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Research on the applicability of digital virtualization to the pain points of museums from the perspective of metaverse

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Abstract: As the third stage of museum digitization, the digital content industry of the museum has become the main new industrial form of information technology and cultural creative industry, which is the best means for the museum to achieve sustainable development. The meta-universe museum takes the user as the center, integrates the hardware and software technology of the current meta-universe related industries, improves the pain points of some functions of the traditional museum, mainly aims at the museum collection center, research center, social education promotion, exhibition and display of four traditional functions to improve the service, including the exhibition of cultural relics, the improvement of educational significance and visitor experience and other key issues to be solved. It has achieved considerable development of the museum.

Keywords: Meta-universe; Museum; Digital virtual; Visitor experience.

1. Introduction

The relevant documents of the Action Plan for the Integrated Development of Virtual Reality and Industrial Applications (2022-2026) released by the Ministry of Industry and Information Technology of China on November 1, 2022 clearly point out that: To accelerate the application of virtual reality in the cultural industry, encourage the first and second level museums, tourism venues with conditions to set up immersive experience facilities and equipment, the use of virtual reality technology, the general development direction is the construction of the meta-universe. Since 2021, industries related to the meta-universe have been developing rapidly. Commercial technology companies such as "Meta" and Bytedance have made great achievements in the construction of the meta-universe. Therefore, the combination of cultural industry and the meta-universe will be unstoppable.

As an important part of the cultural industry, museums have been committed to spreading cultural heritage. Therefore, museums are bound to take advantage of the opportunity of meta-universe to update exhibition methods and establish their own data resources, so as to realize the construction of a new form of meta-universe museum interacting with the real world. In the past, the research on the meta-universe and museum mainly focused on the human-computer interaction and virtual reality scene construction of the museum collection display and visitors' feedback on the application of new technology. With the help of natural interaction in the way of human-computer interaction, the audience can explore the immersive experience of virtual scenes on their own. Technological innovation contributes to the management and curation of museums. To a certain extent, it increases the number of visitors and at the same time increases tourists' understanding of museum collections and broadens the road for the cultural education of museums. One of the functions of this technology is to attract tourists. In addition to the change of communication channels between museums and audiences brought about by new technologies, some museums plan exhibitions with objects as the center, which arouses the emotions and emotional grasp of the audience, and stimulates the audience's sympathy and empathy effect in a more dramatic and immersive way. Museums use new technologies to continuously excavate collection resources, build museum ecology, and make it become an important support for the public society. The meta-universe will expand the new vision of the museum, and will certainly have an impact on the institution construction and social function of the museum. On the one hand, museums will achieve the sustainable development of self-transformation with the help of digital development; on the other hand, as cultural and educational institutions, museums will be more in line with the functional demands of the community and the public, thus enriching the social functions of museums.

The purpose of building the meta-universe module of the museum is to update the hardware facilities for the museum to adapt to the modern development, and to seek the development path of the museum institutions gradually at the edge of isolated culture. The building of this module is obviously effective. Compared with museums, the meta-universe museum has many advantages or advantages, but according to the current research, there is a lack of systematic research on the existing deficiencies of the meta-universe museum. Based on this, this paper intends to explore this problem in depth.

2. The modernization of Museums under the concept of metaverse

The term "meta-universe museum" is not the first one in China. In 2017, some authors have studied the application of hardware facilities such as museum headdisplay equipment with the title of "meta-universe Museum". Thus, it can be seen that the research of meta-universe museum has been around for a long time.

In the 1980s of the last centuries, China has begun to engage in information means to intervene in the protection of cultural relics and museum management, which belongs to

the first stage of museum digitization, also known as the museum digitization, the second stage is from 2012 to establish the museum digitization management based on the information archives of the cultural museum. The third stage is the stage we are currently experiencing -- the smart museum stage. The main form of this stage is that the digital content industry has become a new industrial form highly integrated with information technology and cultural and creative industries. Each stage of this step deployment and development has its own development characteristics and general direction. These characteristics obviously point to the user original content based modern UGC marketing model, in short, the meta-universe museum is a major development direction or module of the third stage

The museum has experienced a total of more than 30 years of information, digital intelligent management after nine years, the latter stage is more than 20 years faster than the previous stage, this is not entirely due to the development of technology, but also partly due to the diversified development of the world and the instability of the world pattern since the 21st century, the diversified development promotes cultural exchange and integration, and increases the international communication of the museum. Learn from the advantages of other countries' museum management and curatorial forms, including the update of hardware facilities have a clearer direction of development. Moreover, since the outbreak of COVID-19 worldwide in 2019, museums in various countries have accelerated the digitization process of collecting cultural relics in order to cope with emergency situations. Firstly, museums can continue to fulfill the social attributes of educational function and meet the cultural demands of people who cannot visit museums during the epidemic period. Second, for the sake of the virtuous circle of sustainable development of museums, helping some museums to recover their sources of income. According to incomplete statistics, Chinese museums will launch more than 2,000 online exhibitions in 2020, and plan more than 3,000 exhibitions in 2021. In the future, China will vigorously develop museum cloud exhibitions and cloud education projects, and build a museum communication system integrating online and offline.

At present, there are two main development directions of museums from the perspective of metaverse. The first development direction is NFT tagging. Online galleries and virtual art museums are the initial attempts of NFT applied to virtual reality copyright trading, and creators can add original NFT characters and objects in the pure simulation multi-dimensional space generated by computer. The works will be transferred to a more real, three-dimensional and high-dimensional form, so that users can appreciate, bid and buy NFT works in an immersive experience mode. By attaching a "label" to each digitized work, it becomes a unique product, no different from an identity card. This process belongs to the first stage in the metaverse -- digital twinning. The digitalization of museum collections is not a new concept, but to a certain extent, with the support of NFT technology, not only can effectively solve the copyright problems of museum collections, but also NFT technology contributes to the security of museum digital collections and the development of future metauniverse museums, as well as the arrival of web3.0 era.

The second development direction mainly focuses on augmented reality, namely the application of virtual reality technology. Virtual products are displayed through VR, AR and other technologies. This direction is at the second and third stage in the metaverse, that is, the stage of virtual native and virtual-real symbiosis. In this stage, visitors can further experience the museum metaverse space where digital collections and user data are piled up. These two development directions have a common goal, which is to adapt to the new technological communication methods, expand the transmission path of cultural heritage, and promote the diversity and sustainability of human civilization. In the final analysis, the combination of the metaverse and the museum is to serve the cultural system.

In addition to the above two directions, museums should vigorously develop big data, 5G, virtual reality, artificial intelligence and other technologies, establish urban integrated smart museums, interconnect with smart cities, and eventually form a multi-platform connection mode of mutual connectivity. This is not only a way for museums to upgrade hardware facilities and complete self-development and innovation in the web3.0 era. At the same time, it is also the core of accelerating the construction of urban integration system in accordance with the trend of The Times.

3. The value and significance of information digitization under the new vision

3.1. Museums in the information Circle

The progress of information technology, digital technology and Internet technology will promote the production, storage and use of digital forms, including text, image, video, audio and other forms, as well as different sources such as network resources, self-built resources and external resources. For museums, it is mainly the storage and use of collection resources and information. Of course, it also includes the digitalization of personnel information, curatorial information, museum news and other related information.

The digitization process of museum collections mainly consists of two dimensions of value, the first dimension is about the value of museum field communication. The 21st century is known as the information Age, and the remarkable feature of this era is the digital informatization of resources. In the past, there was no interconnection mechanism for museum cultural heritage information or other museum information. The information of various departments is not interconnected, and there is a lack of unified standards. In other words, museum information in the metaverse mode is transmitted in the form of point-to-point or platform-to-platform, which means that museum information in the metaverse mode has an interconnection mechanism, and each platform can share information resources, select optimal resources and utilize effective resources. In this way, this kind of resource transmission belongs to the transmission of communication, that is, the process of "metaverse". Therefore, the digital information of the meta-universe museum has the value of in-field communication. The second dimension is about the value of the extraterritorial communication of the museum. The extraterritorial value of the museum under the development state of the metauniverse includes two aspects. The first aspect is the singing degree and viewing degree of cultural relics. The digitalization of cultural relics such as IP image and NFT digital label presents different charm and propagation speed than the previous pictures and electronic archives, and the image with faster speed, farther distance and deeper impression is left in people's mind. This new digital visual image will not weaken the "light charm" of the original

works, but make the original works more widely spread. And improve the accessibility of the original works. The second aspect is the commercial value of cultural relics. After the appearance of digital avatars, the audience of their spread scope is further expanded, and the extension of their influence scope is also gradually expanded. They have received many people's love and pursuit, which lays the foundation for the commercialization of digital virtual cultural relics. Products such as IP image, cultural relic memes, NFT label authorization, digital cultural creation, product packaging and other products are the new direction of cultural relic commercial development, which provides a new development idea for small and medium-sized or private museums, solves the current financial dilemma of some museums, points out the path for the further development of cultural industry, and lays the foundation for the further dissemination of cultural relics. At the same time, it also enhances the influence of museums.

In general, the digital virtualization of the meta-universe Museum will further improve the hardware facilities of the museum, enhance its cultural value, information value, communication value and commercial value, and lay the foundation for the further development of the museum.

3.2. The promotion of cultural and educational significance

The primary purpose of applying virtual reality technology is to further spread heritage culture, which is for people to further understand human civilization. In the final analysis, virtual reality technology promotes cultural education. As a social function of traditional museums, the role of cultural education has been limited. The reason is that not enough people take the initiative to acquire or study the cultural resources of museums. Especially in China, which has a huge population, only a small part of tourists visit for the acquisition of knowledge or the research of museum collections. More tourists visit museums just to educate their children or find a place for leisure, which greatly weakens the educational function of museums from the perspective of visitors' motivation. However, the addition of virtual reality technology can exactly make up for this defect. Through interactive experience, visitors will actually join in the understanding of museum collections, rather than passing by.

From the perspective of tourists, this kind of education to some extent increases the spread of culture and makes more people understand the cultural heritage. In fact, it is not the case that it not only attracts a large number of tourists, but from the perspective of tourists, it is actually a change in the attitude towards accepting culture. In the past, museum Tours were mainly based on museums, supplemented by tour guides. Through the introduction of cultural relics works to increase the understanding of tourists, the limitations of this traditional way of preaching is self-evident, it is faced with a complex audience, but its output is a single way, it is undeniable that the tour guide with good eloquence will make tourists have the same experience, but more tour guides including the introduction text are difficult to give a clear explanation to the public. Nowadays, through interactive means, tourists can take the initiative to participate in it, understand the characteristics of cultural relics and take the initiative to think, which is actually a change from passive to active cultural acceptance.

From the museum level, digital virtual technology gradually increases the participation of tourists, which weakens the dominant position of museums to a certain extent, and gradually forms a content generation mechanism jointly dominated by museums and tourists. In the past, as a cultural and educational institution, the main function of museums is to provide cultural education to visitors. Exhibition and explanation is the main form of education for Chinese museums, and it is an important means to supplement the communication of exhibition information through the mode of oral communication. Generally speaking, museums narrate the stories of museums to the audiences in an intuitive and easy to understand way. It conveys the main meaning and value proposition of the museum and provides the narrative framework of the whole museum. The form of museum education under the metaverse development mode includes not only information exhibition, exhibition and explanation, but also interactive participation of visitors. The form of museum education has been further expanded, and the knowledge acquired in the expanded part will have different effects depending on the cultural background, memory ability, interaction willingness and other factors of the participants. In short, the educational function of museums has not changed. What has changed is the educational path of the museum. In addition, this new educational path of museums will generate unique cultural content of each museum. It is equivalent to that when visitors use digital virtual devices to acquire knowledge, their personal emotions, cultural reactions and interactive data will be generated and kept in the museum information database, which serves as reference data for visitors' personalized experience and the updating and upgrading of museum equipment. This is actually the generation of digital museum user content, that is, the replacement of museum culture and education mode -- the museum from a single cultural narrative to a complex cultural production.

In general, the metaverse development mode of museum provides a new path for museum culture education, and the effect caused by this path is more effective than the traditional cultural narrative mode, and visitors can actually gain new knowledge due to the transformation of the mode. However, at present, the audience of this way is more inclined to the youth, and it has little effect on the introverted tourists.

4. The solution of some problems in the mechanism of cultural relics protection

4.1. Digital display of cultural relics prohibited from exhibition

Currently, museums prohibit the display of some valuable cultural relics for conservation purposes, or restrict the display of some valuable cultural relics unless there are special circumstances. From the perspective of visitors' experience, the exhibition ban weakens the visitors' experience to some extent, and on a deeper level is an indifferent response to visitors' cultural demands. However, this is indeed a very real problem. Even the Louvre, which has 30,000 pieces in its collection, will choose to exhibit highly copied Mona Lisa portraits due to the cultural relic protection mechanism. The exhibition of highly copied works is the result of balancing the cultural demands of visitors and the protection of cultural relics. However, as Benjamin said in Works of Art in the Age of Mechanical Reproduction, it is difficult for the reproduction to form the "light charm" effect

of the original work. To put it simply, on the one hand, it is difficult for the replica to reach the painting height of the original, namely the simulation of techniques and emotions. On the other hand, the uniqueness of the replica is the reason why the audience appreciates it or the value of studying it. Although digital reproduction also belongs to a class of reproduction, but digital reproduction art compared to manual reproduction art and mechanical reproduction art has a wider range of transmission and transmission space, the authenticity of art works will become more complex because of digital technology, in addition, it uses the original "light rhyme" effect to spread art works, can improve the accessibility of the original. From this point of view, digital copy is the use of the original to promote the original, and is different from the mechanical copy using the original to dissolve the original, in general, these two ways of reproduction are popular art, so that art works have a wider spread.

From the perspective of cultural relics in museums, digitalization can increase the accessibility of cultural relics. This accessibility is firstly to promote the popularity of the original works and secondly to digitally display the forbidden cultural relics.

The digital display of cultural relics under the mode of the meta-universe museum includes two types: one is the electronic picture display of the original works, which has been started since the launch of the third generation of mobile communication "China standard" TD-SCDMA commercial use in 2008; the other is the three-dimensional model display, which is a popular way of display in the past two years, especially since the outbreak of COVID-19. Museums all over the world are actively using digital virtual technology to carry out online exhibitions. In fact, the display of such three-dimensional models solves three problems of museums. The first is the exhibition of cultural relics banned from exhibition, the second is to meet the cultural demands of tourists or researchers, and the last is the emergency online exhibition of all cultural relics including cultural relics banned from exhibition in the face of emergencies. With the investment of the state and commercial companies in the meta-university-related industries in the past two years, VR, AR, MR, XR and other technologies will become more and more mature, which also indicates that virtual works will become more real and common.

4.2. Production process and detailed display

In the past, cultural relics in museums were limited by their physical properties and required museums to install glass display cases to protect them, which killed the vitality of exhibition collections for some visitors, scholars and staff, but the fact is that for cultural relics teetering on the edge of survival, this is a kind of enshrined life. The root cause is that in the long history of mankind, there are too many exquisite representative objects of national culture that have been annihilated by the development of history, so we have to protect these cultural relics that have been damaged or will be damaged. From the perspective of the public, the reason to protect these cultural relics is to let the public enjoy these beautiful cultural relics and remember the glorious history of the era in which they are located. To associate with enlightenment for future development. Therefore, based on the cultural relics in the protection mechanism, except for the cultural relics research experts, archaeologists and historians who may have the honor to see and touch the cultural relics closely, the rest of the public almost have no such opportunity, which weakens the educational function of museums to a certain extent, making cultural relics become an elusive visual symbol. In order to change this situation, The museum used to use photos, videos and other forms to enhance the display of cultural relics information, although this method is good, but the audience can only appreciate the cultural relics according to the Angle of the photos, video sequence, visitors' subjectivity is often contained.

Nowadays, the digital virtual exhibition of cultural relics will reduce the distance between cultural relics and the audience as much as possible, enhance the audience's knowledge and give play to the audience's subjectivity. Museums under the development mode of metauniverse further expand the digital display of cultural relics. The display content is not only limited to "digital twin", but also displayed in a series of multi-dimensional, multi-detail and multi-autonomous processes such as the display of cultural relics in detail, production process, abstract display and reedit-oriented display. For example, the Palace Museum launched the APP Han Xizai Night Banquet Map. In order to enable the audience to have a clearer understanding of the details of the painting collection, the APP created a three-layer three-dimensional appreciation mode: overview layer, appreciation layer and experience layer, so that the "digital scroll" can be viewed from a distance and appreciated from close to the audience, to fully interpret every detail of the painting. In this way, digital cultural relics allow the audience to experience their cultural charm in a more vivid and detailed form.

5. Solving the problem of tourists' experience

5.1. Tourists' perceptual authenticity experience

The term perceived authenticity is generally used in the field of marketing, but the concept of authenticity originated in museums, which are often used to judge whether the original art is real or not. Simply speaking, perceived authenticity refers to the question of whether the original art is displayed in the museum or the imitation one. From the perspective of tourists, the problem of authenticity is actually the subjective experience and feeling of tourists. According to the previous survey and research, most tourists can not accurately judge whether the exhibited cultural relics belong to the authentic. The reasons for this situation are various, among which the main reason is the knowledge reserve of visitors, of course, it is because they cannot judge the authenticity of the works. Unable to know the age, characteristics and historical origin of the works, tourists choose to visit the museum in the hope that the museum can give an authoritative explanation. In other words, visitors crave an authentic experience.

In the past, museums exhibited cultural relics and introduced their collections very briefly. One is to let visitors know the general information of cultural relics in a short time; the other is to save exhibition space and avoid crowd gathering. Although this is the most concise and effective way of communication between museums, exhibits and visitors, it will cause certain obstacles in terms of education and research functions. Cultural relics themselves may contain a large number of information resources, and the acquisition of this information needs a large amount of knowledge reserve, otherwise it needs to be explained by tour guides or visitors

through mobile devices to search themselves, its limitations are very obvious, so this has been located in the gap between cultural relics and visitors, can also be called the difficult access to cultural relics.

The meta-universe Museum has a systematic solution to the perception of authenticity. First, it is about the authenticity of the museum. The museum uses heads-up devices, LED screen displays, AI digital human guides, mobile phone apps and other ways to build a resource library by integrating information resources in its collection. The cultural relic information through text introduction, audio explanation, video play and other forms to broaden the access to the authenticity of the museum. Secondly, regarding the authenticity of cultural relics, the museum adopts VR, AR, XR, MR And other digital virtualization means to twin the collection, infuses the age, characteristics and other related information of cultural relics into the virtual collection, generates the detailed information of cultural relics to provide visitors, and presents the appearance of cultural relics in a multi-resource, multi-personality and all-round comprehensive three-dimensional form. Moreover, regarding the perception of authenticity of tourists, normally, tourists hope to get the sense of authenticity when visiting museums. However, due to the excessive specialization of cultural relics exhibitions and the lack of layout design of public vision, tourists often give up the initiative to obtain relevant cultural relics information. However, in the museum of the metaverse, based on the channels for the museum to expand the authenticity of information resources, The use of virtual digital twin collections of cultural relics to create a museum parallel universe, visitors to the virtual identity of the museum library content to browse, and according to their own needs to choose text, audio, video, explanation and other forms of browsing, can also be personalized to browse the content.

In this way, the problem of tourists' perception of authenticity has been gradually solved. Compared with traditional museum visiting forms, virtual visiting forms respect visitors' privacy more and increase tourists' access to information resources, which means that the authenticity of resource information is improved, tourists' perceived authenticity experience is also improved, so the public's satisfaction with museum visiting is improved, and tourists' perceived authenticity ability is also improved. In other words, the ability of the public to identify cultural relics and collections and to identify the authenticity is significantly improved.

5.2. Tourists' edutainment experience

Edutainment in museums is not a new concept, it has been tried in major museums since the 1990s. The traditional form of edutainment does not contain any modern technology, but relies on the organization of tour guides and the active participation of visitors. This form of edutainment has three main defects; First, the participation of tourists is not very high, the classic edutainment is mainly similar to some shows, puzzles, handmade, etc., so its audience is inclined to children or teenagers, many middle-aged and elderly tourists because of the character or practical ability and other reasons are not willing to participate in it, more viewers hold the mentality of watching. Second, personnel scheduling, an entertainment organization often needs the cooperation of several staff to complete, if it is a large song and dance performance will need more personnel, which is not a small challenge for the museum whether it is internal staff management or external staff management. Third, the tendency of entertainment is obvious, most people who participate in the activity hold a fun mentality, compared with the educational purpose of hosting the activity, they are more concerned about whether they are happy to participate in it, happiness has become the main purpose, knowledge acquisition has been forgotten, the effect of entertaining is not obvious, moreover, many museums now hold activities in order to attract tourists to visit, Did not take "teaching" as the primary starting point, the performance of entertainment for entertainment, rather than entertainment for learning, deviated from the original intention of edutainment.

The important difference between modern edutainment and classic edutainment is that it restores, expands and associates the works by means of science and technology, and lets visitors feel the charm of culture, art and history by means of immersive interactive entertainment.

Interactive entertainment is a prominent feature of the meta-universe Museum. The inclusion of entertainment and interactive elements in the museum is, first of all, to attract more tourists, especially young people, to visit the museum and improve the unity of the traditional museum participation group. At the same time, it enables tourists to actively participate in the immersive experience project through interactive forms. Visitors gradually change from the role of being educated to the role of active receiver, which promotes the expansion of the educational function of the museum and enables visitors to acquire knowledge while having fun. Secondly, the personnel demand of digital virtual technology will be relatively reduced, and more personnel demand comes from technicians and digital curators, so the personnel scheduling is relatively simple. However, this will cause another problem, because the virtual digital equipment is limited, some tourists need to line up when visiting and using, and this will have a certain impact on the congestion management of the museum. Thirdly, the relevant information that digital virtual technology can contain is more comprehensive and specific, which plays a good complementary role in the audience's emotional experience. Through various angles of cultural relics display and AI digital human guide analysis, visitors can get key information faster, complete the grasp of the works and even the association, so that the audience can personally feel the emotion that the cultural relics are to express. Thus, emotional resonance can be generated. In addition, the data of this interactive experience will be recorded in the whole process, that is, the information generated by the interaction will be recorded in the museum's resource library together with the storage of the information resource library. The purpose is to provide reference for the future upgrade of the interactive experience service of the Meta-Universe Museum, so as to contribute to the sustainable development of the museum through entertaining and teaching.

6. Conclusion

The meta-universe museum has become a trend of museum development, as far as the present, the meta-universe museum is still in the preliminary stage. By vigorously developing digital virtual technology, the purpose of building a meta-universe museum is to solve the pain points of the museum and realize the sustainable development of the museum. Currently, the exploration of the meta-universe Museum has gradually solved the pain points of the museum that cannot be solved by traditional means from the in-depth display of

cultural relics resources, the collaborative construction of digital resources, the interactive entertainment experience of visitors and other aspects. In addition, now the world situation is changing, and there are many emergencies such as the epidemic. The museum should seize the advantages of relevant technologies in the meta-universe, actively cope with external risks, strive to build a museum with more inclusiveness, diversity, sustainability and community participation, and complete the modernization of the museum as soon as possible.

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