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Research on the Application of Virtual Interaction Technology in the Display Space of Manchu Paper-Cut Art in Jilin Province

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ABSTRACT: This article starts from the current application status of virtual interaction technology in the Manchu paper-cutting exhibition spaces in Jilin Province, explores the problems existing in its application, and, by utilizing application strategies such as cultural output and innovation, spatial layout and functional zoning, and interactive experience design, integrates virtual interaction technology into the design of Manchu paper-cutting exhibition spaces in Jilin Province. The goal is to enhance audience engagement and experience, promote the inheritance and innovation of Manchu paper-cutting culture, and improve the quality and attractiveness of the exhibition spaces.

KEYWORDS: Virtual interaction technology; Manchu paper cutting in Jilin Province; exhibition space; application strategies.

I. THE CURRENT APPLICATION OF VIRTUAL INTERACTION TECHNOLOGYIN THE MANCHU PAPER-CUTTING EXHIBITION SPACES IN JILIN PROVINCE

1.1 Research Background

In 2007, Manchu paper-cutting from Changbai Mountain was approved by the People's Government of Jilin Province to be included in the first batch of provincial intangible cultural heritage lists; in June 2008, it was included in the second batch of national intangible cultural heritage lists. As a representative folk art of Jilin Province, Manchu paper-cutting, characterized by auspicious patterns and unique shapes, plays an important role in creating atmosphere and enhancing recognizability in exhibition space design.

On July 28, 2025, the General Office of the CPC Jilin Provincial Committee and the General Office of the People's Government of Jilin Province issued the "Implementation Opinions on Promoting the High-Quality Development of the Cultural Industry," which emphasized support for the construction of large models in the cultural sector, the development of metaverse application scenarios for culture and tourism, and the creation of distinctive cultural and tourism IP. The intelligence and interactivity of virtual interaction technologies enhance the fun and communication efficiency of exhibition space design, providing technical support for the high-quality development of intangible cultural heritage such as Manchu paper-cutting.

1.2 Current Application Status

According to existing research, there are few independent venues in Jilin Province dedicated solely to exhibiting Manchu paper-cutting. It is commonly featured in the folk culture or intangible cultural heritage sections of comprehensive museums, and venues that use virtual reality technology to create spaces specifically for Manchu paper-cutting in Jilin Province are rare.

For example, the Changbai Mountain Manchu Folk Art Museum, as the first national Manchu folk art museum, has a dedicated area for Manchu paper-cutting, displaying it through a combination of physical objects, images, scenes, and projections. The Guan Yunde Manchu Folk Museum has a Guan family Manchu paper-cutting exhibition room that displays paper-cutting culture only through physical objects and scene reconstructions. After its expansion, the Jilin City Manchu Museum has opened exhibition areas, intangible cultural heritage inheritance areas, and public service areas, using digital interaction, hands-on activities, and leisure reading in various ways to bring paper-cutting to life, providing insights for applying virtual interactive technology in exhibition spaces.

In the future, how to further enrich the presentation of Manchu paper-cutting through virtual interactive technology and enhance the audience's immersive experience is worthy of in-depth research and practice.

II. PROBLEMS IN THE APPLICATION OF VIRTUAL INTERACTION TECHNOLOGY IN THE MANCHU PAPER-CUTTING EXHIBITION SPACE IN JILIN PROVINCE

2.1 Insufficient Depth in Conveying Cultural Connotations

At present, the research and application of designing display spaces for Manchu paper-cutting in Jilin Province using virtual interactive technology are mainly focused on the technical field, lacking attention to the spiritual and cultural values carried by Manchu paper-cutting. This technology-centered design concept merely utilizes virtual reality (VR) technology to recreate scenes of the ancient life and ritual ceremonies of the Manchu, without an in-depth interpretation of the culture. As a result, the richness and depth of the display of Manchu paper-cutting in terms of cultural atmosphere and aesthetic experience are insufficient, making it difficult to fully and profoundly reveal the cultural connotations of Manchu paper-cutting.

2.2 Limitations of Audience Participation

In the exhibition space, visitors can simulate the process of paper-cutting through gesture operations. Although this enhances interactivity compared to traditional exhibition methods, it lacks direct engagement with the exhibits, which to some extent diminishes visitors' sense of participation and immersion. At the same time, when browsing the virtual exhibition hall, visitors' paths and ways of participation are restricted by the preset programs and interface design. They can only follow the predetermined routes during the visit and cannot freely explore areas of interest, reducing their enthusiasm and initiative to participate.

2.3 Limitations of Spatial Shaping

A virtual exhibition hall with a rigid layout and lacking layers and spatial variations, which only uses multimedia technology to play background music and narrate the cultural stories of Manchu paper-cutting, cannot fully reproduce the lighting, scents, and spatial sense of a physical exhibition hall. This limits the audience's immersion in the virtual interactive display space, causing visual fatigue during visits and preventing emotional resonance with the exhibits.

III. APPLICATION STRATEGIES OF VIRTUAL INTERACTION IN THE MANCHU PAPER-CUTTING EXHIBITION SPACES IN JILIN PROVINCE

3.1 Cultural Export and Innovation

3.1.1 Cultural Export

Before using virtual interactive technology to design an exhibition space for Manchu paper-cutting in Jilin Province, it is necessary to systematically explore the historical origins of Manchu paper-cutting, its thematic genealogy, cultural connotations, as well as the personal backgrounds and craftsmanship inheritance of paper-cutting artists. This will lay a solid academic foundation for the subsequent exhibition space design and ensure that the display content accurately conveys the essential spirit of Manchu paper-cutting.By incorporating a timeline into the exhibition space design system, visitors can follow the historical development, systematically experiencing the trajectory and transformation of Manchu paper-cutting art. This helps visitors accurately understand its historical context and achieves a precise reproduction and multidimensional representation of Manchu paper-cutting techniques in Jilin Province.Through in-depth research into historical origins, the designer systematically organizes the thematic genealogy of Manchu paper-cutting, further explores its intrinsic cultural meanings, and distills symbolic elements and connotations. These are vividly presented through virtual interactive technology, deepening visitors' cultural understanding and emotional resonance with Manchu paper-cutting.

3.1.2 Text Explanation

The purpose of exhibition space design is to encourage more ordinary people to visit. When designing the textual explanations of paper-cut exhibits and the interactive communication of information media, it should be based on an objective foundation that assumes no professional background, no specific interests, and no particular sensitivities. The 'word count limitation principle' must be strictly followed to avoid overburdening the audience, ensuring that information related to Manchu paper-cutting in Jilin Province is communicated clearly and efficiently.

In addition, considerations must be given to the care of special groups in the interpretation of paper-cut exhibits to ensure that every visitor can have a good experience. For example, materials with phonetic annotations can be designed for young children to facilitate better understanding and learning of paper-cutting; introductions in local dialects can be provided for elderly visitors to give a sense of familiarity and warmth; Braille versions can be created for visually impaired individuals to ensure they can participate in the cultural experience. Such attentive details reflect respect and understanding for all types of audiences and greatly expand the reach of Manchu paper-cutting art, allowing this traditional cultural treasure of Jilin Province to be appreciated and understood by people across different ages, regions, and physical abilities.

3.2 Spatial Layout and Functional Zoning

3.2.1 Integration of Outdoor Guidance and Indoor Interaction

Traditional exhibition spaces focus on the interior environment while neglecting the shaping of the exterior environment. They only use simple methods such as signage and pattern displays to present the external environment of the exhibition space, making it difficult to directly perceive the theme and nature of the exhibition, and thus fail to attract audiences. Accordingly, when designing the exhibition space for Manchu paper-cutting in Jilin Province, the following methods can be used to shape the outdoor environment.

In terms of sculpture design, patterns such as elderly women, butterflies, phoenixes, and fish can be used to create highly representative thematic sculptures. These sculptures can be placed in outdoor squares, gardens, or entrance areas, with appropriate adjustments made according to the scale of the space and the flow of visitors. This not only showcases the artistic charm of Manchu paper-cutting but also guides the movement of people.

Regarding outdoor signage, display boards can be set up in the outdoor space to showcase stories about the Manchu paper-cutting culture, revealing its historical origins, cultural connotations, and production techniques. Additionally, signs featuring text, images, and QR codes can be designed to promote upcoming Manchu paper-cutting cultural activities, such as paper-cutting workshops, cultural lectures, and exhibition openings, thereby enhancing audience engagement with the Manchu paper-cutting exhibition space in Jilin Province.

3.2.2 Indoor Zoning Design

Meticulous zoning design enhances the use of virtual interactive technology in the exhibition space, effectively showcasing the Manchu paper-cutting culture of Jilin Province. Specifically, the exhibition space is divided into six major areas: the Historical and Cultural Area, Craftsmanship Display Area, Themed Paper-Cutting Area, Interactive Experience Area, Inheritance and Innovation Area, and Cultural Exploration Area.

In the Historical and Cultural Area, visitors gain an in-depth understanding of the historical roots and development trajectory of Manchu paper-cutting, as well as its close connection to shamanic culture and religious beliefs. They can observe the role of paper-cut works in decorating altars and seeking divine protection, gaining a profound understanding of the spiritual connotations of paper-cutting in Manchu culture.

The Craftsmanship Display Area focuses on demonstrating the techniques of Manchu paper-cutting. Through motion-sensing interaction and VR technology, visitors can perform paper-cutting gestures, simulating the cutting action of scissors and experiencing every step of the process. This interactive experience enhances audience engagement and provides a more intuitive understanding of paper-cutting skills.

The Themed Paper-Cutting Area categorizes paper-cut works according to different themes such as ancestral myths, deity worship, folktales, traditional customs, and everyday life. Multimedia displays and interactive explanations allow visitors to deeply understand the cultural significance of each type of paper-cutting. For example, in the ancestral myths section, visitors can watch animated shorts on touch screens to learn about the legends of the Manchu ancestors while viewing related paper-cut works.

In the folktale section, visitors can listen to stories of Manchu heroes through audio guides and appreciate paper-cut works inspired by these figures.The Interactive Experience Area is the most dynamic part of the exhibition space. Visitors can select different paper-cut patterns on mobile screens and use gestures to "apply" them to walls, tables, clothing, and other real-life settings, experiencing the charm of paper-cutting art in a novel way.

The Inheritance and Innovation Area mainly showcases traditional methods of passing down Manchu paper-cutting, modern innovative works, and digital preservation achievements. Visitors can browse high-resolution paper-cut works in a digital museum on touch screens, learning the creation background and cultural significance of each piece. Paper-cut works converted into NFTs introduce visitors to the concept of intangible cultural heritage NFTs. Visitors can also create unique digital paper-cut works using VR devices, convert them into NFTs for preservation and sharing, and understand how digital preservation injects new vitality into traditional culture.

The Cultural Exploration Area sets cultural exploration tasks and puzzle games to learn about traditional Manchu customs. Visitors can participate in treasure-hunting activities to find paper-cut works hidden in the exhibition space. After completing tasks, visitors receive unique digital badges, which serve both as participation rewards and symbols of understanding Manchu paper-cutting culture.

3.3 Interactive Experience Design

3.3.1 Personalized Visit Route Customization

Audience members use their personal mobile devices to enter the system settings interface, selecting content sections of interest based on their preferences. Whether it is the mysterious 'Shaman Culture Paper-Cutting,' the traditional 'Customs Paper-Cutting,' or the modern 'Innovative Paper-Cutting,' they can easily find and customize a personalized tour route. Based on their choices, the system intelligently generates a dedicated visit path, guiding them to explore the rich connotations of Manchu paper-cutting in depth.

3.3.2 Full-course visual guidance and multilingual commentary

The full guided tour information will be presented in an intuitive visual format, allowing visitors to clearly see their current location, the tour route, and detailed introductions of each exhibition area. When wearing headphones, the system will provide real-time multilingual explanations of the exhibits, enabling visitors to freely choose between Chinese, English, or other languages according to their personal needs.

3.3.3 Content Preservation and Review

During the visit, visitors can save any high-definition paper-cutting images or memorable audio and video clips that interest them to their personal mobile devices with just one click. These materials will document the visitors' experiences and become precious mementos of their interaction with Manchu paper-cutting culture.

3.3.4 Interactive Communication Platform

In interactive communication platforms, audiences can interact and communicate with other ordinary viewers, cultural enthusiasts, or even paper-cutting artists. The content they share has the opportunity to become part of the exhibition information, providing new perspectives and interpretations for other viewers. This interactivity can enhance audience engagement, making the virtual exhibition space a dynamic cultural platform that is continuously enriched and evolving.

IV. CONCLUSION

Virtual interaction technology has brought unprecedented opportunities to the exhibition space of Manchu paper-cutting in Jilin Province. Through methods such as augmented reality (AR) and virtual reality (VR), audiences can transcend the limitations of time and space and deeply experience the rich cultural heritage of Manchu paper-cutting. However, the rapid development of technology also brings new challenges, such as the in-depth conveyance of cultural connotations, the flexibility of audience participation, and the diversity of spatial design, which still need to be addressed. In the future, efforts should be made to further optimize the application of technology, deepen the exploration and presentation of cultural content, and enhance audience interaction experience, in order to better promote the inheritance and innovation of Manchu paper-cutting culture. In the integration of technology and art, it is hoped that Manchu paper-cutting in Jilin Province can shine anew in virtual interactive exhibition spaces, becoming a cultural bridge that connects tradition with modernity and local culture with the world.

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