

Design and Application of Virtual Reality Technology in the Museum Cloud Display

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Abstract—The rapid development of science and technology level has made great changes in people's life, the cultural consumption structure of the whole people is increasingly updated, the aesthetic cultural consciousness is also constantly enhanced, the art exhibition mode tends to be diversified, and the virtual reality technology has become an important technical means to improve the quality of museum exhibition. From the perspective of the virtual reality technology, this paper emphatically expounds the advantages of the virtual reality technology in the museum cloud display design, and explores the strategy of the museum cloud display construction based on the virtual reality technology.

Keywords-virtual reality technology; museum; cloud display

1 INTRODUCTION

1.1 Research Background

"COVID-19" in 2020 around the world, according to the national epidemic development and prevention and control situation, strictly implement the public policy to suspend the public business in the face of the sudden outbreak of COVID-19 museum closed, the audience to visit, museums have launched live online, cloud exhibition, cloud lectures and other online activities, in order to meet the epidemic environment of people's spiritual and cultural needs. The outbreak of the epidemic provides an unexpected opportunity for the cloud display in museums and accelerates the process of digital cloud display in museums [1].According to the international association of museums effective research report, according to the post-outbreak era museum began to explore the application of digital technology under the "new normal", now the museum has gradually established different digital communication channels, make collection of cultural relics break through time, space, display form limitation, in both reliable and novel way to enrich the people's spiritual and cultural life, close the distance between culture and the social public.

1.2 Purpose of Research

The discussion of virtual reality technology in the museum cloud display design and application, hope to provide more for new museum cloud display design ideas, make full use of existing resources and virtual reality technology fusion innovation, break the time and space limit of traditional museum, provide the public with more channels, more perspectives, diversification, multiform exhibition, create a can "24 hours 720 degrees" online exhibition platform. At the

same time, combining with China's national conditions, we will explore the development direction of museum cloud display, and optimize and upgrade the way of cultural communication.

1.3 Research Meaning

General Secretary Xi Jinping has repeatedly stressed the need to "make the cultural relics collected in museums, the heritage displayed on the vast land, and the characters written in ancient books come alive". The museum cloud display platform is the perfect integration of science and technology and art, which not only meets people's cultural consumption needs, improves people's life quality and aesthetic level, and is a feasible way to explore the integration and innovation of culture and science and technology.

2 VIRTUAL REALITY TECHNOLOGY AND THE MEANING OF THE MUSEUM CLOUD DISPLAY

2.1 Virtual Reality Technology

Virtual reality technology mainly refers to the use of computer image processing technology and hardware technology to enable people to feel the virtual world through vision, touch, hearing and smell. Virtual reality technology is also known as artificial environment or spiritual environment technology, and it is widely used in art display, art design, space design and other fields [2].

2.2 Cloud Display

Cloud display is a kind of presentation mode without relying on physical forms, comprehensively relying on the "Internet +" mode and digital network technology, through video, audio, high-definition pictures and other multimedia means. It can provide comments, download, sharing and other functions, and can also conduct interesting interaction in the form of questions and answers, comments and thumb up, so as to bring popular science services to the public anytime and anywhere [3].

Cloud display is essentially the product of digital realization, in fact, this concept was published long ago, but the concept of "cloud" did not rise at that time. [4] Relying on the digital network and financial media technology, the "cloud exhibition" of the museum moves the cultural relics and exhibitions to the "cloud" to make the multidimensional display and spread the colorful cultural heritage [5]. Online exhibition can break the original exhibition line setting, to provide visitors with a variety of viewing routes and richer display content. Functions, including retrieval, close reading, pause and backtracking, that cannot be realized by offline viewing, can be realized on the network platform to better meet the needs of cultural lovers [6], break through the traditional limitations of time and space, and build a virtual cloud exhibition hall, also called online exhibition hall.

2.3 Combination of Virtual Reality Technology and Cloud Display

The design concept of the museum cloud display is to use virtual reality technology to digitize the museum exhibits and related information, and the audience can freely choose the exhibition

way and content according to their personal needs and interests in the exhibition space [7]. With the development of virtual reality technology in recent years, the two-dimensional graphic introduction begins to transform to 3 D, and through the AR / VR technology brings the traditional museum with new vitality, so now the AR / VR museum has become a research direction of the industry insiders. With the advent of the 5G era and the maturity and development of AR / VR technology, digital museums are gradually entering the attention of the public [8]. From the original exhibition, to the panoramic display, to 3 d virtual exhibition hall, museum exhibition means and form innovation, the audience by scanning the qr code of cultural relics, if you want to understand can through virtual reality technology let the audience can several times enlarge cultural relics details, watch more related cultural relics, etc., can also be through video explanation into the land of the cultural relics, production process, spread stories, news reports and to use the production of the products and other related information. It can be said that the development of the new museum cloud display is a development process from two-dimensional to three-dimensional.

3 ANALYSIS OF USER NEEDS OF EXHIBITION VISITORS

3.1 Population Composition Analysis

According to a Museum Audience Survey report released by the Cheetah User Research Center in December 2019, 2,525 valid questionnaires were collected for people visiting museums. According to the report, the main audience of visitors to museums are 18-40 years old, accounting for nearly 90 percent, and the main occupations are students and professionals. Generally speaking, these people are generally more receptive to new things, and they are more inclined to try new techniques [9].

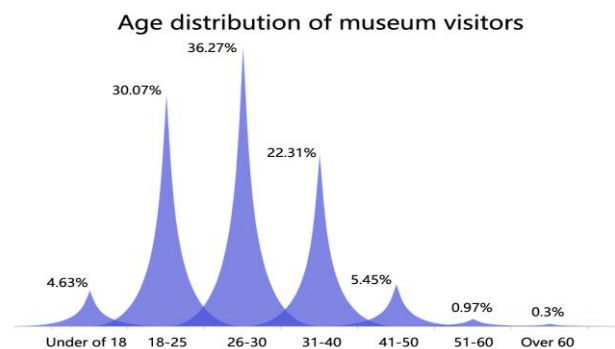


Figure 1. Age distribution of the population visiting the museum

Photo source: Author self-drawing

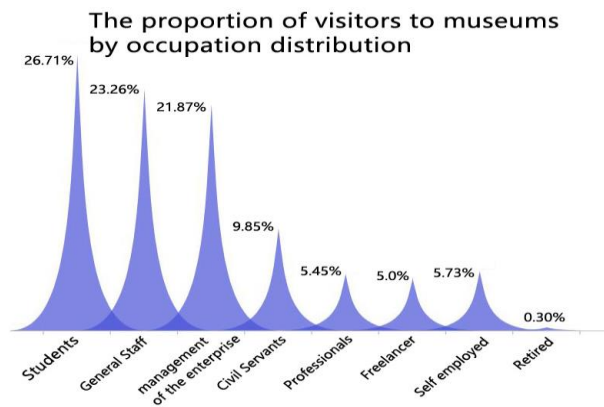


Figure 2. The proportion of the occupation distribution of the visiting museum population

Photo source: Author self-drawing

In general, the main group of people visiting the museum is between 18 and 40 years old, and is mostly students and professionals. They visit museums are often self-driven and more willing to the new. Museums are gradually becoming a popular social place for young people, and the cloud platform of museums needs to be more young and intelligent.

3.2 Offline Exhibition Viewing Experience Analysis

According to the data collation and survey, most offline exhibitors received such feedback:

3.2.1 Related to the introduction of exhibits:

The shortage of the information of exhibits is a great disadvantage of offline exhibitions; the information of exhibits is all text and pictures, and the presentation form is too single; some collections are incomplete, the text of the display cards is not clear, and the exhibit information cannot be searched.

3.2.2 Easy to get lost

In some large museums, audiences are easily lost. Although the museum has paper versions of flat maps, it is difficult to quickly find the exhibits or exhibition areas that you want to see.

3.2.3 Poor interaction

Due to the protection of the collection, visitors usually cannot interact with the exhibits and can only watch from a static distance.

3.2.4 Poor exhibition experience

During the peak period, the popular exhibition area is overcrowded, and the viewing experience is not good.

3.2.5 Poor sharing

After watching the exhibition, you can not be deeply impressed by the exhibits; and if you want to share the viewing experience and exhibits with your friends, only through language and photos, and some exhibition areas are not allowed to take photos, so the form of sharing is more simple.

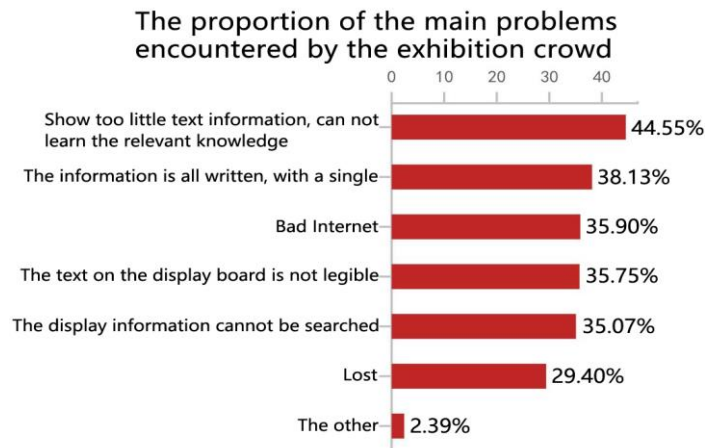


Figure 3. Main problems encountered when visiting museums offline

Photo source: Author self-drawing

In general, visitors to the museum usually expect an impressive and pleasant viewing experience, but because of some factors, it will destroy the viewing experience.

In the state of staying at home while fighting the epidemic, the major museums have just thought deeply about the problems of offline museum exhibition viewing, and launched the "Cloud Museum" to show a more novel exhibition and promotion methods, so that the majority of Internet users can enjoy a wonderful art journey anywhere.

4 OPTIMIZATION SCHEME OF VIRTUAL REALITY TECHNOLOGY IN MUSEUM CLOUD DISPLAY

The general design idea of virtual reality technology in the museum cloud display is as follows:

Add virtual information or image animation, enrich exhibits introduction form, and restore defective exhibits through virtual reality technology, realize online and offline navigation through VR and AR technologies, help audience to find exhibits quickly; use virtual explanation to guide and introduce museums and exhibits, enhance the interesting interactivity between audience and exhibits; build cloud display platform, audience can display 24-hour panoramic exhibition, realize "exhibition freedom"; propose transformation and retention function to commemorate and share, and upgrade the dissemination of culture.

According to the survey, the user experience of offline museums and online cloud museums is evaluated. The results point out that the experience sense, orientation, interactivity and sharing of the museum cloud display platform are better than the offline exhibition viewing experience, and the time and space are more free.



Figure 4. Comparative analysis figure of the offline visit and the online exhibition visit

Photo source: Author self-drawing

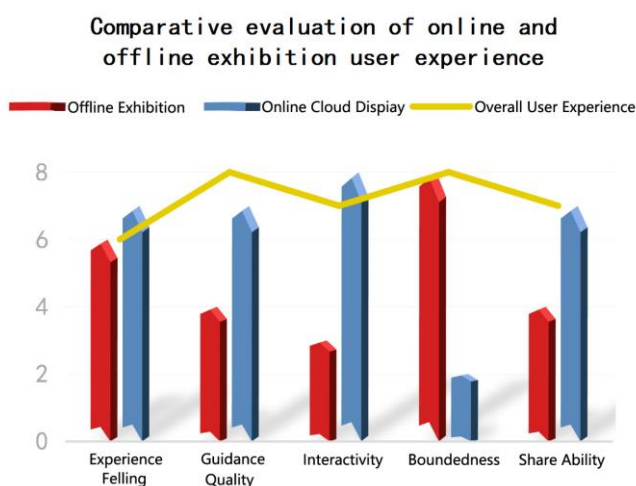


Figure 5. Comparison and evaluation of user experience for online and offline exhibitions

Photo source: Author self-painting

In today's era, the frequency of people swiping their mobile phones has been greatly increased, short videos and live broadcasting have become important communication carriers, and video communication media has become a new popular life among young people. Many online platforms also provide convenience for the cloud display and promotion of museums. Museums must keep up with the pace of The Times, convey the museum cultural relics and the traditional culture behind them in a younger way, and use virtual reality technology to create a cloud exhibition hall with convenient operation, clever display, interactive fun and real visual effects.

5 CLOUD DISPLAY APP CONTENT FRAMEWORK OPTIMIZATION

The optimization of the content framework of the museum cloud display app is mainly aimed at the technical realization of the cloud museum architecture, and the optimization and upgrading of the content framework, so that users can enjoy the exhibition "freely". By analyzing the Cloud Museum App, we can divide the relationship elements into three categories: first, digital management of cultural relics information; Second, the display of cultural relics is diversified; Third, information dissemination and sharing.

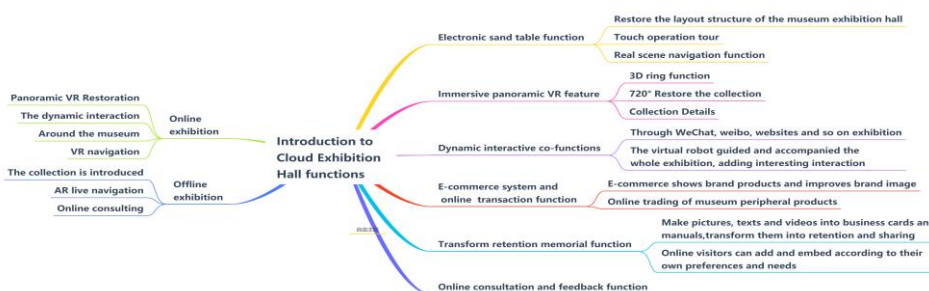


Figure 6. Introduction of Museum cloud display function

Photo source: Author self-drawing

5.1 Digital management of information

The main function of cloud museum and traditional museum is to manage and research the collection, and achieve its educational function in the display process. For the museum itself, the advantage of cloud museum is to digitize the collection information, establish a database, convert the original data text and two digit pictures into text, image, audio and video, and establish a database respectively. It is of great help to museum data storage: in the process of information retrieval, the information hierarchy is clear at a glance, providing convenience and more possibilities for visitors to visit exhibitions and future museum exploration optimization.

5.2 Diversified information display

The museum panorama and exhibits in the museum are integrated with the solid model through sound, light, electricity, image, 3D animation and computer program control technology to restore the internal structure of the exhibition hall and present a dynamic visual effect. Make full use of digital means to make the originally boring exhibition form flexible, realize the vivid display of the collection in the virtual environment, improve the cultural charm of the collection with the help of the atmosphere beyond time and space, and achieve the immersive experience effect [10].

For the complex environment of on-site exhibition, cloud display can find the collection you want to see at a glance. In combination with offline museums, AR live navigation function is added to guide users to visit and browse. The digital collection can view the details of the

collection at 720°, saving users time and travel. You can see the exhibition without traveling thousands of miles, realizing "freedom to see the exhibition"

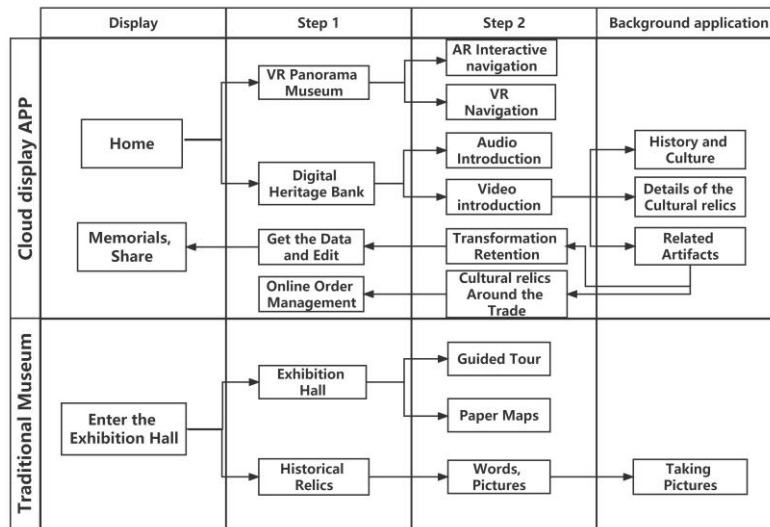


Figure7. APP content framework optimization

Photo source: Author self-drawing

5.3 Information dissemination and sharing

The information sharing of museums is reflected in two aspects. On the one hand, it is the connection of information; on the other hand, it is the interaction between the museum and the audience. Traditional museums are subject to various restrictions, such as technology, concept, space, etc., and it is gradually difficult to resonate with the audience [10]. Cloud museum apps break the traditional limitations, so that the audience's browsing is no longer limited by time and space, and provide more targeted services for different target groups, to fill the deficiencies of traditional museums.

After the exhibition, users can share the pictures and videos of the exhibition as business cards and manuals according to their preferences. The online trading system is provided in the App, so that users can place orders for exhibits or peripheral products, which not only displays exhibits, but also promotes economic development. The cloud museum, which enhances human-computer interaction, also plays a positive role in promoting culture and is an indispensable part of the modern cultural industry.

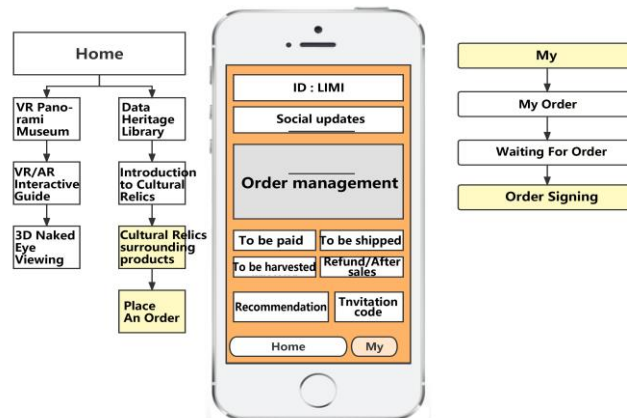


Figure 8. APP cultural relics peripheral products shopping

Photo source: Author self-drawing

6 CONCLUSIONS

Museum cloud display is a new way of museum development developed by major museums using the combination of virtual reality technology and art under the situation of novel coronavirus epidemic. However, at present, the cloud display platform is also an inevitable choice and future development trend for museums to realize digitization and humanization, and to meet the public needs through multiple channels. The current national epidemic situation is getting better, museum according to the national situation after orderly opening, museum cloud display will continue to run, and develop into a more institutionalized, intelligent, digital, normalized cloud museum, the organic combination of offline and online, realize virtual reality technology and art innovation, provide the audience with more diversified cultural services, drive the steady development of The Times, virtual reality technology cloud display will become a new museum to continue to think and explore the new direction. As a new trend in the development of science and technology, virtual reality technology has become a new carrier for the dissemination and learning of traditional Chinese culture, which is bound to have a profound effect on and impact on the museum cloud display.

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