

# Exploring the Application Pathways of AI Virtual Reality Technology in Intangible Cultural Heritage Transmission

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## Abstract

With the accelerated progress of globalization and modernization, intangible cultural heritage (ICH) is confronted with severe challenges, such as the disruption of transmission, limited dissemination, and monotonous forms of presentation. Many precious ICH projects are gradually marginalized due to the lack of effective means of protection and dissemination, placing their cultural value and historical memory at risk of being lost. Exploring integration pathways between new technologies and ICH transmission is of great practical and cultural significance. It can not only inject new vitality into ICH and revitalize it in contemporary society, but also promote the protection and development of cultural diversity and strengthen national cultural identity. This paper focuses on the application of AI virtual reality technology in the field of ICH transmission. By analyzing the connotations of intangible cultural heritage in depth, it elaborates on the immersive, interactive, and imaginative features of AI virtual reality technology, and clarifies its value in innovating recording methods, enhancing presentation effects, and broadening dissemination channels. Furthermore, it explores concrete application pathways to provide new perspectives and approaches for ICH transmission, thereby facilitating its sustainable development in modern society.

## Keywords

AI virtual reality technology; intangible cultural heritage; transmission; application pathways.

## 1. Introduction

Intangible cultural heritage embodies the cultural essence accumulated by different ethnic groups over the long course of history, carrying crystallized wisdom and spiritual traits, and serving as an important bond for maintaining cultural identity. However, with the drastic transformation of social lifestyles, the traditional master-apprentice model of transmission has become increasingly incompatible with the pace of modern society, and geographical barriers also restrict the wide dissemination of ICH. Some ICH projects are even at risk of losing their craft traditions[1]. The emergence of AI virtual reality technology offers new possibilities for addressing these challenges. Unlike traditional technical means, it reconstructs the existence of ICH in a digital dimension: it can accurately capture technical details to overcome spatial and temporal limitations of transmission, while the construction of virtual scenarios activates sensory experiences of audiences. On the basis of preserving the authenticity of ICH, it builds a bridge between tradition and modernity, opening up an innovative and sustainable pathway for transmission. The exploration of this technological route is not only a practical response to the crisis of ICH transmission, but also a timely proposition for promoting the living inheritance of cultural heritage.

## **2. The Connotation of Intangible Cultural Heritage**

Intangible cultural heritage is a spiritual treasure preserved in the long history of human civilization, encompassing a wide variety of categories. Traditional oral literature and the languages serving as its carriers form an important part, as myths, folktales, and epics handed down among the people function as vivid cultural codes. They carry the collective memory and values of specific groups, transcend generations through oral transmission, and sustain the cultural roots of communities. Traditional performing arts are equally significant: the stylized performance of opera, the rhythmic movements of dance, and the melodic patterns of music all use distinctive artistic languages to highlight regional cultural characteristics, embodying the crystallized wisdom and sincere dedication of creators and performers. Traditional handicraft skills more vividly reflect craftsmanship, ranging from the delicate embroidery created stitch by stitch, to the lively patterns cut from paper, to the architectural techniques that combine mechanics and aesthetics. Each reflects the experience and refined artistry accumulated through generations of practice. Intangible cultural heritage is therefore a valuable asset created in human production and daily life. It manifests the cultural genes and spiritual identity of different regions and ethnicities, serves as a vivid example of the diversity of human civilization, and holds irreplaceable value for the study of human history and cultural evolution.

## **3. Characteristics of AI Virtual Reality Technology**

In the digital era, AI virtual reality technology has emerged as a representative innovation, bridging the real and the virtual through its multidimensional features and delivering transformative outcomes across various fields. Its core characteristics are immersion, interactivity, and imagination. Immersion is realized through high-precision computer graphics, advanced display technologies, and spatial positioning systems, which create highly detailed and dynamic virtual environments. Wearing headsets, users are enveloped in high-resolution visuals, 3D sound effects simulate direction and distance, and some devices even incorporate haptic feedback to transmit tactile sensations, thereby blurring the boundary between the real and the virtual and providing a vivid “being-there” experience. Interactivity is achieved through motion capture sensors and AI algorithms, enabling users to interact with virtual objects in real time via body movements and voice commands[2-3]. With millisecond-level responses, systems transform passive viewing into active participation and enhance the sense of engagement. Imagination, perhaps the most meaningful characteristic, encourages developers to transcend the constraints of physics and time-space. Based on existing materials, it enables creative recombination, and through AI-driven generative design integrates dispersed elements into unique and fantastic modes of presentation, providing new opportunities for cultural expression. These three features work in synergy, granting AI virtual reality technology irreplaceable value in fields such as the transmission of intangible cultural heritage.

## **4. The Application Value of AI Virtual Reality Technology in Intangible Cultural Heritage Transmission**

### **4.1. Innovating Methods of Heritage Documentation**

Traditional approaches to documenting intangible cultural heritage have long been constrained by technical conditions. Written descriptions struggle to convey the dynamic rhythm of craftsmanship; photographs freeze only a single moment; and even videos, though able to present continuous processes, cannot capture the spatial relationships between details. As a result, a large amount of tacit knowledge is lost in the process of documentation, leaving informational gaps for future research in this field. The intervention of AI virtual reality technology fundamentally changes this fragmented situation. With the adoption of three-

dimensional laser scanning, the mortise-and-tenon structures of traditional architecture can be precisely reproduced, while millimeter-level accuracy captures the grain patterns carved by hand tools. Motion capture systems, operating at hundreds of frames per second, record the bodily movements of traditional dances and, when combined with biomechanical analysis, transform implicit skills such as breathing rhythms and force patterns into quantifiable data. Environmental modeling technologies can simultaneously collect the natural and cultural settings in which heritage practices are embedded, thus situating craft transmission within a complete ecological environment. This multidimensional approach comprehensively preserves both the material forms and behavioral procedures of ICH, systematically archiving the underlying technical logic together with its cultural context, and thereby providing a holistic digital foundation for future research, reproduction, and transmission.

#### 4.2. Enhancing Heritage Presentation

Heritage exhibition is the bridge that connects cultural heritage with the public. However, traditional exhibition models are constrained by the physical size of venues, opening hours, and geographic accessibility. They typically rely on static displays, making it difficult for audiences to fully experience the dynamic vitality and cultural essence of ICH. AI virtual reality technology offers a powerful solution to these restrictions by creating virtual exhibition spaces that transcend time and space. Within such virtual galleries, 360-degree panoramic technologies can showcase heritage artifacts and artworks in full detail, complemented by carefully designed lighting effects and appropriate soundscapes to highlight key features and enhance audience engagement[4]. A representative example is the “Digital Dunhuang” VR exhibition project launched by the Dunhuang Academy, which digitally reconstructed murals, sculptures, and other relics from several Mogao Grottoes to build a virtual exhibition environment. Since its launch, the project has attracted more than 120 million visits, with a substantial proportion from overseas audiences (see Figure 1). This has allowed people worldwide to experience the beauty of intangible cultural heritage without being constrained by geography or time, thereby greatly improving the effectiveness and influence of heritage presentation.

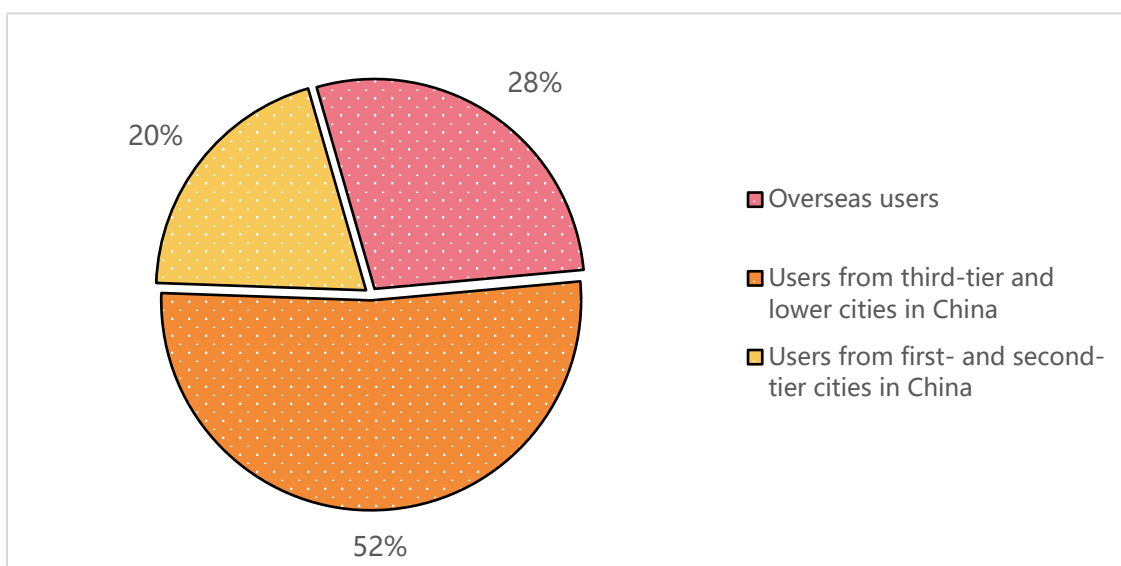
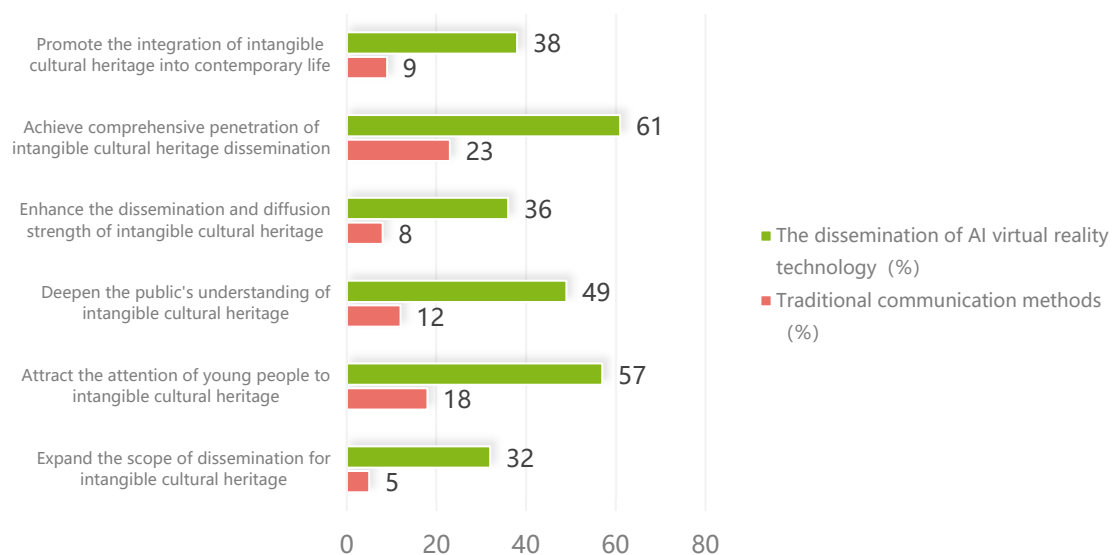


Figure 1. Geographical Distribution of Visiting Users

#### 4.3. Expanding Channels of Heritage Dissemination

Effective dissemination allows ancient wisdom to transcend generational and spatial barriers and to become integrated into contemporary life. At its core, AI virtual reality technology empowers digital transformation and creates diverse channels for the dissemination of

intangible cultural heritage. By overcoming the boundaries of physical space, online VR platforms transform heritage resources into digital content accessible worldwide. Users need not worry about travel expenses or time constraints; with only an internet connection, they can deeply experience intangible cultural heritage projects from across the globe. This approach ensures that heritage from remote regions is also brought into global visibility, significantly broadening the scope of dissemination[5]. In line with the media habits of younger generations, VR’s interactive functions and playful effects can be harnessed to design dissemination models tailored to digital natives, such as heritage-themed interactive games and immersive narrative experiences. By embedding heritage knowledge into youthful and engaging contexts, the barriers for younger audiences to appreciate ICH are lowered. Moreover, dissemination is enriched in both depth and breadth, as virtual platforms integrate multiple layers of information—from historical origins to technical principles and contemporary innovations. Users can explore freely according to their interests, progressing from basic awareness to in-depth study. User-generated content further facilitates secondary dissemination, creating viral diffusion effects. In this way, VR-based dissemination not only expands the reach of intangible cultural heritage but also achieves deep cultural penetration (see Figure 2).



**Figure 2.** Comparison Data of the Effects of Expanding Intangible Cultural Heritage

## 5. Specific Application Pathways of AI Virtual Reality Technology in Intangible Cultural Heritage Transmission

### 5.1. Building Digital Resource Repositories for Intangible Cultural Heritage

With the aging of ICH inheritors and increasing risks of natural damage, the traditional reliance on physical preservation and oral transmission is no longer sufficient to meet protection needs. Constructing systematic digital repositories has therefore become a key strategy for safeguarding heritage. In 2023, the National Cultural Heritage Administration launched the “Special Plan for Digital Protection of Intangible Cultural Heritage,” which collected basic data on more than 3,000 national-level ICH projects. Practices such as Kunqu Opera and Guqin art have achieved comprehensive digital archiving through multimodal technologies. In practical implementation, it is necessary to assemble professional teams of heritage experts, digital technicians, and folklorists. For traditional craftsmanship projects, 8K ultra-high-definition video can record each step of hand movements; for documentary heritage such as the Dai palm-leaf manuscripts, three-dimensional reconstruction can restore carrier textures and textual

details; for oral literature such as Miao epics, dialect annotations and multi-version comparisons can be used to complete digital archiving. Multiple types of data, after semantic correlation and labeling through AI algorithms, are organized into unified resource repositories such as the Suzhou ICH Digital Platform[6]. Through keyword searches, users can obtain detailed information such as raw material ratios and loom parameters for silk weaving, thereby laying a solid digital foundation for cross-regional research and living transmission.

## 5.2. Developing Immersive Heritage Exhibition Platforms

The development of immersive exhibition platforms can overcome the spatial and sensory limitations of traditional display methods, transforming ICH from static exhibits into dynamic presentations, and shifting audiences from passive viewing to active engagement. In museums and ICH experience centers, dedicated zones can be established, equipped with lightweight VR headsets and motion capture devices. Algorithms can render heritage-related historical scenes and craft processes in real time, enabling users to perceive them visually, aurally, and even tactilely, as if observing artisans at work in a traditional workshop or participating in folk events to experience cultural atmospheres[7-8]. Virtual exhibition systems compatible with multiple terminals can further improve model loading speed and interactive responsiveness. After logging into an account, users can control avatars to navigate digital scenes, trigger pre-set audio explanations and multimedia content, or engage in Q&A conversations with virtual guides through voice commands. These measures enhance accessibility, interactivity, and engagement, expanding the temporal and spatial boundaries of cultural experience (see Table 1).

**Table 1.** Information about the Intangible Cultural Heritage Immersive Exhibition Platform

Aspect	Regional areas	Equipment configuration	Experience methods
Offline	Exclusive areas for museums and intangible cultural heritage experience centers	VR headsets, motion capture devices	Real-time rendering of scenes, multi-sensory perception, observing skills, experiencing local customs
Online	Multi-terminal virtual exhibition halls	User-owned equipment	After logging in, control the character to roam, trigger explanations, interact with the virtual guide

## 5.3. Promoting Intelligent Content Creation for Heritage

The intelligent creation of ICH content is of great significance in breaking the spatiotemporal barriers of transmission and revitalizing traditional culture in contemporary contexts. It allows ancient practices to gain new communicative vitality and creative potential. For example, in the ancestral worship ceremonies at the birthplace of the Yellow Emperor, AI technologies were employed to construct modular digital elements, deconstructing ritual procedures, costume patterns, and ceremonial texts into reusable resources. With image-generation technologies, these elements were reinterpreted into modern cultural products aligned with contemporary aesthetics. Meanwhile, VR-based metaverse construction relied on AI to render scenes and orchestrate interactive logic, allowing users to creatively reconstruct ceremonial processes, such as designing lighting effects for ritual spaces or adjusting musical compositions. Beyond individual projects, AI can be widely applied: text-generation technologies can modernize traditional stories into scripts suitable for short video dissemination; style transfer algorithms can creatively reinterpret traditional painting and sculpture, generating visual works that

integrate traditional traits with contemporary styles, thereby expanding the expressive boundaries of ICH content.

#### **5.4. Creating Integrated Projects Combining Heritage and Cultural Tourism**

The integration of ICH with cultural tourism helps overcome the divide between heritage preservation and tourism development, transforming static heritage into dynamic tourist experiences. This not only enriches the cultural depth of tourism but also opens up market-oriented pathways for ICH transmission, achieving the co-development of cultural and economic value. A representative case is the “Naxi Dongba Paper VR Experience Project” launched in 2024 in Lijiang Ancient Town. The project established twelve VR experience stations in the core scenic area, where visitors could immerse themselves in the seven-step papermaking process. Within six months of operation, it attracted over 300,000 participants and boosted sales of Dongba cultural products by 47%. An online extension—the “Ancient Tea-Horse Road Virtual Tour”—integrated the ICH of six ethnic groups, including the Naxi and Bai, reconstructing traditional marketplaces through 3D modeling. Within three months of its launch, the virtual tour received over five million visits, with 63% of users utilizing the intelligent itinerary planning function, significantly encouraging offline tourism engagement[9-10]. This model has quietly transformed ICH from museum exhibits into lived experiences, turning cultural symbols into tangible consumer practices.

### **6. Conclusion**

In summary, AI virtual reality technology, with its immersive, interactive, and imaginative characteristics, provides multidimensional and innovative pathways for the transmission of intangible cultural heritage. From constructing digital repositories that ensure precise preservation, to developing immersive platforms that enhance audience experiences, to enabling intelligent content creation and cultural-tourism integration that extend contemporary vitality, these applications not only transcend the spatiotemporal limitations of traditional modes but also revitalize the contemporary significance of heritage while safeguarding its authenticity. Nevertheless, caution must be exercised to prevent over-digitalization from diluting the cultural essence of ICH, and a balance must be sought between technological empowerment and humanistic transmission. With the continuous iteration of technologies and the expansion of application scenarios, AI virtual reality technology will be more deeply integrated into the ICH transmission system, promoting its living continuation through the balance of preservation and innovation, and ultimately becoming a cultural bridge connecting tradition and the future.

### **References**

- [1] Cheng, F. 2016b. Research on the Design and Experience of Traditional Folding Fan Virtual Painting APP. Master’s thesis, Harbin Institute of Technology.
- [2] Pan, Y. 2022. Intangible Cultural Heritage Through Interactive Digital Experiences. Doctoral dissertation, Toronto Metropolitan University.
- [3] Xue, Y., P. Zhang, and M. Xue. 2023. “Virtual Display and Cross-Cultural Communication of Hejia Village Relics in Digital Media.” In International Conference on Human-Computer Interaction, 140–58. Cham: Springer Nature Switzerland. [https://doi.org/10.1007/978-3-031-35936-1\\_11](https://doi.org/10.1007/978-3-031-35936-1_11)
- [4] Liu, K. 2019. “Let the Art of Paper-Cutting Enter the Campus – Take the Teaching of Paper-cutting in Pengyang County No. 2 Middle School as an Example.” Ningxia Education 10.
- [5] Ma, Z., and Y. Guo. 2023. “Leveraging Intangible Cultural Heritage Resources for Advancing China’s Knowledge-based Economy.” Journal of the Knowledge Economy: 1–33. <https://doi.org/10.1007/s13132-023-01643-9>

- [6] Hu, W. 2019. "Survey Analysis and Enlightenment of Mobile Reading APP." *Library Research* 44 (1): 66–8.
- [7] Xu, Y., Y. Tao, and B. Smith. 2022. "China's Emerging Legislative and Policy Framework for Safeguarding Intangible Cultural Heritage." *International Journal of Cultural Policy* 28 (5): 566–80. <https://doi.org/10.1080/10286632.2021.1993838>
- [8] Qiao, X. 2006. "Youth Groups: The Basis for the Protection of Intangible Cultural Heritage." *Journal of Chongqing University of Arts and Science: Social Science Edition* 5 (3): 1–2.
- [9] Li, X., and Z. Li. 2021. "Design Innovation of Intangible Cultural Heritage: Challenges on the Basis of Mobile Phone Culture." In *Design, User Experience, and Usability: Design for Contemporary Technological Environments: 10th International Conference, DUXU 2021, Held as Part of the 23rd HCI International Conference, HCII 2021, Virtual Event, July 24–29, 2021, Proceedings, Part III*, 37–46. Cham: Springer International Publishing. [https://doi.org/10.1007/978-3-030-78227-6\\_4](https://doi.org/10.1007/978-3-030-78227-6_4)
- [10] Jang, H. C., and Y. N. Lien. 2014. "Educational Exhibition System and the Application of APP on Museum Mobile Learning—National Palace Museum as an Example." In *International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology*. Nagoya University.