Research on the design strategy of natural museum exhibition space based on spatial narrative theory

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Abstract: This study introduces the theory of spatial narrative to explore its application in improving the problem of homogenization of museum display. The research combines non-linear narrative and multimedia technology to enhance the interest and interactivity of the display, and enhance the emotional resonance and participation of the audience. By analyzing the existing problems in the museum, this paper shows the design technique of space narrative theory and its application effect in the museum of China. The study also examined the practical use of virtual reality techniques in the London Museum of Natural History, proving that these techniques can optimize access paths and enhance the educational experience. Therefore, the application of spatial narrative theory can significantly improve the display effect and make the natural museum a more attractive place for learning.

1. Introduction

In the 21st century, with the strong support of the Chinese government, natural science museums around the country were rapidly built and expanded to meet the needs of economic development and cultural construction. However, the content and display forms of traditional nature exhibits tend to be homogenized, which affects the attraction of the exhibits and the enthusiasm of the audience. With the development of computer and science and technology, the traditional display mode and scene creation have been difficult to meet the growing spiritual demand for nature museums. The spatial narrative theory emphasizes the participation and experience of the display space, stimulates the emotional resonance of the audience by creating situations, scenes and atmosphere, and improves the participation and acceptance of the audience. This theory provides a new idea for the space design of the Nature Museum, and helps the designers to better construct and organize the space language, which makes the space more narrative and experiential. How to apply the space narrative theory to the design of the exhibition space of the natural science museum is a problem worthy of further discussion by the designers.

2. The current state of the display space in the Nature Museum

The design of display space in traditional natural museums is often limited by the architectural layout and traditional ideas, which mainly adopts the linear narrative based on evolution and

encyclopedia-like display methods. This way takes the physical exhibits as the core. Although it attaches importance to the value of science education, it ignores the interaction with the audience. According to Walter Benjamin's halo theory, exhibits in traditional museums are often regarded as objects of lofty values, making the display space a place for the dissemination of authoritative knowledge. The audience passively receive information, and the lack of effective interaction between the exhibits and the audience, making the display space appear static and isolated.

This one-way and solidified narrative mode is difficult to stimulate the audience's interest in exploration and learning enthusiasm. The lack of interactive and participation opportunities in the display mode makes it difficult for the audience to have emotional resonance with the exhibition content or achieve a deep understanding. The exhibition content of traditional nature museums is usually expanded along a fixed theme axis and story axis, organized by linear time series or classification system, restricting the audience to explore according to the non-preset path, and inhibiting the more free experience and personalized learning path.

With the progress of science and technology and the diversification of audience needs, the traditional display method gradually exposes its limitations. Contemporary audiences seek more interactive and multisensory participatory experiences, expecting to gain knowledge and inspiration through participatory and experiential displays. However, many traditional natural science museums have not yet been designed to fully use virtual reality and other new media technologies to enhance the attractiveness and interactivity of exhibitions. This uniformity of information transmission is not enough to meet the complex needs of different audience groups.

3. Three Space narrative

3.1 The origin and development of narrative theory

Narrative theory originated from the literary field, emphasizing the relationship between the expression, content structure, form and meaning of the text, and was introduced into several art fields, [1-2]. Classical works such as Bakhtin's "dialogue theory" and Gernet's "narrative discourse" theory laid the foundation of the field. In the narrative design of architecture and space environment, the narrative structure is combined with the spatial structure to form the spatial order [3] of internal logic and meaning. Exexpresses [4] through narrative thread, clues, spatial behavior patterns and cultural symbols, emphasizes that the media conveys the thoughts of the narrator, connects time and space, and creates an architectural space [5] of immersion and resonance.

3.2 The connection between spatial narrative science and museum design

Space narrative science is closely related to the design method and practice of museum exhibition space. First, the spatial narratology explores the way of telling the story and the organization form of the narrative space. The spatial design principle of the museum is related to the narratology, which promotes the narrative development through the spatial display, and endows the museum space with rich cultural connotation and educational significance. Space narrative science provides the theoretical basis and design principles for the design of museum exhibition space. For example, the flashback technique creates suspense through plot development, the interlude technique introduces different symbols into the space to enrich the structure, and the interlback technique adds new content in the lack of content expression, so as to make the narrative more complete. The exhibition space design of the museum draws on the concepts and principles from the spatial narrative science, and creates a more vivid exhibition atmosphere through the narrative logic and the space organization strategy.

4. Application strategies and challenges of spatial narrative in natural museum

4.1 Application of spatial narrative in nature museums

In architecture, spatial narratives construct meaningful spatial sequence by configdifferent spatial forms and streamlines. In the Museum of Natural History, the architectural space, as the physical basis of the display, transforms the narrative content into spatial elements, effectively arranges the exhibition space, forms a narrative structure that can inspire the audience, and shows the logic and development of the story. The design of the display space subdivides the complex themes into multiple sub-themes, planning the priorities and rhythm of the space through clear narrative content, temporal order, and plot development. By carefully arranging various sizes and open Spaces, and adopting nonlinear narrative strategies, the designers promote the development of the story through spatial layout and visual orientation, enhance the narrative effect of the exhibition, reveal the deep value of the exhibits, so as to improve the overall narrative quality.

Shanghai museum of natural science with "nature, harmony" as the theme, with "evolution" as the main line, from the "process", "phenomenon", "mechanism" and "the" culture ", with" evolution "," picture "and" epic "civilization" three plates has ten permanent theme exhibition, the introduction of novel space layout. The museum has five floors, and many Spaces are designed as wrong floors. In the "Ecological Vientiane" section on the B2 floor, visitors can directly see the African forest downstairs, forming a visual logical connection.

By simulating three scenes: "ocean", "land" and "sky", the museum enables the audience to experience a multi-dimensional natural environment in a large-scale space.People innovatively set different paths in the same space to realize multiple narratives and provide different spatial experiences.

The architectural design is based on the shape of the nautilus, and multiple flow paths are launched in parallel to interact with the buildings and landscape in the central courtyard, so that the audience can realize the line of sight communication during the visit. This design makes the visiting route more flexible, and the audience becomes a part of the display of each other, and each visiting channel brings a different viewing effect.

The Shanghai Museum of Natural History adopts the hypertext spatial narrative, which subdivides countless knowledge points into nodes to form multiple Spaces or exhibition halls. The large exhibition hall and the exhibition hall are connected through the hierarchical layout, the long corridor and the upper and lower channels, making the audience immersed in each theme. In large biology halls, designers use ramps that allow visitors to quickly reach different locations. In the space showroom, the circular corridor and opening design enhance the hypertext experience. In wildlife exhibitions, nested spatial structures allow visitors to quickly reach different sections. These layouts try to enlighten the domestic application of hypertext spatial narrative.

Compared with the traditional linear or modular nonlinear spatial narrative, Shanghai Museum of Natural History creates more channels and doors through the staggered layer and multi-layer space, promotes visitors to "jump" and "transmit" between nodes, and enhances the level of spatial narrative. The transparent visual connection guides visitors to make visit plans, links the visit content to the distant exhibition hall, and promotes the formation of hypertext thinking. For example, the "Evolution" section of floor B1 connects different exhibition halls through gentle slope, connecting logical prompts with related contents in the middle, which enhances visitors' hypertext thinking.

4.2 The combination of new technology and spatial narrative

Display designs in natural museums tend to focus on the display of specimens. However, this traditional display method often fails to meet the needs of modern audiences because of the lack of dynamic interpretation of a single specimen display, which makes it difficult for the audience to

quickly understand the scientific principles and related stories behind the exhibits. As the direct participant and experiencer of the display space, the viewer plays a key role in the narrative plot and process. Through different perceptual systems (such as vision and hearing), they feel the narrative plot and content in the space, forming a unique visiting feeling and emotional resonance. Vision is the most intuitive way of perception, where the viewer observes the spatial interface, exhibits and text information. Hearing conveys the narrative content through audio information. With the progress of science and technology, the ways of information reception have become diversified, no longer limited to a single sense, but through the combination of vision, hearing and touch, to improve the viewing experience.

Therefore, the multimedia display mode is becoming more and more popular, which not only enhances the display effect, but also improves the experience of spatial narrative. The following takes Chongqing Museum of Natural History as an example to analyze the combination of its technology and spatial narrative. The new Chongqing Museum of Natural History was built in 2015. It is a comprehensive natural science museum with six permanent exhibition halls: Beilin Hall, Chongqing Hall, Dinosaur Hall, Earth Hall, Evolution Hall and Environment Hall.

In the museum's Beilin Hall, the Wild African continent exhibition area shows the environment by restoring the natural landscape of Africa, and although the scene is realistic, the transmission of information is still limited. To improve the narrative effect, an electronic operation screen is installed in the exhibition hall. Through this interactive device, the audience can touch the screen to obtain detailed information about the specimens, such as the living environment and the growth process, transforming the traditional exhibition from passive acceptance to active exploration, and enhancing the interactive and educational value of the exhibits. In the dinosaur hall, three-dimensional projection technology is used to intuitively display its bone and muscle structure on the dinosaur model. This multimedia application not only improves the visual effect of the display, but also greatly enhances the audience's sense of participation and the efficiency of information acquisition.

In the rainforest section of Kenneth Berlin Hall, the museum combines scene restoration and multimedia technology to create an immersive experience through semi-isolated zones of stake and rope structures, patchwork wooden ground, and animal models hidden in the woods, and the sound effects of the rainforest. This design enables the audience to feel the real and dynamic changes of the natural environment, and enhances the immersion of the spatial narrative.

In addition, in the African continent and desert plate, the museum uses rockery and trees to restore the living environment of animals, combined with background paintings, and set up "telescope" interactive exhibition items to obtain the information of distant animal specimens through mobile lens, enhancing the interactivity and narrative coherence.

In the exhibition area of ants, the museum uses augmented reality technology to project them onto the three-dimensional walls, forming a strong sense of reality. The audience can participate in the interactive games through the interactive screen, and learn about the life habits and growth patterns of ants while entertaining. The application of these multimedia technologies not only enhances the appeal and expressiveness of the space, but also enhances the audience's participation and sense of experience, thus making the spatial narrative more vivid and effective.

Despite the wide application of new technologies in natural museums, there are still some problems that affect the effect of spatial narrative. First of all, the display form is single, mainly combining the specimens with pictures and text. The interactive mode is monotonous, and it is difficult to achieve multi-level spatial narrative experience. Secondly, the purpose of the display is not clear, and some exhibition items excessively pursue the artistic effect and ignore the dissemination of popular science information, which weakens the coherence and depth of the narrative. Finally, the new technology is too professional, and it is difficult for the curators to grasp the final display effect, and it needs professional maintenance, which increases the complexity of management. These questions suggest that nature museums need to further improve digital technologies to enhance the effectiveness of spatial narratives and the immersive experience of

audiences.

4.3 Guide function and technology use prospect of virtual space

Virtual space has the guiding function and the new guide route derivative potential in the nature museum, especially the application prospect of head-mounted virtual reality devices. Taking the Natural History Museum in London as an example, the paper discusses its virtual space guiding function and its application prospect. The Natural History Museum in London has 70 million specimens of biology and earth, divided into five sections: botany, entomology, mineralogy, paleontology and zoology. Visitors can use their headsets for an interactive experience.

The museum uses a multi-line space narrative form, displaying tryodocus fossils in the central hall. Visitors observe the transformation of fossils into entities in the virtual world through a headset, and interact with the building, breaking the original visiting logic and creating new visiting routes. In the "Undersea World" section, virtual reality technology makes the exhibition hall gradually submerged by sea water, and specimens such as whales swim freely in the virtual environment, providing a new spatial experience. These virtual models are predesigned to guide the visitor route to form a multi-line spatial narrative.

However, the application of virtual reality technology also faces challenges. The current $360°$ panoramic video provides real-time visual preview, but limits the freedom of movement, and each visitor can only accommodate one person to watch, reducing the interactivity. The London Natural History Museum of London has taken steps to deal with these problems, such as requiring visitors in the central hall to sit on benches and designing narrow corridors in the Marine animal exhibition hall to avoid crowding. However, the application of virtual reality technology still faces the challenges of space limitations and high cost.

5. Conclusion

This study explores the application of spatial narrative theory in the design of natural museum exhibition space, with special emphasis on the role of nonlinear narrative and multimedia technology in enhancing audience engagement and educational experience. The case analysis verifies how this innovative narrative strategy can improve the interest and immersion of the exhibition, and promote knowledge transmission and emotional resonance. It also points out the challenges in the application of virtual reality and other technologies, including cost and maintenance issues. Future research needs to focus on the integration and optimization of these technologies to ensure their sustainability and accessibility in museum displays. To sum up, through the integration of technological innovation and theoretical application, the Nature Museum has the potential to further play its role as a bridge in science and cultural education, and stimulate the public's in-depth exploration of natural science.

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