Research on the integration and application of digital technology in the exhibition design of university history museum

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Abstract. University history museum is a comprehensive place integrating collection, research, exhibition, publicity and education, and it is an important part of campus culture construction. As a place for the precipitation and sublimation of university history and culture, the exhibition space design of university history museum has been paid more and more attention. The development of digital technology in China today provides a good opportunity for inheriting the history and culture of colleges and universities. By using the research methods of literature review and chart research, combined with the development status of digital technology in China, this paper expounds the design principles and concepts of the exhibition space of university history museum, and summarizes the methods and strategies of the integration and application of digital technology in the exhibition design of university history museum.

Keywords: Exhibition space design; University history museum; Modern exhibition hall; Digital technology exhibition.

1. Introduction

The university history museum is a carrier that reflects the historical process and cultural connotations of universities, accumulates the cultural traditions of the university, condenses the historical heritage of the university, and is the business card of each university. The historical exhibits and graphic materials collected in the university history museum depict historical figures and events during the establishment and development of universities, enabling visitors to have a close understanding of the historical evolution of universities.

In recent years, with the rapid development of emerging digital technologies, the application of digital technology in various exhibition halls has become increasingly common. Digital technology refers to the technology of digitizing various information such as text, images, animations, and sounds through computer devices, enabling people to interact with real-time information through various senses. For display design, digital display methods have stronger designability and avant-garde characteristics. The interactivity, comprehensiveness, and strong sense of presence that traditional methods cannot compete with have become a more suitable way for people to observe exhibitions in the information age.

The aim of this study is to apply digital methods to the design of display space in university history museums, breaking through the traditional display status of single university history museums, and forming a more diversified display form. The display of university history museums relies on digital means, such as VR devices, holographic imaging technology, circular projection technology, human-machine interaction technology, floating imaging technology, etc., to fully leverage the advantages of university collections, "activate" relevant historical scenes, make the history and cultural display of universities more vivid and interesting, give visitors greater attraction, and help them more intuitively explore the historical and cultural value behind the exhibits. In addition, the application of digital virtual exhibition halls has broken the traditional design concept of exhibition halls, adopting digital modeling and 3D technology, allowing users to browse the content of exhibition halls online through computers, mobile phones, and wearable VR devices, compensating for regional limitations, and allowing "browsing" to be anytime and anywhere, allowing more people to participate in the exhibition. The application of digital display methods has a huge driving force in increasing the activity of the university population and expanding the influence of university history and culture,

thereby fully leveraging the cultural popularization and social education functions of the university history museum. This provides a good opportunity for the design of the exhibition space of the university history museum.

2. Research background

2.1.Development background of digital technology in China

Digital technology is a scientific technology that accompanies electronic computers. It refers to the use of certain devices to convert various information, including images, text, sound, and images, into information that can be recognized by electronic computers for calculation, processing, storage, transmission, dissemination, and restoration. The main content includes big data, cloud computing, intelligence, the Internet of Things, and 5G technology. In today's digital industry era, it can significantly improve the efficiency of overall information transmission, enrich information transmission methods, and is widely used in various industries.

Nowadays, big data, artificial intelligence, VR, AR, 5G, blockchain, video cloud technology, and other technologies are accelerating innovation and upgrading, improving the software ecosystem, expanding the application scenarios of the digital industry, and greatly overcoming the impact of the epidemic on offline industries. Digital technology and industry complement each other, not only stimulating the endogenous potential of the industry, but also accelerating the deep integration of the industry chain, technology chain, and innovation chain.

The in-depth construction of 5G networks will further promote network speed and quality improvement, as well as the comprehensive development of the Internet of Things. By 2021, a total of 1.425 million 5G base stations have been built nationwide, double the previous year. It is expected that 2.4 million 5G base stations will be built by 2022 (Figure 1). On the basis of 5G networks, cloud services such as cloud performances and cloud cinemas utilize various audio-visual technologies to provide users with high-quality cultural audio-visual enjoyment and immersive experience needs online, as well as 3D reality, virtual idols and other technologies to give users a sense of immersive experience, derived from a wider range of cultural and creative fields, and create greater value.

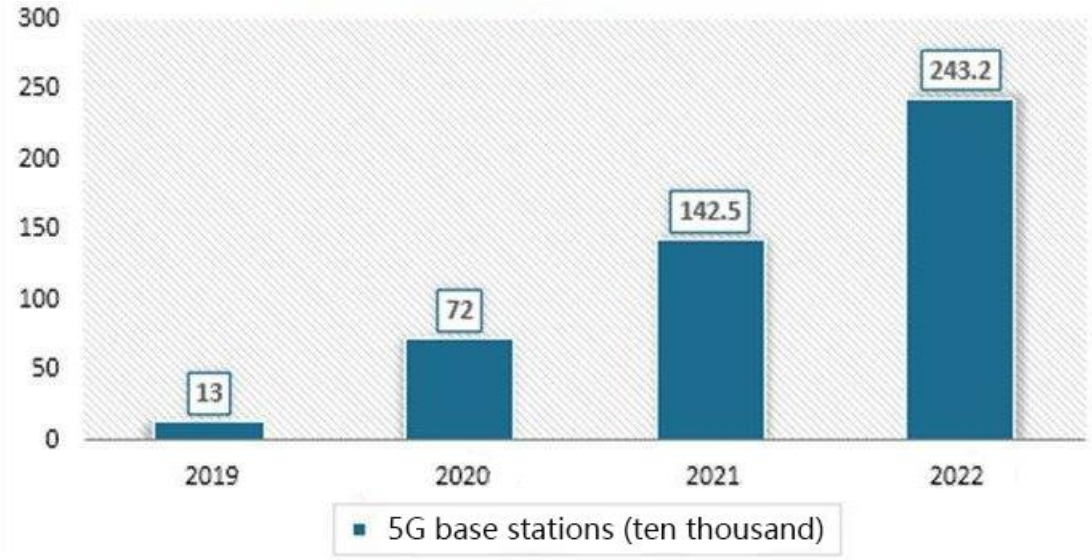


Figure 1. Forecast of the Number of 5G Base Stations in China from 2019 to 2022

At the same time, blockchain technology triggers information digitization, which can securely store digital information in the blockchain, continuously empowering fields such as the internet, online consumption, online culture, and online live streaming. With a large amount of capital investment, the scale of China's blockchain industry continues to rise (Figure 2).

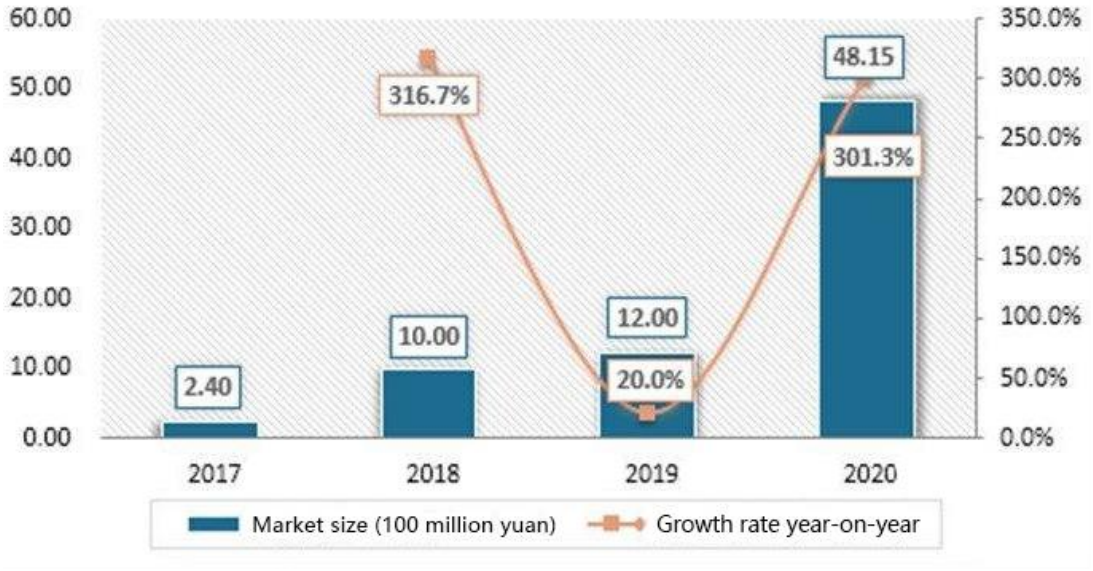


Figure 2. Market size of China's blockchain industry from 2017 to 2020

Overall, with the continuous and vigorous development of digital technology, innovative, experiential, and interactive social services and sharing models that rely on public, organizational, and individual cultural resources, utilize digital technologies such as VR, AR, 3D, and internet big data have gradually formed. This provides a good platform for China to accelerate the integration of various industries and fields, promote cultural dissemination, and digital display development.

2.2.Development status of digital technology in display design in China

In recent years, various exhibition institutions such as museums, exhibition halls, and science and technology museums in China have been actively exploring new paths for the integration of history, culture, art, and modern life. With the rapid development of emerging digital means, new display methods that integrate traditional and digital displays have emerged, providing acceleration for the transformation of traditional display methods. After research, the application of digital methods in display design in China has shown the following trends:

(1)Utilize various new exhibition modes such as "digitalization+exhibition" and "art+exhibition". In the past decade, traditional display design has been transitioning towards "cloud based" development, with new models such as cloud viewing exhibitions, cloud experience, cloud audiovisual, etc. constantly emerging. Cultural display live broadcasts and other exciting events have emerged. In this context, exhibition institutions have also collaborated and interacted with new media platforms, utilizing technologies such as 5G, VR, AR, artificial intelligence, multimedia, etc. to develop library resources, setting up practical functions such as online reservation entry and online virtual exhibition halls, and constructing comprehensive displays within the museum through traditional exhibitions, digital interactions, and other forms. At the same time, through artistic treatment of decoration, color, and materials in the exhibition hall, a strong artistic atmosphere is given to the exhibition hall, meeting the artistic viewing needs of visitors. Combining digital technology, art, and traditional display methods to form a new exhibition hall model that is more in line with the needs of people in today's era will further bring people closer to history and culture.

(2) Emphasize diverse interactive technologies. Nowadays, with the emergence of digital interaction research in exhibition institutions in China, visitors can experience the exhibition process firsthand and stimulate their interest in exhibits. The exhibition space can effectively mobilize visitors' various senses, enhance their interest in visiting, and create a profound immersive experience through various interactive methods, such as online and offline data visualization, holographic 3D projection of collections, panoramic screens, VR devices, etc.

(3) Create a digital virtual exhibition hall, integrating online and offline. The digital virtual exhibition hall breaks the traditional design concept of the exhibition hall, adopts digital modeling

and 3D technology, breaks through the "time and space limitations", digitizes the core content resources of the exhibition hall, allows users to browse the exhibition hall's content online through computers, mobile phones, and wearable VR devices, making "browsing" anytime, anywhere, and more convenient. This guides a new direction for the display design of university history museums.

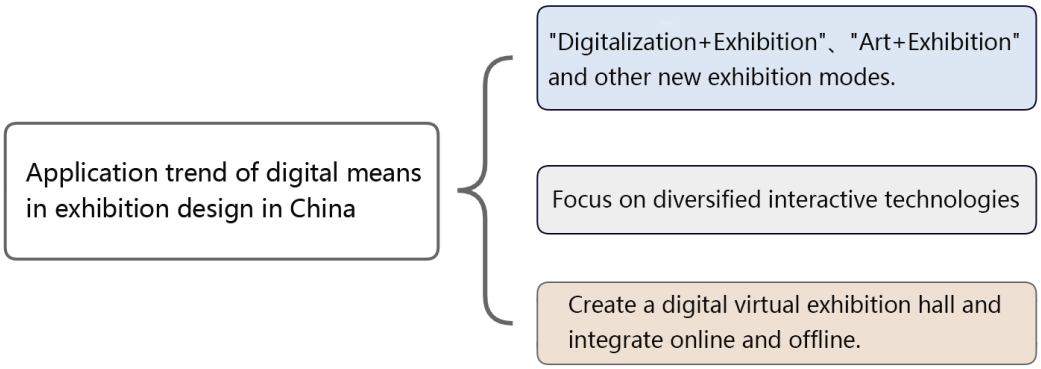


Figure 3. Application Trends of Digital Means in Display Design in China

2.3. Development status of display design for domestic university history museums

China's higher education has a history of over a hundred years, and a group of universities in China have crossed the long river of history through twists and turns. On the one hand, in order to better integrate university history resources and promote the work of university history archives; On the other hand, it is also to amplify the influence of university history culture and achieve better external publicity effects. After comprehensive consideration, the University History Exhibition Hall has emerged. With the continuous changes of the times and the rapid progress of higher education, domestic universities have been preparing to build university history museums, and China has gradually ushered in an upward period for universities to establish university history museums.

1.3.1 Display content of current university history museums

The University history museum is the chronicle of universities, which is a venue to display the development history of universities, the process of running universities, and the appearance of universities in different eras. It has multiple functions such as collection, research, display, and educational activities. The exhibition time of university history museums is usually longer, and some even have permanent displays.

The University history museum focuses on the historical process of universities, displaying mainly the origin of the university, basic overview of the university, major historical chapters of the university, achievements and honors of university education, and unique activities of the university. Narrative design techniques are commonly used in the display design of the university's history museum, which uses elements such as text explanations, historical relics, and archive images to artistically process and record and present major historical events experienced by the university since its establishment. Visitors follow a specific route to observe the exhibition and gain relevant historical and cultural knowledge.

1.3.2 Display methods of current university history museums

The current display method of the university history museum is mainly through display. As the most traditional display method, display is the most frequently used display form in the display space. Display and display can be further divided into hanging display, placement display, clip display, and other forms. The emergence of digital display will eliminate the limitations of traditional display methods, further improve the efficiency of conveying information in exhibition content, enhance the experience of visitors, and strengthen the popularization of scientific research achievements, cultural knowledge, and art.

1.4 Existing problems in the display design of domestic university history museums

1.4.1 The display format is relatively simple

In some of the university history museums that have been built, the display form of exhibits is relatively single, with more static display forms. The use of emerging high-tech display methods is insufficient, interactive display methods are lacking, and exhibition displays fail to focus on the audience as the main body of thinking to meet their psychological needs, lacking interest and attractiveness.

1.4.2 Serious homogenization phenomenon

In addition to national key universities with a long history, many ordinary colleges and universities organize their university history materials in a timely manner

Later on, the intention to seek donations from society was relatively weak, with insufficient emphasis and protection. Many university history museums did not display corresponding themes according to the different characteristics of their respective universities, resulting in prominent issues of homogenization and formalization, greatly limiting their use.

1.4.3 Insufficient display and promotion efforts

At present, the external understanding of university history museums in society is still more limited to the level of archives. As the largest online carrier of current traffic, the construction of virtual university history museums is often overlooked and cannot play the role of publicity and dissemination that should be played.

The principles of integrating digital technology into the display design of university history museums.

3. Principles of integration and application of digital technology in the exhibition design of university history museum

3.1.Use integrating digital technology with traditional exhibition methods

In the design of exhibition spaces, it is particularly important to transform the conveyed information into vivid and vivid display language, in order to arouse the interest of viewers. Digital technology processes various types of information such as text, images, animations, and sounds through computer devices, allowing people to interact with real-time information through multiple senses. It has strong expressive power and can make up for the shortcomings of traditional displays in the university history museum. It transforms the historical and cultural information of universities into vivid and vivid display languages, arousing stronger interest from viewers.

3.2.Integrating university characteristics into the digital display of the university history museum

The design of the display space of the university history museum needs to be in line with the characteristics and spiritual temperament of the university campus, in order to reflect its unique historical and cultural connotations. This study integrates the characteristics of universities into the digital display design of the university history museum, unifying the characteristics of universities with the display design, and making the university history museum serve as a display window with university characteristics, inheriting and promoting the history and culture of universities, in order to further enhance their visibility and influence.

3.3.Enhancing the research and publicity functions of university history museums through digital technology

In addition to the basic external display area, in order to improve the research level and enhance the influence of universities, it is necessary to set up a dedicated area for external communication and

teaching research in the university history museum, such as the digital chemistry technology seminar room, digital projection hall, etc., to create a display space for the university history museum with multiple functions such as teaching research, display, and external publicity.

3.4.Creating a digital display based on historical authenticity and scientificity

The excellent digital display effect of university history museums depends on the reasonable use of digital display methods. The display space of the university history museum conveys the historical and cultural value behind the exhibits to visitors. Digital display needs to follow the basic principles of scientificity and authenticity, and on the basis of a complete and authentic reproduction of historical exhibits, create a display effect that conforms to the viewer's sense of experience, ultimately achieving the goal of fully displaying the historical and cultural value of the collection, fully popularizing cultural knowledge, and playing the role of social education.

The means of integrating digital technology into the display design of university history museums

4. Means of integration and application of digital technology in the exhibition design of university history museum

4.1.Innovation of display mode

This study is based on the current issues in the display design of university history museums. Through a comprehensive examination of the situation and existing technology of domestic universities, digital methods are applied to the display design of university history museums. Virtual explanations, multimedia popularization, and interactive experiences are used to fully develop the collection resources. Combining the characteristics of universities themselves, innovative research is conducted on the display mode of university history museums, Finally, a new display mode of "digitalization+exhibition" and "university characteristics+exhibition" will be formed for the university history museum.

4.2.Application of digital technology

4.2.1 Naked eye 3D display technology

In the current field of historical display, the application of naked eye 3D display technology has been very extensive, playing a great synergistic role in breaking through the limitations of space and time in display. Naked eye 3D display technology can give the audience a stronger sense of realism and liveliness, using temporal, dynamic, and storytelling virtual images to showcase cultural history, achieving the goal of audience participation and experience. In addition, combined with surround sound effects, with the help of super realistic panoramic images, the audience has a sense of immersive experience. In terms of visual effects, it enables the audience to watch three-dimensional virtual characters and historical stories on the exhibition stand in real-time, creating a visual historical and cultural atmosphere that is both fantasy and true. The naked eye 3D display technology is currently in a rapid development stage, and it is believed that it will bring a better viewing experience to the audience in the future.

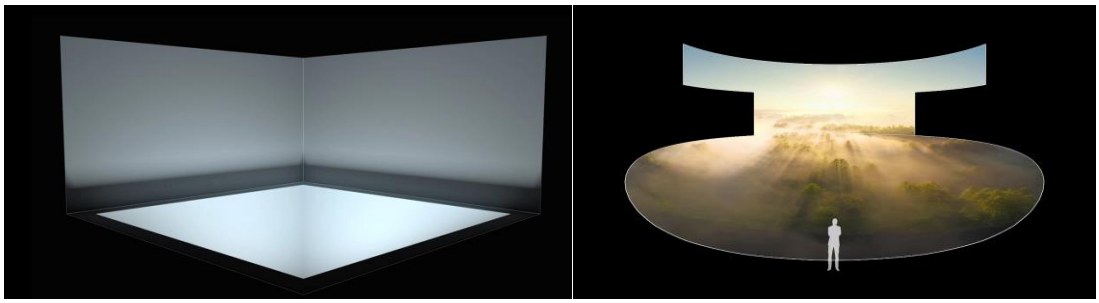


Figure 4. Realizing a zaked 3D immersive experience using multiple interface combinations

4.2.2 Circular projection technology

Circular projection technology is a projection technology that requires the use of circular screens to simultaneously project multiple devices and ensure compliance with the principle of screen curvature within 3600. On this premise, to successfully run the circular projection technology, it is generally necessary to construct an immersive projection mode on the basis of equipping more channels and projection equipment in advance. Therefore, the circular projection technology basically belongs to a new type of projection system with high visual and auditory immersion. This system can meet a wide range of audience perspectives. If the circular projection method can be appropriately introduced into the exhibition hall, it will attract more visitors. In addition, visitors inside the exhibition hall will also experience the auditory effect of three-dimensional surround, thus achieving a higher level of viewing experience. For example, currently exhibition halls can use this technology to present various astronomical popular science knowledge to visitors, and record relevant collection or promotional videos, so that visitors can truly feel the artistic charm of the exhibition hall's collections inside the museum.



Figure 5. The circular projection technology has an extremely smooth visual effect

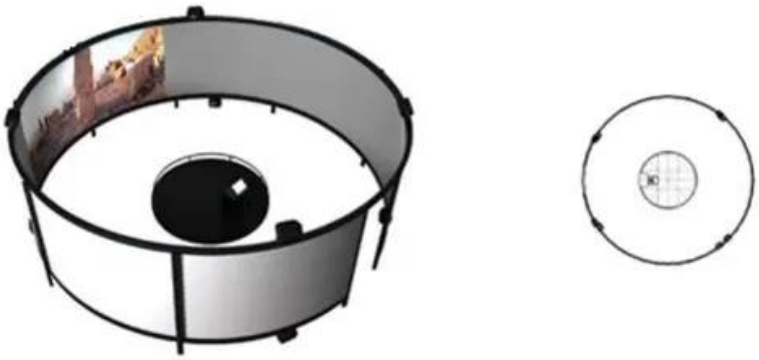


Figure 6. Structure of the ring curtain

4.2.3 Holographic imaging technology

Holographic imaging, also known as 360 ° digital imaging processing technique. This technology is based on the principle of light diffraction and combined with 3D image processing technology for imaging. In addition, holographic imaging technology can appropriately control human visual errors, improve the viewing effect of visitors, and the imaging method of reducing errors enhances the visitors' experience.

At present, holographic imaging technology can be applied to university history museums, especially for complete or individual exhibits in university history museums. In the current era of the

internet, this technology can be applied to various historical collections in university history museums, such as some lost and damaged collections that are not convenient for exhibition. Because holographic imaging technology can magnify the fine parts of some collections, such as the sides, shoulders, or bottom of important collections. Therefore, by utilizing holographic imaging operations and processing methods, a diverse range of three-dimensional images and graphics can be presented to the audience within the scope of the cabinet's actual scene.



Figure 7. Holographic imaging technology

4.2.4 Virtual reality technology

Virtual reality technology, or VR technology. In essence, the principle of VR technology is to build real space and content with the help of digital technology, which means that VR technology has achieved good interactive effect. Therefore, from the user's point of view, VR technology can present a real-time, realistic and virtual three-dimensional environment, so users will have a strong sense of generation. At the same time, VR technology can also be used to trigger users' association, which shows a good interactive effect. In addition, users will feel similar real world from the perspective of pictures and scenes, and the virtual reality is very strong. From the current situation, VR technology can control all kinds of virtual objects in real time on the basis of good interactivity. With the help of interactive equipment, a virtual environment with high fidelity is created, so that users can experience the feeling of being there.



Figure 8. Various types of VR devices



Figure 9. Visitors can simulate the experience through the VR equipment provided in the museum.

4.2.5 CAVE immersion stadium construction

CAVE immersive digital exhibition hall is an upgraded embodiment of VR technology application, which is composed of hardware and software. In terms of hardware, four-sided LED splicing or 4/5/6 channel fusion interactive projection combination is generally used; After the immersive exhibition hall is built, the audience can walk into this space on the spot to interact, experience, explore and touch. In terms of software, it can be combined with exhibits stories and cultural knowledge for immersive display; The audience is immersed in the display scene and experiences the display content empathetically. At the same time, the audience can also use gestures and The sensing devices are linked, control the interactive program, and interact with the spatial environment of digital exhibits in real time. CAVE's immersive venue construction allows the collection to be presented to the audience in a multi-dimensional and three-dimensional way, and experience the experience environment of 1:1 simulation of the collection.



Figure 10. CAVE immersion stadium construction

4.2.6 Man-machine interaction technology

In order to enhance the interaction between historical exhibitions and audiences, human-computer interaction technology is needed. Human-computer interaction is essentially an information exchange process, which refers to the interaction between human and computer as the main body on the human-computer interface. At present, there are interactive scenes, interactive desktops, interactive projections and interactive sand tables. Among them, interactive projection technology is widely used in physical display. In the specific use process, as long as the audience stands in a specific position and makes actions such as holding the exhibits, holding the exhibits, and holding the exhibits, the

interactive projection sensor will capture the action images of the audience and upload them to its server, and then the virtual characters on the screen will make the same actions as the audience. This is a kind of human-computer interaction. Through this man-machine interaction technology, people's interest in historical exhibits can be greatly enhanced, and people's curiosity about history and culture can be stimulated, so as to achieve the purpose of spreading history and culture through exhibition in the exhibition hall.

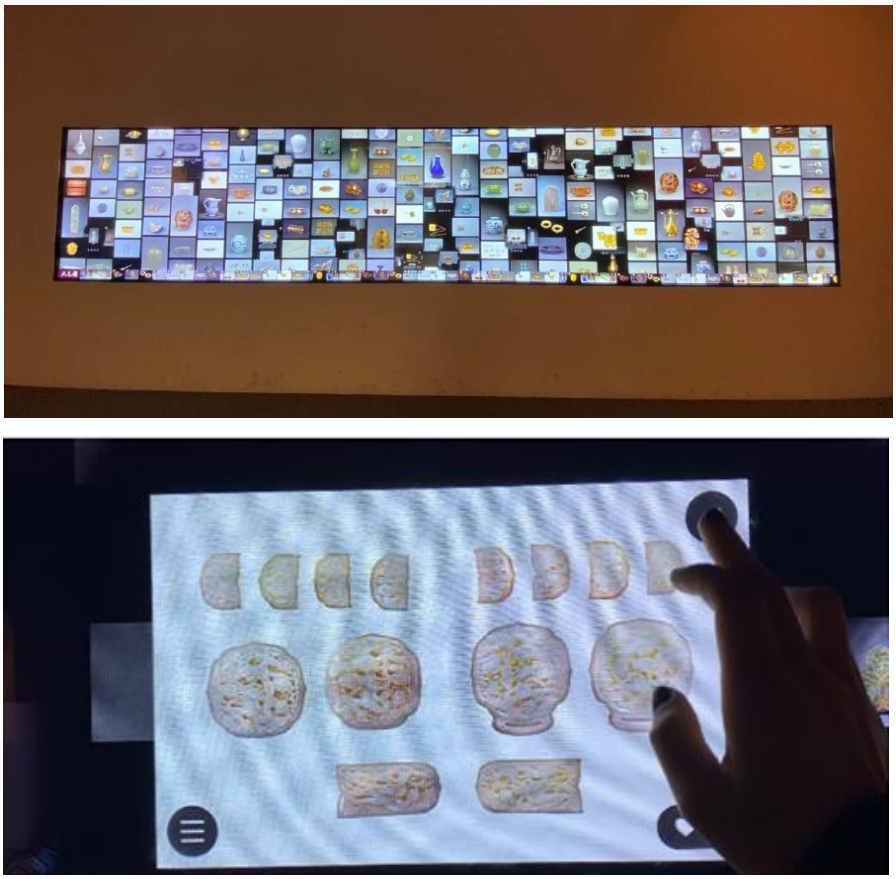


Figure 11. Touch interactive digital screen in the exhibition hall

4.2.7 "Yunyou" digital exhibition hall

Due to the epidemic situation in COVID-19, cultural and cultural institutions in many places are temporarily closed, and more and more exhibition halls have opened online digital exhibition halls. Visitors can watch online exhibitions through their official websites, WeChat WeChat official account, applets and other platforms, or visit the exhibition hall online with the help of panoramic virtual technology. The way the public visits museums with the help of science and technology has also made a qualitative leap. The mode of "cloud tour" of museums and the combination of online and offline has also brought new development possibilities to the exhibition hall. With the development of online technology, "Yunyou" exhibition hall is attracting more and more visitors to visit the exhibition online; Lectures in the exhibition hall, online celebrity punching in the exhibition hall, and so on, attracted many visitors to participate. The influence of the university history museum should not only be within the university history museum, but also attract the audience by combining the online digital display form, which will make the university history museum more vital.

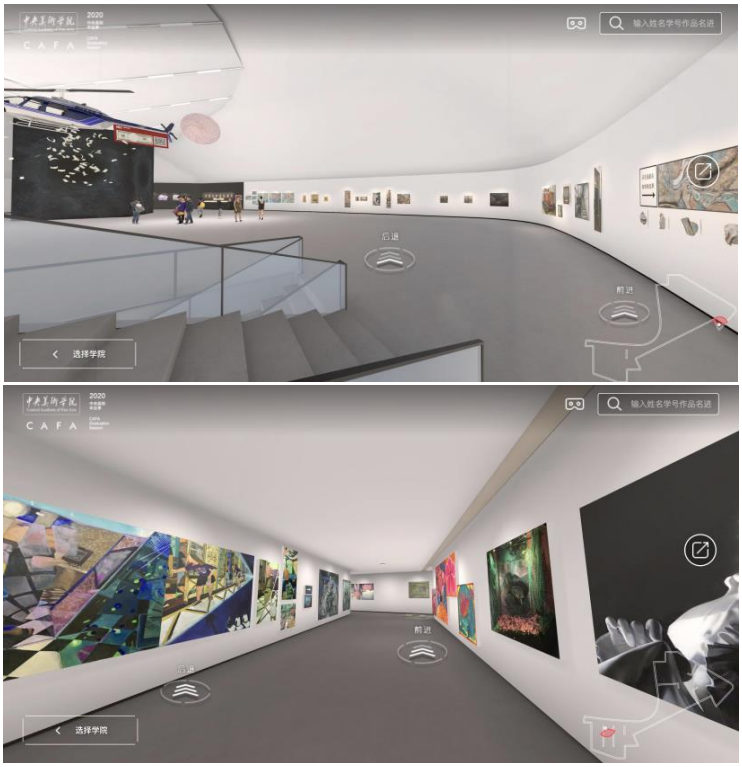


Figure 12. Mobile end boundary of virtual exhibition hall on line

5. Total knot

As the exhibition space of university history and culture, university history museum bears the heavy history of the university, inherits the campus culture with university characteristics, and embodies the feelings of teachers, students and alumni. The exhibition design of the university history museum needs to be based on the university's own university history and culture, and build a space that can represent and show the historical and cultural connotation of the university. At the same time, the university history museum needs to follow the development of the times, apply digital technology to the design of the exhibition space of the university history museum, endow the university history museum with more diverse exhibition forms, fully tap the cultural connotation of the university history museum, and give full play to its value. Based on the current development of digital technology in China, this paper analyzes and summarizes the concepts and principles of the exhibition design of university history museums, hoping to provide some reference and reference for the exhibition design methods and strategies of other university history museums in China.

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