

Application of immersive design in the spatial design of historical theme

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Abstract. With the upgrading of cultural consumption demand and the rapid development of digital technology, historical theme exhibitions are no longer satisfied with the traditional mode of "cultural relics display + text explanation", but gradually transform towards a more interactive, experiential and immersive direction. As a design concept emphasizing multi-sensory experience and emotional resonance, immersive design has injected new vitality into the space design of historical theme exhibitions. This paper takes the application of immersive design in the spatial design of historical theme exhibitions as the research object. Firstly, by analyzing the immersive design theory and the uniqueness of historical theme exhibition space, it discusses the internal logic and value of their integration. Furthermore, starting with the technology-driven elements of sensory immersion construction, it analyzes the specific application of combined strategies such as overall wrapping in the space, and reveals how they promote the transformation of the audience from onlookers to participants. On this basis, it puts forward the core design principles of authenticity-oriented, narrative-centered, audience-focused and integrated design, supplemented by specific design strategies. Finally, by summarizing the research conclusions, it prospects the future development trend of immersive design in the field of historical theme exhibitions, aiming to provide theoretical reference and practical approaches for improving the communication efficiency and cultural value of historical exhibitions.

Keywords: immersive design, historical theme, exhibition space

1. Introduction

In 2024, the General Office of the Ministry of Culture and Tourism and four other departments clearly stated in the Action Plan for the Innovative Development of Smart Tourism (Ban Ziyuan Fa [2024] No.82) that cultural and museum venues, archaeological site parks and other institutions are encouraged and supported to build new smart tourism immersive experience spaces by applying technologies and equipment such as Virtual Reality (VR), Augmented Reality (AR), Extended Reality (XR), Mixed Reality (MR), the Metaverse, naked-eye 3D, holographic projection, digital light and shadow, and intelligent perception (Figure 1).

At the same time, the rapid development of digital technology has provided a strong driving force for the innovation of exhibition modes. As a spatial narrative method centered on people's personal experience, immersive design has thus been introduced into the spatial design of historical exhibitions. It aims to go beyond the traditional static display, and transform abstract history into a perceptible and accessible dynamic

experience by constructing a personally feelable and interactive environment, providing a brand-new path for improving the traditional exhibition mode. This paper aims to explore the application of immersive design in historical exhibitions, put forward new prospects for the spatial design of historical theme exhibitions, improve the homogenization phenomenon, attract more visitors to historical theme exhibition spaces, and thus narrow the distance between people and history.



Figure 1. Virtual reality technology

2. Core concepts and theoretical foundations

2.1. Analysis of immersive design theory

Immersive design does not refer to a single technology; it aims to create a multi-dimensional stimulating environment that enables participants to fully engage themselves in it and temporarily filter out perceptions related to the real world, thereby achieving a high degree of sense of immersion, participation and emotional resonance.

In the book *Universal Principles of Design*, the explanation of the term "immersion" adopts the flow theory. In short, it is to use people's sensory and cognitive experiences to create an atmosphere for participants to enjoy a certain state. Proposed by the American psychologist Mihaly Csikszentmihalyi in 1975, this concept refers to a state of complete concentration and self-forgetfulness that people reach when engaging in a certain activity.

In design, users can be led into a state of flow by creating an attractive and challenging environment, thus achieving an immersive experience. Immersive design takes this psychological state as the design goal, and guides users to enter the "flow" channel through the conscious planning of space, narrative, sensory elements and interactive mechanisms. Its purpose is to make people devote all their mental energy to the current target situation, feel pleasure and satisfaction, and thus forget the real world. It utilizes the physical environment to influence people's behavior, perception and emotions, and creates the atmosphere of historical scenes. It transforms linear historical facts into a narrative with beginning, development, climax and ending, as well as suspense and highlights, and focuses on how to tell stories by using spatial sequences. It emphasizes systematically planning all the touch points and feelings of the audience before, during and after the exhibition from the perspective of user experience to ensure the integrity and fluency of the immersive experience. Its development is closely linked to the scientific and technological progress and the rise of the experience economy since the late 20th century [1].

2.2. Uniqueness of historical theme exhibition space

Different from art exhibitions, science and technology exhibitions and other types of exhibitions, historical theme exhibition space emphasizes reproducing the development from the past to the present, handling the

relationship between the past and the present, attaching importance to reproducing past things, connecting time and space, and has unique functions and attributes.

Unlike the free layout of art exhibitions and the functional zoning of science and technology exhibitions, the layout of historical exhibition space serves historical narrative and cannot be arbitrary. It follows the linear chronological order or thematic plate structure to guide the audience's emotions and cognition. Compared with contemporary art exhibitions that encourage free exploration, historical exhibitions have a strong and somewhat mandatory streamline guidance to ensure that the audience understands history according to the causal logic and avoids misunderstanding.

The content of historical exhibitions is based on historical facts and also needs active construction. The core is cultural relics, which are witnesses of history and form the foundation of exhibition content. The design should protect and highlight cultural relics, and the exhibition should be objective and faithful to historical facts. However, an absolutely objective reproduction is impossible. Curating an exhibition is the selection, organization and interpretation of historical materials, which makes the historical exhibition space maintain a balance between objective presentation and subjective construction.

The ultimate purpose of historical exhibitions is not only display, but also education and communication, which determines the particularity of its methods [2]. Different from commercial exhibitions with the purpose of marketing and art exhibitions with aesthetic experience as the core, the educational function is the primary task of historical exhibitions. All display methods, including the most cutting-edge immersive technologies, ultimately aim to transmit historical knowledge more effectively, inspire historical thinking and shape historical outlook.

2.3. Correlation between immersive design and historical exhibitions

The combination of immersive design and historical theme exhibitions is not a simple superposition of technologies or blind following of trends, but stems from the deep alignment of the two in core goals and value orientations, forming a profound correlation of mutual need and mutual achievement.

First of all, the ultimate effect of immersive design is consistent with the social benefits of historical exhibitions: breaking the temporal, spatial and emotional barriers between contemporary audiences and history, and establishing a deep connection. Immersive design guides participants to enter a state of flow, integrate into the created environment and generate a sense of immersion; historical exhibitions enable the audience to understand history, empathize with historical figures, reflect on historical events, and form cultural identity and historical reflection. The technical and interactive means of immersive design provide a direct path for historical empathy.

Secondly, the values of the two are consistent. Immersive design promotes exhibitions from information dissemination to real experience, which is the embodiment of "audience-centered". It embeds historical knowledge in experience, allowing the audience to gain personal memories and feelings, and realizing an essential leap from simple information dissemination to real experience [3].

3. Application paths and design elements of immersive design in historical theme exhibitions

3.1. Technology-driven elements for creating sensory immersion

Vision is the dominant part of the senses. By using large-scale projection technology, LED mirror screens and other equipment, the entire exhibition space—including walls, floors and even ceilings—can be transformed

into a unified and dynamic canvas. For example, in a theme exhibition showing the urban life of the Song Dynasty, four-sided projection can seamlessly piece together the prosperous scene of the streets of Bianjing, with pedestrians coming and going and wine flags fluttering, making the audience feel as if they are wandering in the ancient streets. VR/AR/MR technologies provide a more personalized way of visual exploration. Through VR devices, the audience can "walk into" a ruined ancient palace, or scan a broken cultural relic with an AR tablet to see its digitally restored complete form in its original position, realizing the precise superposition of virtual information and physical space (Figure 2).



Figure 2. Immersive experience space

Sound is the key to shaping a sense of space and emotions. The application of 3D panoramic sound technology and fixed sound sources can create a sound field with a strong sense of direction and distance. When expressing the theme of the battlefield, sounds can come from all directions: the sound of horses' hooves in the distance, the sound of arrows streaking through the air, the shouts of soldiers beside, together forming a realistic auditory battlefield. The combination of environmental sound effects with music and narration at specific narrative nodes can effectively guide the audience's emotions and strengthen the dramatic rhythm of the exhibition.

A deeper sense of immersion comes from the involvement of touch and even smell. Interactive devices such as touchable replica cultural relics and operating platforms simulating historical crafts allow the audience to establish a direct connection with history through touch. Somatosensory equipment can simulate the jolt of riding a carriage or the shaking of a ship's hull in a simulated navigation experience. In addition, the odor simulation system releases matching odors in specific scenes, which can instantly trigger the audience's associative memory and greatly enhance the realism of the environment.

3.2. Combination strategies of sensory immersion elements and historical exhibition space

3.2.1. Overall wrapping combination: creating a "time-space capsule"

Highly integrate panoramic projection, 3D sound field and environmental atmosphere control and apply them in a relatively closed exhibition hall space, making it a complete historical time-space capsule isolated from the outside world.

The space itself becomes a narrative canvas. Walls and floors are no longer static carriers, but dynamic historical scenes themselves. For example, in the dynamic scroll exhibition hall of "*Along the River During the Qingming Festival*", the walls of the entire circular exhibition hall are projected as the dynamic long scroll of *Along the River During the Qingming Festival* (Figure 3). The alternation of day and night, people's activities, carriages, boats and bridges in Bianjing City are all presented in a vivid way. Combined with the ambient sound of the bustling city and specific odors (such as the smell of wine shops and food stalls), the audience feels as if they are standing on the bank of the Bian River in the Northern Song Dynasty, realizing the transformation from viewing the painting to entering the painting.



Figure 3. Immersive space design

3.2.2. Spatial nested combination: building a "virtual-real overlapping realm"

Embed AR/MR, fixed sound sources, interactive projection and other technologies in the space with physical cultural relics and real architectural structures. Virtual information and real space overlap each other, forming a virtual-real integrated experience. The authenticity and historical value of the space itself are the foundation of the experience, and technology serves as an enhancement means to explain, restore and expand the connotation of the exhibition space (Figure 4). For example, the AR guide of the Old Summer Palace Ruins: tourists walk among the real ruins with AR devices, and the digitally restored former palaces and pavilions are superimposed on the device screen in real time. When they walk to specific locations, the fixed sound sources play historical sounds related to the functions of these places (such as court discussions, palace music and dance) [4]. The virtual splendor and the real vicissitudes coexist in the same space, producing a strong historical contrast and reflection.

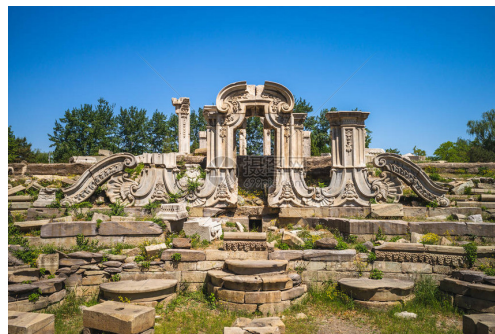


Figure 4. Historical site

3.2.3. Linear guided combination: constructing a "narrative journey"

Distribute different technical elements in a linear space according to the narrative clue. Guide the audience's emotional curve through the change of spatial rhythm combined with the switching of audio-visual content. The space itself is the narrative structure, and technology is a tool to strengthen the emotion of each chapter. For example, the "Long March" theme exhibition line of a revolutionary history memorial hall:

(1) The chapter of "Departure": Use projection to create the tense light and shadow of enemy aircraft bombing on the walls, combined with the sound of explosions and sirens in the surround sound.

(2) The chapter of "Trekking": Floor projection simulates the scenes of snow-capped mountains and grasslands, somatosensory equipment creates the effect of cold wind, and the space temperature drops.

(3) The chapter of "Joining Forces": Use magnificent panoramic projection to show the grand scene of the victorious joining of forces, the music turns into a stirring and majestic tone, and the light becomes bright and warm.

3.3. Combined presentation of sensory immersion elements and historical exhibition space

3.3.1. For the audience: the identity transformation from onlookers to participants

The combination of the two creates a highly credible historical scene. The audience no longer views history through glass display cabinets, but walks into history with their whole bodies. Their identity transforms from detached and passive information receivers to involved and active time-travelers. For example, in the overall wrapping-style Normandy Landings exhibition hall, the audience stands on a simulated landing craft, surrounded by the turbulent waves and a hail of bullets in the panoramic projection, with the deafening sound of artillery fire and soldiers' shouts in their ears, the simulated vibration under their feet, and even the faint smell of sea water and gunsmoke. At this moment, they are no longer students learning World War II history, but a soldier rushing to the beachhead at the risk of life that morning. This identity transformation brings an unparalleled emotional impact and deep memory.

3.3.2. For the exhibition space: the functional evolution from a static container to a dynamic field

The space itself transforms from a passive container carrying objects into a living entity that can breathe, change and interact with people. Walls can tell stories, floors can respond to footsteps, and the entire space becomes a flowing historical field with narrative ability. For example, in a spatial nested-style ancient tomb exhibition, the real tomb structure is a static container. However, when tourists hold AR devices and see the virtual murals come alive from the walls, interpreting the life stories of the tomb owners, and hear the ancient sacrificial prayers from the fixed audio, this silent space for thousands of years is instantly activated and becomes a vibrant dynamic field for cross-temporal dialogue with contemporary audiences.

3.3.3. For history itself: the value reshaping from a frozen past to a conversable present

This is the most profound effect. Combined immersive technologies eliminate the historical temporal distance, bringing the distant past closer to a perceptible present connected with the moment. It makes history accessible and thought-provoking, and stimulates the audience's historical reflection on real-world issues. For example, in an exhibition of ancient water conservancy projects, through interactive sand tables and somatosensory equipment, the audience can understand the wisdom of the ancients and experience the eternal topic of the relationship between humans and nature.

4. Design principles and strategies of immersive historical exhibitions

4.1. Core design principles

4.1.1. Authenticity as the foundation, experience as the essence

All immersive experiences must be based on rigorous historical research. The restoration of scenes, costumes, architecture, sounds and other elements must be evidence-based, and fictional interpretations and fabrication must be eliminated. The purpose of technology is to reveal the truth of history more profoundly, not to cover it up. Experience enables this truth to be more perceived and understood by modern audiences.

4.1.2. Narrative as the main line, technology as the auxiliary

Technology is a means, not an end. The core competitiveness of an exhibition is always a strong narrative ability. The choice of technology should depend on whether it can better serve the telling of historical stories, the display of characters' fates and the transmission of the spirit of the times. In the initial stage of planning, the core narrative and emotional goals should be clarified first, and then the most suitable and economical technical solutions should be selected accordingly to avoid using VR merely for the sake of VR.

4.1.3. Audience as the center, establishing emotional connection

The design should shift from the educator's perspective to the audience's perspective. Focus on the audience's emotional journey, guide the audience to transform from passive reception to active experience by creating empathy points (such as personal stories and fate choices) and the joy of exploration, and establish a personalized emotional connection with history.

4.1.4. Emphasizing holistic integration and a well-rhythmized experience

Immersive experience needs to pay attention to integrity. Visual, auditory, interactive and other elements should be harmonious and unified to jointly create a credible world. At the same time, the space needs to have a sense of breathing. After high-intensity immersive sessions, provide areas for quiet reflection (such as facing physical exhibits) to form a well-rhythmized visiting pace. Plan the alternate layout of immersive areas and quiet viewing areas to prevent sensory overload and aesthetic fatigue [5].

4.2. Specific design strategies

Treat the entire exhibition space as a grand narrative script, and control the audience's emotions through the design of spatial sequences:

(1) Beginning (Introduction): At the entrance area, use gradual lighting, guiding sound effects and simple preface installations to slowly lead the audience from the real world into the historical context.

(2) Development (Expansion): In the main exhibition area, comprehensively use panoramic projection, scene restoration and AR interaction to unfold the historical picture step by step, allowing the audience to go deeper gradually.

(3) Climax (Turning Point): In the core event exhibition area, concentrate on using the most impactful immersive technologies (such as large-scale CAVE spaces, multi-channel somatosensory devices) to create an emotional peak and form the core memory point of the exhibition.

(4) Conclusion (Reflection): At the end of the exhibition, design a relatively peaceful and open space to encourage the audience to meditate, dialogue with history, connect with reality and complete the sublimation of meaning.

This exhibition attaches great importance to the audience experience in particular. The equipped head-mounted devices are designed for comfort, the experience duration is controlled at about 30 minutes, and the experience images are clear with high quality, bringing the audience a strong sense of immersion and visual impact. This 30-minute duration setting is also highly consistent with the mainstream market trend. In the first half of 2025, 74% of new projects will control the duration at about 30 minutes to effectively alleviate the audience's dizziness and fatigue. The exhibition takes "a day and a night" as the time line, the entire experience is driven by stories, and interactive links are set up with interaction as guidance. It focuses on the storytelling and interactivity of the exhibition, allowing the audience to experience the "World of the Ming Dynasty" in the *Kunyu Wanguo Quantu (The Universal Map of the Myriad Countries)* from a first-person perspective. For example, in the third scene of the exhibition, the audience will "board a ship and set sail", sailing far and wide on the "Zheng He Treasure Ship" restored and rebuilt according to the records in the *Huangming Jilue (A Brief Account of the Ming Dynasty)* of the Ming Dynasty. The ships and whales are endowed with vitality in the VR environment, and the audience can operate props such as the star pointer, the celestial scale and the water compass with a raise of the hand, dominate the changes of the images and realize motion interaction [6].

5. Conclusion and prospect

5.1. Research conclusions

First of all, the application of immersive design in historical exhibitions is an improvement of audience experience-centered spatial narrative and a systematic design method. It transforms static historical information into dynamic experience and narrows the distance between history and the contemporary era.

Secondly, the application of immersive design has multi-directional approaches. This paper summarizes them into technology-driven sensory immersion, narrative-guided emotional immersion and interactive media-based cognitive immersion. The three are interdependent and progressive, providing possibilities for the innovative design of historical exhibitions.

Finally, a successful immersive historical exhibition must follow the principle of striking a balance between historical authenticity and artistic experience. On this basis, it applies the strategies of spatial narrative, technology integration and interactive design, and plans the application of technology in the space to realize the sublimation from information dissemination to personal experience.

5.2. Future prospects

The development of technologies such as artificial intelligence will drive immersive exhibitions to move from preset programs to intelligent response. The system can perceive the audience's emotions and interests in real time, dynamically adjust the content difficulty and realize personalized exhibition viewing. Brain-computer interface technology may enable us to observe the impact of historical scenarios on the audience's brain activities, providing a scientific basis for experience design.

In the future, immersive historical exhibitions will no longer make the audience passively immerse themselves, but will encourage the audience to think critically, dialogue with history in various ways and build a reflective and diverse cultural space by designing open endings and controversial historical material topics.

In short, immersive design has endowed historical exhibitions with new vitality, but the core driving force for its future development is humanistic care and the spirit of history, not technology itself. Only by adhering to history as the guide and people as the foundation can technology illuminate history and realize an in-depth dialogue between the past and the present. This paper studies and discusses the application of immersive design in the spatial design of historical theme exhibitions, hoping to play a guiding role in future design.

The conclusion should elaborate on the key points of the research results, analyze the conclusions drawn from the results, and explain their significance for future research or practice. All sections such as patents, appendices, funding projects, and acknowledgments should be placed after the conclusion and before the references.

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