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Evolving Narrative Forms in Digital-Age Museum Spaces: From Static Displays to Interactive Experiences

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Abstract

With the continuous advancement of digital technology, museum exhibition spaces are undergoing a fundamental transformation, from traditional static displays to interactive, visitor-centred environments. This evolution introduces cross-media storytelling, where emotional engagement, sensory immersion, and user interaction are central to the visitor experience. Modern museums aim to deliver more than visual presentation by facilitating multisensory, participatory encounters with cultural and historical content. This paper presents a conceptual exploration of spatial narrative strategies in the digital age, outlining three narrative typologies: natural, scene-based, and interactive. It highlights how emerging technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) are influencing exhibition design, enhancing user participation, and enabling personalised engagement. By examining selected practices from leading institutions and synthesising insights from narratology and architectural theory, the study contributes to a deeper understanding of spatial storytelling in contemporary museum design. The findings aim to support innovative, user-focused approaches in future cultural exhibition spaces.

Keywords Digital age; Museum; Narrative form; Spatial narrative

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Introduction

In the digital age, art exhibition spaces are increasingly characterised by digitisation and cross-media integration. Traditional exhibition spaces are often limited to static displays; therefore, as museums overcome the limitations of physical space and traditional media through digital technologies to create a more interactive and participatory display environment (Winesmith & Anderson, 2020). The modern museum exhibition gradually gets rid of the single narrative mode, and integrates various narrative means such as literature narrative, drama narrative, video narrative and music narrative. The combination of multiple narrative modes enables the exhibition to have more dimensional expressions, which can convey more rich and diverse cultural and artistic information to the audience, and continually enhance the visitor experience (Guo,K., Fan, A., Lehto, X., 2023). Currently, digital transformation in museums focuses on three main aspects: (1) the digitisation of collections to preserve cultural heritage; (2) the digitisation of information management for efficient handling of exhibit data; and (3) digital display using virtual technologies to enable remote or online access. so that precious cultural heritage and works of art can be permanently preserved; The second is the digitization of information management to process and manage exhibit information in a more efficient way; Finally, the digital display of the exhibits, through virtual technology to enable the audience to visit the exhibition online or remotely, breaking through the limitations of physical space. Studying and paying attention to the evolution trend of museum narrative mode can aid in understanding and forecasting future directions in museum spatial design and provide new ideas and methods for art display innovation in the digital age.

Narratology in Architecture

Narratology is the study of narrative structures, techniques, and theories that primarily explores how humans construct narratives using language, imagery, sound, and other expressive forms, and how these narratives affect the comprehension and emotional responses of the listener or reader (ZoranG, 1984). Spatial narrative theory is a branch of narratology, which mainly studies the function, meaning and expression of space in narrative (Whitten M, 2022). This theory focuses on how to use space to construct narrative, influence narrative structure, and give narrative profound meaning. The integration of narratology and architecture represents an innovative interdisciplinary domain that aims to introduce narrative strategies into architectural design in order to create built environments with profound spatial experiences and cultural significance. Pioneering work by Bernard Tschumi and Nigel Coates in the 1980s explored how narrative strategies could transform spatial experiences into 'event discourses' by studying how narrative strategies can be used to transform spatial experiences into "event discourses" for architectural and urban spaces (Chen H.& Yang L, 2023). Their formation of the NATO (Narrative Architecture Today) group further advanced the integration of narratology and architecture, exploring

how architecture can tell stories and express themes through spatial design. Sophia Psarra's 2009 work, *Architecture and Narrative: The Construction of Spatial and Cultural Meaning*, expanded the discourse by analysing narrative-driven architectural case studies, which further expanded this field, studying architectural cases with narrative characteristics and illustrating how architecture constructs spatial and cultural meaning through narrative. This book marks a new stage in the application of narrative research in architectural design and provides a new research paradigm for architectural design (Shin J, 2021). In Western theory architectural narrative is seen as a mode of cognitive structure that organizes spatial text and cultural meaning and promotes aesthetic perception. Advances in digital technology have introduced cross-media narratives, evolving toward interactive forms that prioritise user engagement and gradually evolved into an interactive narrative mode emphasizing interaction. This model is a new trend in architectural design by combining virtual reality, augmented reality and other technologies to create a more immersive and interactive experience. This shows that modern architectural design is not only concerned with the physical form of the space, but also how to enhance the audience's sense of participation and depth of experience through narrative and interaction. In museum architecture, narratology primarily enhances user experience through spatial storytelling. It concerns itself with translating abstract spatial concepts into perceptible and engaging narrative experiences, so as to make the exhibition content more attractive and educational. By combining elements such as time, space, users, designers and scenes, narratology helps to effectively integrate spatial concepts into exhibition design and can adopt linear or non-linear narrative ways to enhance the user's sense of participation and depth of experience. From a narrative perspective, spatial storytelling serves as a multi-modal process of communication, involving the integration of multiple media forms. The different forms of media and their blending affect the way and effect of information transmission, forming a multidimensional expression space. This cross-media expression can redefine the architectural space of a gallery or museum, creating novel art forms such as interactive installations and immersive virtual Spaces. These new forms not only heighten experiential immersion but can even override the original architecture to create reimagined media environments. to achieve a reimagined media space. Therefore, modern museum design needs to integrate digital art, narrative art, and media technologies to create a personalized, interactive display experience.

Historical Evolution of Museum Spatial Narrative

Having outlined how narratology enriches architectural design, the following section traces the evolution of narrative forms in museums, charting their development from static exhibits to fully interactive environments. The historical development of museums reflects a significant transformation in exhibition design, spatial function, and visitor roles in exhibition design, spatial function and the role of the visitor (Ruff, Stelmach, & Jones, 2022). Beginning with the basic categorisation of

exhibits, museums have transitioned to elaborate narrative-driven displays, the exhibition design has gradually developed into a narration-oriented elaborate design, and now it pays more attention to the personalized experience and free exploration of visitors, constantly strengthening the experience of visitors. The space function has gradually transformed from the traditional display and storage of objects to a public place integrating multiple functions, repositioning the museum as a multi-functional platform for cultural display, social engagement, and public education. for public interaction, socializing and education. With the change of narrative methods, the visitor's role has shifted from passive observer to active participant, with many exhibitions now fostering co-creation and interactivity in the exhibition, and even becoming a part of the creation and narrative, which greatly enhances their sense of presence and situational experience. This transformation is underpinned by a user-centred design philosophy, through the use of digital technology and high-tech means, museums are able to provide visitors with a richer and more personalized interactive experience, so that they can establish a deeper emotional connection with the exhibition. As technological innovations continue, museum design is expected to become increasingly dynamic, flexible, and participatory, the design of museum space will be more diversified and flexible, and the interaction and participation will continue to deepen, promoting the museum to become a more open and dynamic cultural platform (De Fina, 2021).

Early Stage: Static Narrative

In its early form, the museum primarily exhibited cultural relics. These artefacts were typically categorised by period, type, or theme and displayed in a static, non-interactive format. General historical exhibitions followed a linear timeline, with simple layouts involving glass cabinets and minimal design enhancements. The form of presentation is a combination of intuitive education and information dissemination, presenting specific themes and art forms through artifacts and supporting exhibits. In the relationship between space, exhibits and visitors, the space functioned as a backdrop, with the exhibits as focal points and visitors moving through predetermined routes. The narrative is simple, and basic ambient elements, such as audio narration or background music, were sometimes used to enhance the environment. The space and media are independent, the display content is fixed, and the visiting method is relatively simple. With the development of digital technology, the narrative forms of museums are more diverse and innovative. Artists use video, animation, virtual reality and other means to build a rich narrative space. The audience participates in the narration through interactive devices and touch screens, which enhances the sense of participation and interactivity. Modern museums have moved beyond linear narratives, offering open-ended and diversified experiences enabled by digital media.

Middle Stage: Situational Narrative

As society evolved, museums expanded beyond traditional formats to include disciplines such as art, science, nature, and technology. and museums have expanded from the traditional single type to cover history, art, science and technology, nature and other fields. The early stage of the show can no longer meet the modern audience's growing demand for experience. Museums began drawing from theatrical design by constructing immersive backdrops and narrative scenes around the exhibits to integrate exhibits into a contextualized display space. This technique enhanced visual impact while providing contextual understanding of the artefacts' historical or cultural backgrounds. The historical, cultural or story background of the exhibits. The museum space is no longer a single exhibition area but has evolved into a multifaceted space supporting both display and interaction. Through innovative design concepts and sets, the museum's spatial forms are enriched and diversified, which can flexibly adapt to different exhibition needs while enhancing the visitor experience. Audio, video, and virtual reality technologies have become integral to enriching the sensory and narrative depth of exhibitions. to introduce audiences to a more immersive art experience. This all-round sensory experience not only deepens the audience's understanding of the exhibits but also allows artists and curators to have a broader creative space. Recent advancements in artificial intelligence (AI) and augmented reality (AR) have further enhanced exhibition interactivity and personalisation. They have also begun to be applied to museum exhibitions and interactive links, further enriching the form and content of exhibitions. For example, through AI systems, viewers can interact with virtual artists to co-create personalised artworks. Similarly, AR technologies integrate virtual content into real-world displays in real scenes to bring audiences an immersive art experience. In addition, museums began to focus on social engagement and educational functions. Art lectures, workshops, artist residency programs and other activities have attracted more community residents and students to participate in them, promoting the interaction and integration of art and society.

Scenario Restoration or Simulation

Designing separate exhibition areas that simulate full narrative environments is an effective and creative strategy. Through scene simulation or scene restoration, designers can combine exhibits with specific historical events, cultural backgrounds or storylines to create a more immersive experience for the audience. This method considers multiple dimensions of the original event, including its time period, participants, setting, and sequence of activities and places. Through careful layout and design, exhibition spaces can become a true extension of time and space, immersing visitors in reimagined moments of historical or cultural significance. For example, when the existing museums display historical events, they help the audience better understand the historical background and situation by restoring the time and environment of the events. Rather than offering a mere factual account, these recreations offer vivid and emotionally resonant representations of historical events

through emotional and visual means, so that the audience feels as if they are in it. Designers utilise a range of elements—including lighting, props, soundscapes, and spatial configuration—to construct a compelling atmosphere. Including sets, props, lighting and sound effects. Sets and props help create visual authenticity, lighting modulates the atmosphere of the environment, while sound effects provide auditory support, making the exhibition a more multi-sensory immersion experience. The organic combination of these elements makes the exhibition not only display objects but also bring the audience into the story situation through multiple senses. By taking the audience into a specific time and environment, the designers create an immersive exhibition experience. The audience is no longer just a spectator but is actively guided into a dynamic situation to experience the exhibition content. This immersion enhances the emotional resonance of visitors and allows them to understand the theme of the exhibition more deeply in the context.

Theme Exhibition Hall

Themed exhibition halls, such as those focusing on traditional Chinese painting and calligraphy, centre their design around specific cultural narratives, which is an innovative way in the field of cultural exhibitions. In this exhibition hall, the exhibits are closely displayed around the theme, divided into exhibition areas according to different periods, art categories and types, and through the corresponding scene construction, so that visitors have a deeper understanding of the historical background, the development of traditional Chinese calligraphy and painting and style schools. Each section is crafted to reflect the distinct aesthetic values and historical context of its respective time period or artistic style. or art category. For example, by simulating the study environments of literati during the Song Dynasty, their calligraphy works and literary creations can be displayed, allowing the audience to feel the cultural atmosphere and aesthetic taste of literati in the Song period. Or through the simulation of the scenes of imperial painting academies of the Ming and Qing Dynasties, the works and painting techniques of the court painters are displayed, so that the audience can understand the unique style and aesthetic taste of the court painting school. Such immersive scene simulations prove more impactful than static textual or visual descriptions alone. By creating realistic scenes, the audience can feel the cultural connotation and artistic spirit behind traditional paintings and calligraphy more immersive. At the same time, incorporating multimedia tools and interactive components further deepens audience engagement and educational value. the audience's sense of participation and learning experience, so that the audience can have a deeper understanding and appreciation of traditional painting and calligraphy.

Later: User Experience-Centric

As science and technology advance, media are playing an increasingly central role in museums. Media are no longer merely supportive or display tools but are now focused on enhancing visitor experience.

The museum industry is undergoing a user-centred transformation. This shift seeks to improve the overall visitor journey by offering more interactive and engaging experiences. The new museum design not only focuses on the exhibits themselves but also considers how visitors can engage more deeply with the exhibits to encourage empathy and consensus-building. For instance, the Science Museum in London utilises sensor-based technology to create interactive displays where visitors can explore scientific principles by touching a screen or using gesture controls. In *Digital Art*, Paul argues that interaction in digital media now extends beyond basic point-and-click interfaces to view works, but is more participatory, allowing the viewer to interact or create in a specific environment. Narrative is no longer a one-way transmission of information nor a pursuit of singular conclusions, but an open discussion process that encourages users to participate in the creation. Information is conveyed through experience and perception, allowing users to become fully immersed. The exhibits and spaces are no longer separate, but merge together to create a comfortable experience. Consequently, traditional layout types, such as radial, hall-based, or linear configurations, may no longer suit the needs of experience-driven museums. to the modern museum with user experience as the core. Contemporary museums must embed user experience principles into their spatial design to foster a genuine sense of place and engagement, avoid user visit fatigue, and provide a personalized and private experience. In this new design mode, museum Spaces and exhibits are no longer simply displayed, but are integrated with each other to create a comfortable viewing experience, and the media is invisibly integrated into it. Therefore, modern museum design should go beyond traditional methods and focus on how to enhance the overall experience of users through the integration of space and exhibits.

Narrative Types of Museum Space Based on User Experience

Natural Narrative Form

Natural transmedia narratives typically adopt a third-person perspective and presents information through static flat pictures (such as text and images). This mode emphasises temporal and spatial logic, typically featuring linear time progression within a fixed spatial context. Showing the characteristics of linear time and single space, that is, the information unfolds in time order and is concentrated in a fixed spatial area. This kind of narrative is relatively common in the early exhibition hall design, because it is simple and direct. Information is presented via static visual elements, which users process primarily through auditory and visual channels, which belongs to the primary cognitive mode. While intuitive, this model offers limited interactivity and dynamic content, relying heavily on the designer's layout and composition to communicate content effectively.

Scenario-Based Narrative Form

Scene-based transmedia narratives often employ a first-person perspective to create a rich narrative experience by blending static imagery with animated and dynamic media elements. Through

comprehensive consideration of time, space and media, this narrative form uses techniques like visual collage and spatial layering to portray complex narrative sequences and varied storytelling forms, such as parallel narrative and master-slave interweaving. In this narrative process, users shift from passive receivers to active participants, engaging in a more advanced and responsive narrative experience of audio-visual narration. With advancements in digital technologies, particularly 3D virtual environments, scene-based narration has entered a new era of immersion of immersive experience. Users are now able to navigate freely within three-dimensional virtual environments, which enhances the dynamic and realistic sense of narrative. Immersive experiences allow users to feel a higher level of engagement, making them feel as if they are actually in a virtual world, thus increasing the depth and interactivity of the narrative. For instance, the Los Angeles County Museum of Art (LACMA) employs VR headsets in selected exhibitions, allowing visitors to explore the details and context of the artwork in virtual reality. These VR features encompass virtual reconstructions of artworks, demonstrations of artistic processes, and interactive art education activities. This application enriches the narrative form of the museum.

Interactive Narrative Form

Interactive narrative space refers to environments that respond dynamically to user input, enabling varied and personalised storytelling experiences. The concept of Interactive Narrative Space, as theorised by game designer Chris Crawford, focuses on how narrative experiences can be achieved through interactivity. The concept was proposed to explore storytelling in video games and other interactive mediums, emphasising interaction as a core driver of narrative progression. He emphasized that interactive storytelling should enable the user to actively shape the story's direction and content, thereby creating a virtual art space. In this narrative form, the user plays a role in the story by interacting with the system, driving the development of the story plot, and thus providing a high-level narrative experience. Interactive narrative is user-centred and focuses on user participation and interaction. This form is different from the traditional linear narrative, but in which user choices and behaviours directly influence narrative outcomes, so that each user can get a unique narrative experience. On the support technology of artificial intelligence, the system can adjust the story plot and display content in real time according to the user's behaviour and choice, making the narrative more flexible and dynamic. The interactive narration of digital exhibition space reflects the development trend of future exhibition space. A growing number of museums and cultural institutions are adopting this innovative approach to display, creating immersive environments for visitors through virtual reality, augmented reality, voice recognition and other technologies. This interactive narrative not only increases the audience's sense of participation and experience but also injects more creative and interactive elements into the display space, enabling visitors to have a deeper understanding of the display content and enhances the attraction and influence of the exhibition.

Initial Stage: "Interface" of Human-Computer Interaction

In the initial stage of human-computer interaction, the design of the interactive interface usually focuses on the basic technical implementation and user experience. Mobile applications serve as early interfaces for accessing virtual spaces and enable users to operate and experience in a digital environment. These applications use mobile terminals as the carrier, although they can simulate the on-site experience and participation of physical space, but though they are constrained by limited interaction depth and usability issues. At this stage, the user needs to actively input instructions, and the system receives and processes these inputs through the terminal, and finally the computer system provides feedback information. While user experience considerations are present, the interface design often remains unintuitive, the design of the operating interface is still not user-friendly, and the feedback mode is limited, so the interactive experience cannot be fully realized. In museum display spaces, many interactive systems take the form of digital installations that are actually products controlled by computer programs. Within the preset limits, these installations are able to interact with the user and at the same time, through aesthetic or artistic treatment, become part of the interactive experience. The Science Museum in London, for example, is using 3D glasses to allow visitors to experience virtual reality Space adventures in its exhibition "Exploring Space", showing various objects and probes in the universe through stereoscopic images. This approach, while providing a more immersive experience than traditional mobile apps, is still a nascent form of interaction.

Advanced Stage: "Extension" of the Body

With the advancement of technology, human-computer interaction has entered an advanced stage. The key to this stage is the development of intelligent technology, so that interaction is no longer solely dependent on traditional operating interfaces. Affective computing plays a central role in this phase, which involves the collection of data such as facial expression, human posture, voice tone or physiological indicators to judge the user's emotional state and respond accordingly. Such intelligent systems have already been trialled in museums to foster affective engagement between exhibits and visitors, which greatly promotes the emotional interaction between people and space. Through these technologies, museums are able to provide a more personal and emotional exhibition experience, allowing visitors to create a deeper connection with their exhibits. Future trends suggest that AI technology will further drive innovation in interactive experiences. Artificial intelligence systems will be able to actively recognize human behaviour in a natural state and provide appropriate feedback, thus weakening or even eliminating traditional human-machine operating interfaces. This development trend heralds the arrival of an interactive model that integrates intelligence and symbiosis. In this new model, physical interface devices may eventually disappear, replaced by seamless, embedded systems responsive to users' emotional and behavioural cues, and people will

access interactive services in a more natural way. This approach will make the interaction process more seamless and natural, reflecting the core characteristics of future interaction models. For example, when visitors enter a specific area, sensing devices can be automatically activated to understand the needs and interests of tourists through voice recognition, emotional computing and other technologies, and then provide personalized display and interpretation services based on this information. There is no need for the user to perform complicated operations. This intelligent way of experiencing is not limited to the field of museums or homes but integrates intelligent interaction into the network of the entire society or city, becoming an invisible system engineering. This state of intelligent symbiosis will provide people with a more convenient, personalised and comfortable life experience, and also lay the foundation for the development of smart cities and smart societies.

Application of Comprehensive Form

Contemporary museum spaces often employ a variety of narrative approaches to meet the needs and interests of different target users. These include traditional exhibitions, digital displays, and interactive narrative systems. Interactive narrative is a major feature of a digital museum, which is mainly realised through a human-computer interaction system. These systems are usually intelligent, networked and personalized. Intelligent systems can analyse user behaviour and preferences in real time to deliver personalised experiences to provide personalized content and interactive experiences. The characteristic of a network is that the system can connect multiple platforms and resources to achieve seamless sharing and transmission of information. The personalized model allows each visitor to choose a different interaction path according to their own interests and needs, thus obtaining a tailored visit experience. For example, the Metropolitan Museum of Art (New York) demonstrates this approach through layered narrative strategies in its exhibitions. Each work of art is presented not only through its visual beauty, but also with a detailed explanation of its historical background, artistic style and creative process. For example, a museum may provide detailed information about the artist's life, motivation for creation, materials and techniques used, and so on. This multi-angle narrative helps visitors understand and appreciate the works of art from different levels. Exhibitions often include an interpretation of the cultural and historical context of the work of art, so that visitors can better understand the social, historical and cultural environment reflected in the work. This contextual detail deepens the viewer’s appreciation and expands the educational value of the exhibition, but also provides visitors with richer cultural content. The Metropolitan Museum of Art uses virtual exhibition technology to enable visitors from around the world to access its exhibitions online. Through the virtual exhibition platform, visitors can explore the museum's valuable collections in depth through high-resolution digital images and detailed descriptions at home or anywhere. This digital experience breaks down geographical constraints and makes museum exhibits accessible to more people. The museum also uses augmented reality (AR) technology, which allows visitors to superimpose virtual

information on the actual exhibition space via mobile devices or dedicated glasses. Visitors can see three-dimensional views of the artwork, interactive infographics, and even "see" the creation process or historical context of the artwork through AR technology. The Metropolitan Museum of Art offers dedicated mobile apps that not only provide a guided tour of the exhibition but also allow visitors to select different exhibition content based on their personal interests. Through the app, visitors can access detailed artwork information, audio guides, interactive maps and more. The app also provides a personalized recommendation function to recommend relevant exhibits and exhibitions based on visitors' browsing history and interests. Visitors can also customize the experience by creating their own exhibition route using the mobile app, selecting exhibition areas and artworks of interest to them, and creating a personalized visit plan. This custom experience enables visitors to better control and optimize their visit to the museum, ensuring that they can focus on what interests them most. Through these integrated narrative and digital means, the Metropolitan Museum of Art not only enhances the display of artworks but also provides a richer and more personalized visiting experience. This approach not only elevates the educational function of the museum but also makes the appreciation and learning process of the artwork more interactive and immersive.

Conclusion

The advancement of smart technologies is reshaping how museums design and deliver spatial narratives. Modern exhibition Spaces are no longer limited to traditional static exhibits and fixed display forms but are transformed into intelligent scenes that integrate digital technology and human experience. Advances in interactive technology allow visitors to explore the exhibition space more freely, no longer restricted by fixed routes and time. Visitors can now engage with exhibits through smart interfaces, VR, and other immersive platforms, experience multidimensional virtual scenes, and can conduct personalized visits. Experience according to individual interests and needs. This characteristic of autonomous participation and personalized interaction makes the museum a dynamic and creative node of a social network that facilitates dialogue and exchange between people. In the digital exhibition intelligent environment, the application of the Internet of Things, cloud computing, and big data technology provides more possibilities for museums. The exhibition space is no longer limited by physical space, but can create colourful, dynamic and real scenes, allowing visitors to feel as if they are in the river of history or the virtual future. Intelligent scene designers, narrative media and users form a new mode of interaction to create meaning and value together, creating an integrated, systematic intelligent environment. The museum is not just a physical building, but a smart museum ecosystem that integrates multiple smart technologies and resources to create a richer, more interactive and educational museum experience for visitors, while also driving the digital transformation of the museum industry. However, the integration of digital innovation presents challenges related to sustainability, accessibility, and curatorial balance, such as the time and resources

required to create engaging interactive content. In order to maintain the interest of the audience, the museum needs to constantly update this content, which can pose sustainability issues in the long run. Without regular content updates, the novelty and relevance of interactive experiences may diminish and affect audience engagement. When designing interactive technology, museums need to ensure a balance between technology and narrative content. If the technology is too complex or interferes with the exhibits themselves, it can cause viewers to be distracted from the story and message the museum is trying to convey. A simple and intuitive user interface is a key consideration in the design. The museum's audience is diverse, including people of different ages, cultural backgrounds and technical proficiency levels. Designing accessible and inclusive interactive experiences for all groups is a challenge. Part of the audience may not be familiar with or interested in technology, so museums need to provide alternative ways of non-technical interaction. While interactive technology can enhance the experience, some viewers still prefer more traditional ways of viewing, such as static displays and thinking for themselves. Museums must strike a careful balance between technological integration and the preservation of their core curatorial values, without allowing technology to overwhelm the core values of their exhibits. In facing these challenges, museums often need to balance innovation with feasibility, ensuring that they can deliver advanced interactive experiences while still meeting the needs of a broad audience and maintaining the core values of their exhibits. In the future, the spatial narrative form of museums needs to consider and balance many challenges, find innovative ways to enhance visitor experience, and let museums play an increasingly important role as an important platform and carrier for social development and cultural exchange.

Limitations and Future Research

This study offers a conceptual synthesis rather than an empirical analysis. No fieldwork or usability studies were conducted, which limits the generalisability of its claims. Additionally, the technological case references are illustrative rather than evaluative. Future research could include user testing of different narrative forms, comparative studies across institutions, or longitudinal analysis of engagement metrics in digital versus hybrid exhibitions. Empirical evidence would strengthen the framework and contribute to guidelines for narrative-driven exhibition design in diverse cultural contexts.

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