in the design of cultural and creative products cannot be separated from the existing huge cultural relics elements of the museum [12]. It can be said that the cultural relics elements accumulated by the museum itself are the most fundamental soil for its cultural and creative product design [12]. The characteristic IP with cultural connotation is used in the surrounding products of the museum, to resonate emotionally with consumers and bring more commercial value to the museum.

4.3 Build an immersive narrative scene of virtual and real symbiosis

To make the cultural relics 'alive', the design works also need to combine the original historical environment and background. Therefore, it is possible to construct an immersive narrative scene with the coexistence of virtual and real, restore the original environment of the cultural relics, and provide the audience with an immersive experience. The question of whether to keep artifacts on display has been discussed since the 18th century, when museums opened their doors to public access [13]. During the second half of the 18th century, for instance, Antonio Canova (1757–1822), Giuseppe Valadier (1762–1839), and Luigi Canina (1795–1856) proposed preserving the artifacts (such as capitals, moldings, or architraves) discovered during the preservation of the Appian Way monuments on location by positioning them on particular walls close to the ruins [13]. The 3D rendering of cultural relics enables the audience to obtain information on cultural relics through the virtual touch and multi-angle observation of cultural relics [8]. Therefore, designers can apply 3D modeling, virtual reality technology and other means to the exhibition hall to create an immersive experience of virtual space and an interactive experience of real space. Through virtual reality glasses or immersive projection technology, the audience can feel as if they are on the scene of historical events to ensure that the audience has a profound sense of the spiritual and cultural essence. An experience in the UK is 'Curios Alice: the VR experience', a digital sneak peek at the exhibition 'Alice: Curiouser and Curiouser', which was introduced by the Victorian and Albert museum in 2021 [14]. Users of the virtual reality experience lived in Alice's Wonderlands and were fully

submerged in ‘Alice’s Wonderland’ [14]. This immersive narrative scene of virtual and real symbiosis can not only enhance the audience’s visiting experience, and make the public receive good cultural and historical education, but also effectively spread the culture of intangible cultural heritage museums.

5 Conclusion

This paper analyzes the characteristics of digital interactive art, such as interactivity, virtuality and interest, and illustrates how artists use digital interactive technology to create novel works. At the same time, it discusses the relationship between digital museums and intangible cultural heritage, introduces the development status of digital museums and the technical means of creating digital intangible cultural heritage space, and points out the advantages of digital museums in display form and interaction.

Through analysis and research, it can be found that the application of digital interactive artworks in the field of art has broad development prospects. The progress of science and technology makes digital interactive artworks gradually change people’s understanding and appreciation of art. Artists can expand the space of artistic creation and the appreciation experience of the audience by constantly exploring new digital virtual reality technology and presentation methods. As an important place to display and inherit intangible cultural heritage, the museum also improves the display effect and audience experience through the application of digital virtual reality technology. This technology also provides a variety of possibilities for intangible cultural heritage museums, and contributes to the protection and inheritance of cultural heritage that is not tangible.

From the perspective of the self-development and social needs of the intangible cultural heritage museum, curators can further study the application strategy of digital virtual reality technology in the museum. They can deeply explore how to better build an interactive learning platform of ‘teaching through fun and learning through fun’. They are also able to create a museum characteristic IP empowered by new technology and build an immersive narrative scene of virtual and real symbiosis. At the same time, curators also need to pay attention to the reality that China’s current digital intangible cultural heritage museums are still in a relatively early stage. Under the ‘new trend’ of the digitalization of the cultural and museum industry, they should actively respond to the national call, be down-to-earth, innovate the display mode, break the space-time boundary of the collection, ensure the innovation and development of digital interactive artworks, and better play the social and cultural functions of the museum to promote Chinese traditional culture.

In a word, as a product of the digital age, digital interactive artworks and digital museums are of great value and significance to the display and development of digital intangible cultural heritage museums in the future. This study provides museum workers with the application strategy of digital interactive technology in

intangible cultural heritage museums, which is conducive to making greater contributions to the protection and inheritance of digital interactive art and intangible cultural heritage in the future. Future research and developments will further explore new technologies and application methods in the operation of the museum’s foreign exchange exhibitions to flexibly respond to the evolving environment.

References

1. G.H. Geng, X.W. He, M.L. Wang, Q.S. Yuan, G.J. Yin, Y. Xu, Z.G. Pan, *JIG* **28**, 1567-1584 (2023)
2. Y. Huang, The Development and Application of Digital Media Interaction in Artistic Experience, in proceedings of 2022 2nd International Conference on Social Development and Media Communication (SDMC 2022) SHS Web of Conferences, 155 (2023)
3. H. Bai, *SXD*, (2022)
4. L.H. Tu, *SLI*, 58-61 (2024)
5. X.T. Zhao, *SZU*, (2020)
6. S. Gao, Y.F. Wu, *Med Commun R* (2023)
7. H.Y. Yue, *MYSD*, 23-29 (2023)
8. Y. Li, *FA*, 47-50 (2021)
9. M.N. Zhou, *MYSD*, 116-119 (2023)
10. M.Q. Guo, H.Y. Wang, *CBBQ*, 119-121 (2023)
11. X.X. Gao, *CRHE* 81-86 (2022)
12. Y.M. Jiang, *JCFU* 60-62 (2023)
13. F. Banfi, M. Pontisso, F. R. Paolillo, S. Roascio, C. Spallino, C. Stanga, *ISPRS Int. J. Geoinf* **12**, 28-28 (2023)
14. A. Curios, The VR experience, Victorian and Albert Museum, London, <https://www.vam.ac.uk/articles/curious-alice-the-vr-experience>