Article

Research on the Emotional Experience of Digital Virtual Technology in Museum Display Design

Yi Ding

Kookmin University, Seoul, 02707, Korea
Correspondence: 412521967@qq.com

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Abstract: ***Background:*** Advances in digital virtual technology have transformed museum display design, shifting from static exhibits to dynamic, interactive experiences that prioritize human-centered emotional engagement. This shifts underscores the need to understand how such technologies enhance audience experiences and facilitate cultural transmission. ***Purpose:*** This study analyzes museum display policies, cultural artifact presentation methods, and industry trends to evaluate the role of digital virtual technologies in fostering emotional experiences, categorizing their applications, and envisioning future museum development. ***Methods:*** A mixed-methods approach was employed, including case studies of technology-integrated museum exhibitions, conducting a systematic literature review, and performing fieldwork at museums utilizing digital innovations. ***Results:*** Technologies such as virtual reality, augmented reality, holographic projections, and interactive installations deepen audience emotional connections, enhance understanding of cultural artifacts, and increase participatory engagement. ***Conclusion:*** Integrating digital virtual technologies with cultural artifacts introduces innovative interpretive methods, significantly enriching audience emotional experiences and advancing cultural and societal progress. As these technologies evolve, human-centered design will be critical in shaping museum experiences, supporting education, and promoting cultural transmission. Future research should explore on finding strategies that balance emotional impact with accessibility.

Keywords: Digital virtual technology; Museums; Display design; Emotional experience; Cultural transmission

1.Introduction

1.1 Research Background

With the rapid development of technology, digital virtual technology has become an integral part of museum display design. According to China's State Administration of Cultural Heritage, the total number of museums across China reached 6,565 as of 2022, receiving 578 million visitors in 2022 alone. Museums have become an important place for people to travel for daily study and understanding of local history, however, the traditional display of cultural relics, spatial layout and other single display forms have been difficult to meet the needs of modern audiences for interactivity, immersion and emotional experience. With the introduction of digital virtual technology, such as holographic projection, augmented reality, virtual reality and three-dimensional scanning and other innovative technologies appeared and widely used, for the museum display design has brought revolutionary changes. The static form of exhibition has gradually transformed into a dynamic, interactive experience where visitors are able to explore the details behind the culture in a virtual environment. This personalized way of viewing the exhibition not only brings the distance between the audience and the exhibits closer, but also brings a refreshing immersive experience, which significantly improves the audience's emotional engagement and satisfaction. In recent years,

museums around the world have launched a variety of new development modes such as cloud viewing, interactive exhibitions, immersive theater, themed experience space, digital collections and so on. The integration of virtual reality technology and museums breaks through the spatial limitations, effectively overcomes the limitations of traditional museums, and brings a brand new display mode (Huang, 2021). Museums pay more attention to the emotional experience of tourists, the people's traditional impression of ponderous knowledge of the history museum, through the extensive application of virtual technology, combined with technology and art, innovative presentation of a new display form. This move not only enhances the information dissemination ability of the museum and stimulates the emotional resonance of the audience, but also gives it a brand new dimension, thus enhancing the effect of education and cultural dissemination, and promoting the change of the exhibition mode, which will surely become the core trend of the future development of museums.

1.2 Research Purpose

This study aims to explore in depth the application of digital virtual technology in museum display design and how it enhances the emotional experience of the audience. By analyzing the existing application cases of digital virtual technology, its effectiveness in enhancing the audience's emotional resonance and educational effect. The study will also explore how to realize deeper cultural inheritance and educational significance through digital virtual technology, so as to provide innovative ideas and methods for museum display design.

1.3 Research Methods

Literature Analysis Method.Through the platforms of Knowledge.com and Google Scholar, we collect domestic and international literature on the innovation and development of museum display design, analyze the relevant literature on visitor behavior, emotional experience, and digital virtual technology, and gain a deeper understanding of how different design strategies affect the visitors' visiting experience, sort out and analyze the existing research, and summarize its theoretical foundations related to the way of viewing the exhibition, spatial perception, interactivity, emotional experience, and immersion, so as to provide references for future design and practice.

Case study method. By analyzing the classic cases of museum virtual display design at home and abroad, the necessity of integrating museum digital virtual technology display and emotional experience design is discussed in depth. Through successful design cases, it provides valuable experience for future museum display design and helps museums better utilize digital virtual technology and emotional design to create cultural experiences with profound impact.

Field research method. Through field research, in-depth investigation of museum display content and design. Research on museum visitors to get first-hand information and feedback. Fieldwork can directly observe the interaction between visitors and exhibits, understand their viewing experience and emotional response, and analyze the museum's display design.

1.4 Research content

This study first conducts an in-depth research on the background of digital virtual technology display in museums, systematically organizes domestic and international literature related to museum display, and comprehensively analyzes the characteristics and emotional design of digital virtual technology. Through this process, the study explores the potential value of digital virtual technology in museum display and provides sufficient theoretical basis. Secondly, it summarizes the expression forms of digital virtual technology and museum display design, and deeply analyzes these forms to bring emotional experience to the audience. Finally, the study will explore the future

development trend of museum display design and provide forward-looking insights and suggestions to guide future research and practice.

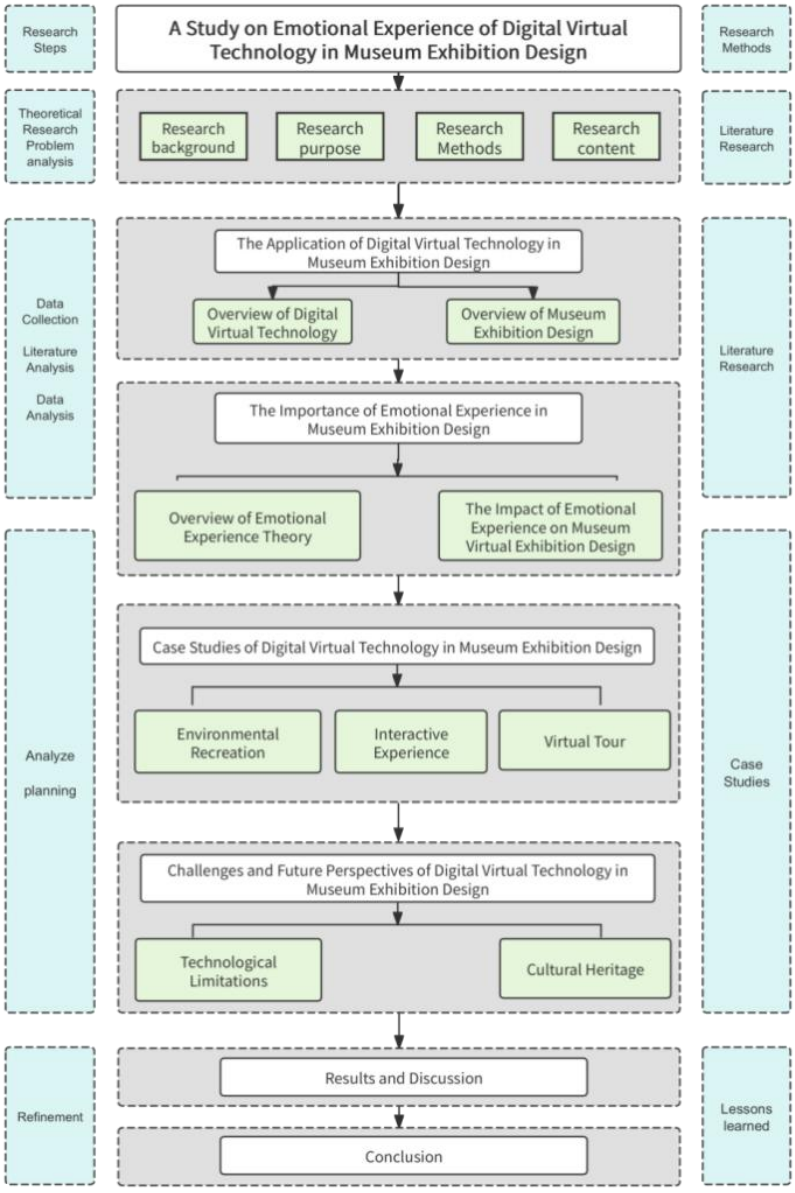

Figure 1: Frame Diagram

2. Literature Review

At present, the academic research on museum virtual display is mainly reflected in three aspects, one is the research on the concept of emotional design. In his book Design Psychology,Norman (2005) put forward the concept of "Emotional Design", which advocates that designers should pay attention to the emotional needs of users and create a pleasurable experience for users through design. Simon (2018), an American woman museologist, explains in her book The Participatory Museum that a museum is a place where visitors can create, share, and interact with others around their exhibits. Cotter et al. (2024), in the book Emotional experiences, well-being, and ill-being during art, argues that designers should pay attention to users' emotional needs and create pleasurable experiences for them through design. being, and ill-being during art museum visits: a latent class analysis," identifies patterns of emotional experiences during art museum

visits through latent class analysis and examines how these patterns relate to well-being and ill-being. Positive emotional categories were obtained in terms of higher well-being and lower discomfort, while two negative emotional categories differed only in terms of psychological distress. Papagiannakis et al. (2024) , in "Mixed Reality, Gamified Presence, and Storytelling for Virtual Museums," shows that the renaissance of commercial VR and AR hardware, storytelling, presence, and gamification are three fundamental areas to consider when developing new mixed reality applications for cultural heritage. This topic has sorted out the relationship between museums, audiences and the guided tour medium, and clarified the scope and value of design research. Chen's (2021) "Research on Emotional Experience Design of Museum Mobile Guiding System" analyzes the media form, interaction characteristics, application scenarios and technological trends of museum mobile guiding system, combines with the theory of emotional experience, discusses the shortcomings of user's emotional experience, and puts forward the necessity and key value of emotional experience design.

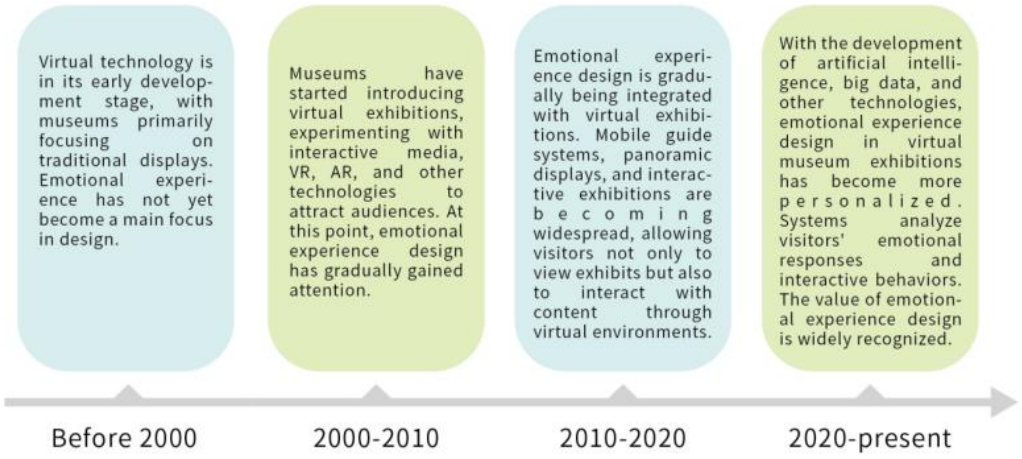

Figure 2: Emotional experiences in the development of virtual displays in museums

Secondly, it is about the research on virtual display design of museums. Jiang and Fu (2022), in the article "Research on the application requirements for the transformation of physical museums to virtual display space - taking the 'digital Dunhuang' cultural display space design program as an example", through analyzing the innovation of virtual display in museums, combining with Dunhuang digitization successful cases, discussing the design elements of virtual display and arguing the necessity of virtual display technology in museums with the current demand. In the article, by analyzing the innovation of virtual display in museums, combining with the successful cases of Dunhuang digitization, exploring the design elements of virtual display, and combining with the current demand, arguing the necessity of virtual display technology in museums. After analyzing the application of virtual reality technology in museums, Ma (2019) further discusses how the technology can enhance the effect of museum collection display design after analyzing the application of virtual reality technology in museums. Zhang and Zhao (2019) in the article "Virtual Reality Display Design of Guangxi Folk Bronze Drum Museum" pointed out that the virtual reality display design themed on the dissemination of Guangxi Zhuang Bronze Drum culture, with the help of the strong aggregation power of the Internet, helps the inheritors and craftsmen to find a high level of mobility channels, and promotes the transformation of non-fraditional culture from a static display to a dynamic dissemination, and from the promotion of culture to the economy of art, and the cultural carriers have also been transformed from the materialized records for the heritage of artisans. Lv (2023), in "The Status and

Characteristics of Virtual Exhibitions in Japanese Museums", selects three representative museums as cases to comparatively analyze the status and characteristics of different types of virtual exhibitions from the aspects of the content structure, display form and interaction mode of virtual exhibitions. In Luo's (2022) "Practical Exploration of VR and AR in Virtual Museum Exhibitions", he briefly analyzes the concepts of VR, AR and virtual museums, and discusses the practical application of VR and AR technologies in virtual museum exhibitions. In "Exploring the Application of Immersive Experience in Museum Exhibitions", Wang (2019) mentions that virtual reality and hologram technology can design an interactive narrative system from the perspective of the exhibits to create an immersive physical space with a strong sense of experience.Li and Wang (2017), in "Research on the Interactive Application of Museum Exhibits Based on AR-VR Hybrid Technology", put forward a method for the development of museum interactive display system based on AR-VR by analyzing the key points of AR and VR hybrid technology.

By analyzing the current status of foreign research on the emotional design of museum virtual displays, it can be found that emotional experience design is a human-centered emotional design concept that integrates elements of design psychology. By thinking deeply from the audience's perspective, applying emotional experience design to museums can not only strengthen the social education function of museums, but also enhance the audience's sense of participation and provide a more diverse interactive experience. However, there is still a lack of research on the combination of emotional design and museum virtual display, which needs to be further deepened and improved.

Table 1: Summary of Literature Features

Research Direction	Reference	Trait
Emotional experience	"Emotional experiences, well-being, and ill-being during art museum visits: a latent class analysis", "Mixed Reality, Gamified Presence, and Storytelling for Virtual Museums", "A Study on the Interaction Design of Chinese Umbrella Museums Based on Emotional Experience", "A Study on Emotional Experience Design of Museum Mobile Guide System ".	Contemporary museums can not only focus on the display itself, but also focus on the emotional factors of the audience itself, and study the relationship between the model and the sense of well-being and fulfillment, and put forward the necessity and key value of the emotional experience design
Museum Virtual Presentation Design	"Study on the Application Requirements for the Transformation of Physical Museums into Virtual Exhibition Spaces - Taking the Design Program of 'Digital Dunhuang' Cultural Exhibition Space as an Example", "Interactive Expression and Linguistic Transformation of Chinese Museums Using Virtual Reality Technology in Exhibitions--The Development and Application of VR Shadow Game 'Tian Ji Jockey' as an Example".	Digital technology techniques change the way of "dialog" between people and museums, and put forward the contrast and development relationship between traditional display and dynamic interactive display, thus highlighting the significance of heritage and education of digital virtual technology in museums.

3. The application of digital virtual technology in museum display design

3.1 Overview of digital virtualization technologies

Digital virtual technology, as a product of the combination of modern technology and art display, is playing an increasingly important role in museum display design.

With the help of computer-generated images, sound and tactile feedback and other multi-sensory experiences, it provides a new way of interaction for the audience. vr technology can put the audience in a fully immersive three-dimensional space, while AR technology can superimpose virtual information in the real environment, creating a surreal experience. Digital virtual technology is not only limited to visual and auditory representations, but also allows viewers to feel a realistic sense of touch when touching virtual objects through haptic feedback devices, such as force feedback gloves. Such technological integration breaks the limitations of traditional physical space, making the museum display design more rich and diversified, bringing deep emotional resonance and more immersive viewing experience.

Table 2: Digital Virtual Technology Classification

Research Direction	References	Trait
ViaualReality(VR)	With a computer-generated, fully virtual environment, users wearing a VR headset can fully immerse themselves and interact with the virtual world.	The user is completely isolated from the real world and experiences a completely virtual environment.
Augmented Reality(AR)	Through hardware such as cameras, sensors and display devices, virtual information is projected into the real scene, realizing the fusion of virtual and reality.	The virtual elements are combined with the real world and the user still operates in the real world.
Mixed Reality(MR)	Combining the characteristics of virtual reality and augmented reality, virtual objects can not only coexist with the real world, but also interact with the real environment. Virtual objects can collide or occlude with real objects to enhance the realism of the interaction.	Seamless integration of virtualization and reality, where virtual objects have a "sense of reality" and interact with the environment.

3.2 Museum Display Design Overview

Display design is a form of design aimed at conveying information, and its core essence lies in serving as a media carrier of information. Information dissemination is a system, which requires that the information transfer of museum display is not the transfer and acceptance of simple information, but the dynamic process of information collection, processing, dissemination and acceptance, which is the use of a variety of media to shape a spatial environment, which in turn attracts the audience to participate in order to enter the space by way of hands-on experience, and to get a direct feeling by participating in the display of activities (Meigong Book Club, 1993). Museum display design is a bridge connecting history and modernity, cultural relics and audience, which not only carries the function of education and dissemination of culture, but also is an important place to stimulate the audience's emotional experience. With the integration of digital virtual technology, museum display design has been transformed from traditional static display to dynamic and interactive experiential display.

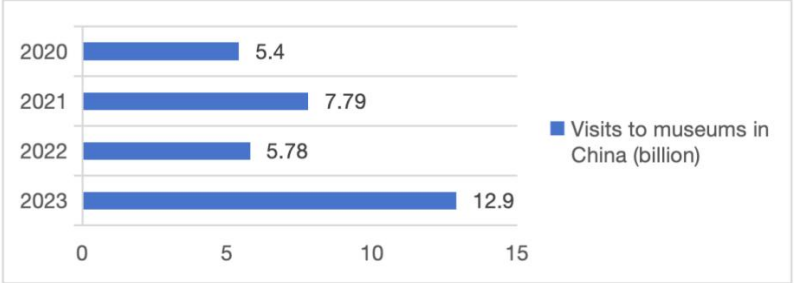

Figure 3: “Bubbles and Wizards” Interactive Art Installation
Source: http://www.gybn100.com/?news=hyzx-57

According to the latest data released by the State Administration of Cultural Heritage, museums nationwide will receive 1.29 billion visitors in 2023, and it can be seen from Figure 3 that museums, as an important place for culture and education, are becoming increasingly influential and attractive. With the rapid development of information technology, digital virtual technology is gradually becoming the core element of museum display. As an important hub of information dissemination, the operation mode of museums also presents diversified approaches and styles. With the help of digital technology, it can not only deepen the research and exhibition of traditional museum collections, but also enhance its function of knowledge dissemination. Display is the main way of communication between museums and audiences, and interaction is the essence of display art. Its purpose is to influence the audience's attitude through communication and to stimulate them to participate and think about the information. Modern museum display design integrates the essence of art and design, communication, psychology, aesthetics, philosophy, architecture, sociology, ergonomics, semiotics and new media. It is a combination of art and technology, forming a design system with unique development rules, artistic standards and expressions. The integration and application of technology makes the museum display design more vivid and interactive, thus deepening the audience's understanding and emotional resonance of the stories behind the exhibits. 4. Creation and Expression of Digital Interactive Art.

4. The Importance of Emotional Experience in Museum Display Design

4.1 Overview of Emotional Experience Theory

In the cross field of digital virtual technology and museum display design, the theory of emotional experience plays a crucial role. Emotional experience theory emphasizes that emotion is an internal psychological state produced when humans interact with the environment, which can profoundly affect individual cognition and behavior. According to Norman's (2005) research, emotional experience can be divided into three levels: instinctive, behavioral and reflective. In the digital virtual display of museums, the instinctive layer involves the audience's first impression and intuitive reaction to the display interface; the behavioral layer focuses on the fluency and pleasure of the audience's interaction with the technology; and the reflective layer is related to the audience's thinking and emotional memory of the display content after the experience. Through well-designed digital virtual technology, museums can stimulate the audience's deep emotions, thus enhancing the effect of education and cultural dissemination. The use of digital virtual technology to restore historical scenes, cultural relics display, game interaction and other forms of expression to help the audience immersive experience of historical events, this immersive experience can stimulate the audience's empathy and emotional resonance, thus deepening the understanding and memory of history. The application of emotional experience theory not only enhances the attractiveness of the museum display, but also provides theoretical support and practical guidance for the application of digital virtual technology in the museum.

4.2 The influence of emotional experience on the virtual display design of museums

With the introduction of digital virtual technology, the museum display design has evolved from the traditional static display to a more dynamic and interactive experience. The theory of emotional experience points out that emotion is the core force driving human behavior, so the integration of emotional experience in display design can greatly enhance the audience's participation and memory. In contemporary museums, creating a rich emotional experience has become an indispensable part. When visitors

are in the exhibition space of a museum, their thoughts and emotions often resonate with the environment. For example, the "Holographic Zoo" of the Shanghai Nature Museum utilizes holographic projection technology to vividly reproduce the life scenes of ancient dinosaurs, allowing visitors to feel as if they have traveled through time and space, are in the ancient times, and interact with dinosaurs, and experience an unprecedented immersive visual experience. Modern museums with the help of virtual technology greatly enhance the audience's sense of emotional involvement, so that they can focus more on the exhibition environment and activities, and even forget about the outside world and time when interacting with the exhibits. The core goal of virtual display design is to realize the effective transmission of information and emotional resonance through the interaction between people and display content. In this process, visitors are no longer passive receivers, but actively cognize, think and create through emotional involvement.

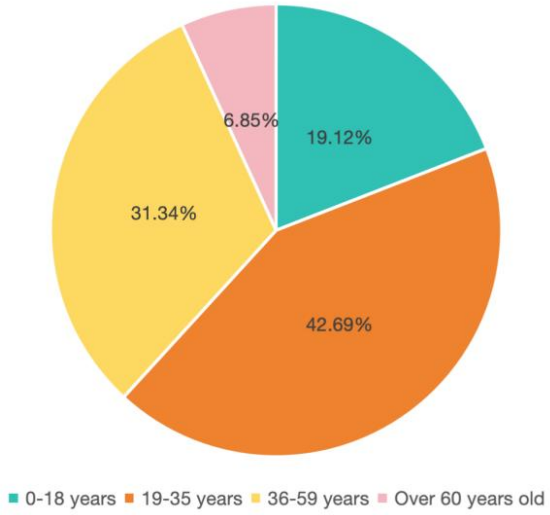

Figure 4: National Museum of China Data Report 2023
Source: National Museum of China

As shown in Fig. 4, taking the National Museum of China as an example, the data of 2023 shows that the composition of audiences in different age groups is as follows: 19.12% for 0-18 years old, 42.69% for 19-35 years old, 31.34% for 36-59 years old, and 6.85% for 60 years old and above. Among them, more than 60% are under 35 years old, indicating that young people have become the main force of the audience of the National Museum. Human's emotional response to external stimuli is a natural instinct. In the exhibition space, elements such as spatial layout, display effect, curatorial form, etc., are important factors triggering visitors' emotional response, which belongs to the instinctive level of emotional experience. When visitors acquire new knowledge or participate in interaction, they tend to produce a sense of pleasure, and this emotional experience belongs to the behavioral level, which is the most intuitive and characteristic form of emotion in exhibition design. In addition, the interactive devices in the exhibition not only promote the communication between people and space, but also often trigger deeper emotional reflection, which is called the emotional experience of the reflection layer. During the visit, visitors generate associations and thoughts through real contact and interaction with the exhibits, thus triggering a more complex emotional experience. This reflective level of emotional experience is the accumulation and deepening of emotions in the process of viewing the exhibition, reflecting the audience's higher emotional awareness and resonance.

5. Digital virtual technology in the museum display design case study

5.1 Environment reproduction

With the help of digital virtual technology, the environment reproduction in museum display design has reached an unprecedented level. As shown in Figure 5, taking the China Grand Canal Museum in Yangzhou as an example, technologies such as three-dimensional scanning, real-time rendering of full-area projection and 720° immersive scene interactive theater make the audience feel as if they were immersed in the flavors of the two banks of the ancient canals. The audience starts from Hangzhou, travels through the bustling city streets, passes through Suzhou, hears the melodious opera, enjoys the wedding scene on the canal, and finally arrives in Beijing. This series of virtual technology use, as if leading the audience through time and space, immersive. Not only that, virtual technology can also be historical scenes, natural environments, and the original background of the art works realistically in front of the eyes. For example, the Louvre Museum utilizes VR technology to reproduce the process and technique of creating Da Vinci's famous painting “Mona Lisa”. Through this immersive experience, the audience not only has a deeper understanding of the story behind the work, but also enhances the emotional resonance. Through these technologies, the museum's display breaks through the limitations of physical space and expands to an infinite virtual world, giving the audience a new cognitive and emotional experience.

Figure 5: China Grand Canal Museum in Yangzhou
Source: https://www.d-arts.cn/article/article_info/key/MTIwMTMxODA5MjSDuY1osIbOcw.html

5.2 Interactive Experience

With the assistance of digital virtual technology, interactive experience in museum display design has become an important means to enhance the emotional experience of visitors. This innovative approach not only changes the traditional mode of exhibition viewing, but also makes the audience change from passive receivers to active explorers, greatly enhancing their sense of participation and interactivity. As shown in Figure 6, take the Stamp Museum of Hangzhou Museum as an example, the museum enables visitors to explore the history and culture of stamps through well-designed interactive experiences. With the help of touch-screen display technology, visitors can browse the detailed information of the stamps through simple operations, understand the historical background behind each stamp, the appreciation of early print engravings and the production process, and be able to have a more vivid learning experience. This interactive design not only gives the exhibits more vividness, but also greatly enriches the learning experience of visitors, enabling them to create a deeper emotional connection with the exhibition content through interaction. Whether children, teenagers or older visitors, they can easily participate in the interactive process of the exhibition and acquire the knowledge they are interested in. In the design of the Stamp Museum, Hangzhou Museum has taken into special consideration the needs of visitors of different age groups and ensured the friendliness of the interactive interface and the convenience of operation. This design not only reduces the threshold of technology use, but also improves the enthusiasm of audience participation.

Figure 6: Stamp display at Hangzhou Museum (photo by the author)

5.3 Virtual Tour

Aided by digital virtual technology, virtual tours have become an important part of the emotional experience in museum display design. Through VR and AR technologies, visitors are able to immerse themselves in an environment that transcends the limitations of physical space, experiencing an unprecedented sense of interactivity and engagement. As shown in Figure 7, taking the Guangdong Provincial Museum as an example, the museum uses virtual tour technology to enable visitors to walk into the ruins of an ancient civilization as if they were there by wearing AR glasses, and feel the reproduction of cultural relics in person. This immersive experience greatly enhances the audience's perception of history and culture, and through visual, auditory and other multi-dimensional stimulation, prompting deep emotional resonance between the audience and the exhibits. Similarly, the Forbidden City Museum presents the architectural details of the Forbidden City virtually in front of the global audience through VR panoramic technology. From the magnificent architecture of the red walls and yellow tiles to the detailed explanations of each exhibit, the audience can feel the shock of a visit to the site at home or anywhere through the virtual space, which is almost indistinguishable from a visit to the site. This technology breaks the boundaries of time and space, making it possible for viewers even thousands of miles away to have a realistic viewing experience. In addition, combined with the principle of emotional design, the virtual tour is not only limited to the transmission of information, but also able to guide the audience's emotional flow through a carefully designed narrative path. It is as if they have experienced that period of history, so that they can receive education and inherit culture in a subtle way. This design is a perfect combination of education and entertainment, so that the function of the museum from pure display to a cultural experience with emotional resonance. The application of virtual tour technology not only improves the interactivity and attractiveness of the museum, but also gives more emotional depth and cultural connotation to the exhibition process, truly realizing the integration of science and technology and culture.

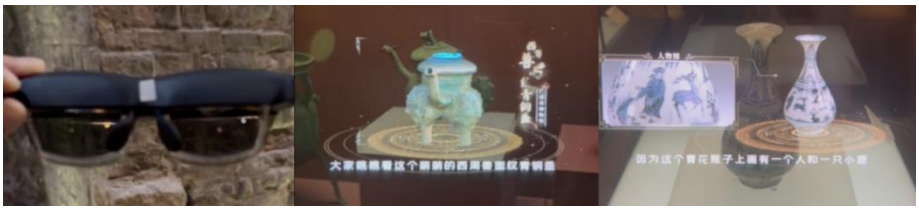

Figure 7: Guangdong Provincial Museum AR glasses guide
Source : https://www.bilibili.com/video/BV1yF411S7es/

6. Challenges and prospects of digital virtual technology in museum display design

6.1 Technical limitations

When exploring the application of digital virtual technology in museum display design, technical limitations are a factor that cannot be ignored. Although VR, AR and holographic projection technologies provide museums with the possibility of immersive

experiences, their high hardware equipment costs and maintenance expenses often constrain their wide application. In addition, with the rapid iteration of technology, museums need to constantly update their equipment to keep their displays modern, which undoubtedly adds to the cost pressure of long-term operations. Technological constraints also manifest themselves in the stability and reliability of digital virtual technologies. Issues such as network latency and software glitches can lead to interrupted or disjointed user experiences, which can affect the quality of the emotional experience. In museum environments, technical problems may break the immersion of visitors and diminish the appeal of the display. Therefore, when designing digital virtual displays, museums must give due consideration to the maturity and stability of the technology to ensure that the content of the display can be reliably supported by technology. In addition, technical constraints also relate to the ease of content creation and updating. Digital virtual displays often require the support of specialized technicians, and museum display content usually needs to be updated regularly according to changes in exhibition themes. If the technology platform does not have the ability to quickly update the content, it may be difficult for the museum to reflect the latest research results or social events in a timely manner, thus affecting the timeliness and educational significance of the display. Therefore, when choosing digital virtual technologies, museums should prioritize solutions that have a flexible content management system in order to respond more effectively to the need for content updates. To better serve the creation of emotional experiences, museums must overcome these technological limitations in their display design. Close collaboration with technology developers is essential to maximize the audience's emotional experience under limited technological conditions.

6.2 Cultural Heritage

The application of digital virtual technology in museum display design provides brand new possibilities for cultural inheritance. Through technologies such as VR, AR and holographic projection, museums are able to break through the limitations of time and space and display historical relics and cultural stories to the public in a more vivid and interactive way. As shown in Figure 8, the number of museums in China is growing year by year, which means that the display design form of museums must keep up with the development of technology and continue to innovate in order to better promote the audience's cultural heritage and understanding. For example, with the help of AR technology, the National Palace Museum allows visitors to view the three-dimensional models of ancient buildings through cell phones or tablet computers, and feel the weight of history and the continuation of culture. The educational significance of digital virtual technology in museum display design is multi-level and multi-dimensional. It not only allows the museum's educational resources to be more widely disseminated, but also enables the global audience to enjoy exhibits that could otherwise only be seen in specific locations through online virtual tours. The popularization of this technology has made the combination of digital virtual technology and museum display design a model of innovation. It has not only changed the form of museum displays, but has also dramatically expanded the boundaries of education. Digital virtual technology not only enhances the audience's sense of participation, but also effectively stimulates their interest in and respect for traditional culture, demonstrating its significant educational value in cultural heritage. In addition, through sentiment analysis models, museums can quantify the audience's emotional response to the use of digital virtual technology, thus further optimizing the display design to better match the emotional needs of the audience. This technological integration is driving museum design and cultural education to new heights.

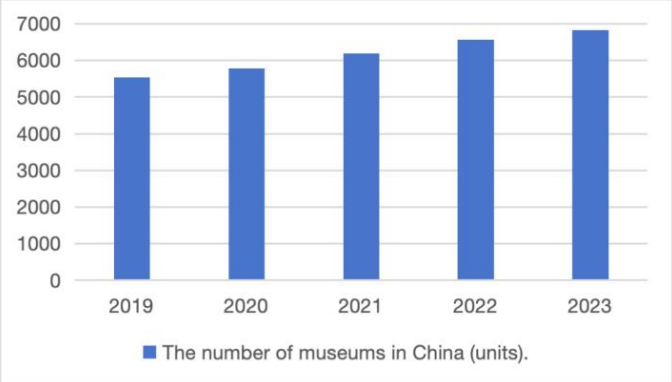

Figure 8: Number of museums in China, 2019-2023 (author's mapping)

7. Conclusion

In the integration of digital virtual technology and museum display design, the creation of emotional experience has become a core factor in enhancing visitor satisfaction and educational effect, and the depth and breadth of such emotional experience has also become an important standard for measuring the success of the design. By analyzing the cases of applying digital virtual technology in several museums, it can be found that when the technology is closely integrated with the design of emotional experience, it can significantly enhance the participation and satisfaction of visitors.

The construction of emotional experience needs to take into account the user's sensory, cognitive and emotional dimensions, and digital virtual technology provides strong support in these three aspects, creating a new experience beyond the traditional display form. Through well - designed interactive experiences and virtual tours, museums can effectively stimulate the emotional resonance of the audience and create unforgettable memory points. With the help of virtual reality technology, visitors can not only perceive the exhibits more deeply, but also become more emotionally involved, which further highlights the great potential of digital virtual technology in creating emotional experience.

The application of digital virtual technology in museums not only enhances the emotional involvement of visitors, but also deepens the educational significance of the exhibition. Through interactive and dynamic display design, the audience can immersively participate in the reproduction of historical events, making the learning process more vivid and effective. This immersive experience greatly enhances knowledge transfer and understanding. The theory of emotional experience points out that emotion is an important force driving human behavior. Therefore, in the museum display design, the use of digital virtual technology to create an emotional experience can not only enhance the audience's participation, but also play an important role in the realization of cultural dissemination and educational significance. Through this immersive experience, it is easier for the audience to create an emotional connection with the exhibits, thus gaining a deeper experience in cultural cognition and historical understanding.

However, despite the many innovations and changes that digital virtual technology has brought to museum displays, it also faces a number of challenges. The limitations of digital technology remain a major challenge for museum display design. Despite the advances in technology, issues such as hardware costs, software development and maintenance still exist. In addition, the optimization of user experience is an ongoing process, and display designers need to continuously collect feedback and make improvements. Technical limitations, optimization of user experience, deepening of educational significance and effectiveness of cultural transmission are all issues that need to be focused on in the future.

To realize the organic combination of digital virtual technology and museum display design, museum designers not only need to keep up with the development of technology, but also need to actively explore and innovate. The future development needs to carry out all - round thinking and exploration in the aspects of technological progress, user experience design, educational content innovation and cultural value transmission, so as to ensure that digital virtual technology can better serve the shaping of the emotional experience, make it play a maximum role in display design, and ensure the synergistic development of the two, thus realizing the perfect integration of the emotional depth and cultural connotation of museum display.

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