



Henan Opera on the Global Stage: A Digital Intervention for Overcoming Cultural Distance through AI and VR

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Abstract

Henan Opera, a key Chinese intangible cultural heritage, faces significant barriers in global dissemination due to profound cultural distance extending beyond language to include aesthetic and contextual gaps. Traditional outreach methods struggle to bridge this divide. Drawing on qualitative data from multiple stakeholder groups and comparative case analysis, the study develops the AI-VR Integrated Communication Model as a new paradigm for understanding technology-mediated intercultural engagement with performing arts. Artificial Intelligence (AI) facilitates intelligibility through adaptive translation and contextual annotation, while Virtual Reality (VR) provides immersive, embodied experience via virtual theaters and interactive narratives. Together, they transform passive viewing into active cultural dialogue. This study offers some insights into dynamically preserving and revitalizing traditional performing arts, demonstrating how targeted technology can effectively shorten cultural distance and foster global appreciation.

Subject Areas

Communication, Arts

Keywords

Henan Opera, Cultural Distance, Artificial Intelligence, Virtual Reality, Digital Heritage, Intercultural Communication

1. Introduction

Henan Opera (Yuju), as one of China's most influential regional opera forms, carries profound historical memory and aesthetic wisdom. Recognized as a national

intangible cultural heritage, it embodies what the United Nations Educational, Scientific and Cultural Organization (UNESCO) defines as “practices, expressions, knowledge, and skills that communities, groups, and individuals recognize as part of their cultural heritage” (UNESCO, 2003) [1]. However, like many traditional performing arts, Henan Opera faces a critical challenge in the era of globalization: how to transcend cultural boundaries and resonate with international audiences whose aesthetic sensibilities and interpretive frameworks are shaped by fundamentally different cultural traditions.

The concept of cultural distance is central to understanding this challenge. Cultural distance encompasses not only linguistic barriers—the most visible obstacle—but also deeper dimensions including aesthetic paradigms, embodied schemas, and contextual presuppositions. Traditional opera in the digital age confronts a “cultural context dislocation” (Chen, 2024) [2] between its inherent artistic logic and contemporary popular culture, while digital effects often attenuate the authenticity of performance. This dislocation is magnified in intercultural contexts, where audiences lack the cultural literacy necessary to decode the symbolic language of traditional performance. For Henan Opera specifically, the challenge is compounded by its regional character. Unlike Peking Opera, which has benefited from decades of state-sponsored international promotion, Henan Opera remains relatively unknown outside China. Its musical system, characterized by the distinctive *Bangzi* (梆子) rhythm and regional vocal techniques, lacks familiar reference points for international audiences. Its narrative conventions, drawing on Chinese historical and literary traditions, presuppose cultural knowledge that foreign viewers do not possess. Its performance aesthetics, emphasizing symbolic suggestion over realistic representation, operate on principles fundamentally different from Western theatrical traditions.

The rapid development of digital technologies, particularly Virtual Reality (VR) and Artificial Intelligence (AI), has opened new possibilities for cultural heritage dissemination. As Feng (2025) [3] argues, digital technologies serve as “key enabling means” for intangible cultural heritage protection, facilitating not only precise documentation and scene restoration but also multi-domain integration that shifts heritage from static preservation to living transmission. VR technology, with its core attributes of immersion, interactivity, and imagination, has demonstrated particular promise in cultural heritage contexts. By transcending temporal and spatial constraints, VR enables users to immerse themselves in traditional culture as if physically present, enhancing user engagement. Large language models can generate contextual annotations that bridge knowledge gaps. Generative AI can adapt cultural content while preserving its essential characteristics. The convergence of AI and VR thus presents a compelling opportunity: AI renders cultural content intelligible across linguistic and conceptual boundaries, while VR renders it perceptible through embodied, immersive experience.

Despite these technological advances, significant gaps remain in both theoretical understanding and practical application. First, while cultural distance is frequently

invoked as a barrier to intercultural transmission, existing conceptualizations tend to treat it as a monolithic construct, overlooking the multidimensional nature that characterizes traditional performing arts as Henan Opera. Second, there is limited understanding of how distinct technological capabilities, particularly AI and VR, map onto specific dimensions of cultural distance. Most studies focus on general VR heritage applications without addressing the specific characteristics of performing arts, their dynamic, performative, and interactive nature (Ren *et al.*, 2026) [4]. Third, the potential synergy between AI and VR in intercultural contexts remains undertheorized, with most research treating these technologies separately. To bridge these gaps, three research questions are addressed in the present study.

- What constitutes a multidimensional conceptualization of cultural distance in Henan Opera dissemination?
- What are the respective capabilities of AI and VR in addressing the different dimensions of cultural distance in Henan Opera dissemination?
- In what ways do AI and VR generate synergistic effects in Henan Opera dissemination?

2. Literature Review

2.1. Cultural Distance in Inter-Cultural Performing Arts Reception

The concept of cultural distance has been extensively theorized in intercultural communication studies, but its application to performing arts reception requires careful specification. Cultural distance concerns the degree of difference between cultures along multiple dimensions, including language, values, norms, and aesthetic conventions. In the context of performing arts, cultural distance manifests in what Geng (2023) [5] terms “interpretive dislocation”, the misalignment between the performer’s encoded meanings and the audience’s decoding frameworks. As Chen (2024) [2] notes, the cultural context dislocation between traditional opera and contemporary audiences is itself significant; when compounded by intercultural difference, it becomes a formidable barrier to meaningful engagement.

This dislocation operates at multiple levels. At the linguistic level, audiences face barriers of lexical and syntactic difference, compounded by the poetic and metaphorical language characteristic of traditional opera. At the aesthetic level, they encounter unfamiliar conventions of vocal production, bodily movement, and symbolic representation. At the contextual level, they lack the historical and literary knowledge that narrative presupposes.

Recent research has explored how immersive technologies might address this challenge. Jung *et al.* (2025) [6] investigated how geographical, social, and cognitive proximity moderate the effects of VR-based information systems on heritage experiences, finding that proximity factors significantly influence immersion, satisfaction, and continuance intention. Their study suggests that VR can overcome the distance between the knower and the known, enhancing historical understanding and emotional engagement. This finding has direct implications for intercultural performing arts communication: if VR can shorten experienced dis-

tance with historical heritage, it may similarly shorten distance with geographically and culturally distant performing arts.

2.2. AI-VR for Intercultural Mediation: Translation, Annotation, and Adaptation

AI has made remarkable strides in intercultural mediation. Neural machine translation systems now achieve near-human performance on many language pairs, while large language models demonstrate sophisticated capabilities in generating contextual explanations and cultural annotations. The application of AI and VR to intangible cultural heritage has evolved significantly over the past decade. Early efforts focused primarily on visual documentation, creating three-dimensional records of cultural artifacts and spaces. More recent work has emphasized interactive experience design, recognizing that intangible heritage consists of practices rather than objects, performances rather than artifacts. Wu (2024) [7] develops “Social Connection Interspace,” a platform designed to facilitate interaction across language barriers in the Metaverse. Powered by VR and large language models, the platform enables real-time connection and understanding, demonstrating how AI can function as a cultural mediator in immersive environments. The integration of hand tracking and consideration of verisimilitude further enhance the sense of authentic presence across cultural boundaries.

In the specific context of Chinese opera, a pioneering project at Henan University of Finance and Economics has demonstrated the potential of AI for opera communication. The “Xiangyu Digital Human” project, developed over three years, successfully created an AI digital human of the renowned Henan Opera master Chang Xiangyu. The project employed Sora large models for historical image generation, HeyGem for dynamic form reconstruction, GPT-SoVITS for deep learning of vocal characteristics, and Hedra models for audiovisual integration. This technical achievement suggests the possibility of preserving not only the external form of operatic performance but the distinctive vocal and gestural signatures of individual masters, which is crucial for a tradition that values lineage and stylistic authenticity.

The integration of AI and VR for cultural heritage represents a convergence of two technological trajectories. AI provides the intelligent mediation that makes cultural content accessible across linguistic and conceptual boundaries; VR provides the immersive environment and embodied interface. From a theoretical perspective, this integration can be understood through the lens of Task-Technology Fit theory, which emphasizes that the degree of alignment between technical capabilities and task requirements plays a decisive role in user experience and satisfaction (Goodhue & Thompson, 1995) [8]. In this regard, the task in intercultural opera reception is rather complex: audiences must simultaneously decode linguistic content, interpret aesthetic conventions, and grasp contextual meanings. Effective technology may address all these dimensions in an integrated manner.

3. Methodology

A qualitative research design was adopted in this study. Qualitative research facilitates an in-depth examination of phenomena by addressing the “what,” “why,” and “how” questions (Yin, 2014) [9]. The study is exploratory in nature, making it well-suited for investigating complex, context-dependent phenomena where the objective is theoretical development rather than hypothesis testing.

3.1. Participants

A total of 26 participants were recruited for semi-structured interviews in this study through purposive sampling, ensuring the inclusion of individuals with relevant experience and diverse perspectives on the intersection of technology and cultural preservation in Henan Opera. Three groups of participants were involved in this study, respectively practitioners with at least five years of professional experience in Henan Opera, cultural communicators with a minimum of two years in cultural heritage dissemination or digital cultural projects, and international audiences to be non-native Chinese speakers with limited prior exposure to the art form. Practitioners were recruited via provincial opera troupes in Henan; cultural communicators through professional networks in heritage and digital humanities; and international audiences through university international student associations and expatriate networks.

Ethical approval was obtained prior to data collection. All participants provided written informed consent and were anonymized through alphanumeric coding. Specifically, eight Henan Opera practitioners were coded as HOP1-HOP8, six cultural communicators coded as CC1-CC6, and twelve international audiences coded as IA1-IA12. **Table 1** provides an overview of the participant categories and their respective focus areas.

Table 1. Overview of study participants.

Participant Category	Code	Description	Focus of Inquiry
Henan Opera Practitioners	HOP1-HOP8	Performers, directors, and inheritors with experience in international performances or digital projects.	<ul style="list-style-type: none"> - Observations of international audience responses - Experiences with technology-mediated performance - Perspectives on cultural preservation versus innovation
Cultural Communicators	CC1-CC6	Professionals working in cultural exchange organizations, festival programmers, and digital heritage project managers.	<ul style="list-style-type: none"> - Strategies for bridging cultural gaps - Experiences with technology-enhanced cultural programming - Assessments of audience engagement
International Audiences	IA1-IA12	Individuals from diverse cultural backgrounds who had experienced Henan Opera either in traditional settings or through digital media.	<ul style="list-style-type: none"> - Experiences of cultural distance - Interpretive strategies - Responses to technology-mediated encounters

3.2. Instruments

To comprehensively investigate the interplay between technology and cultural preservation in Henan Opera, this study employed a multi-method approach combining semi-structured interviews, comparative case analysis, and document review. Semi-structured interviews served as the primary tool for capturing nuanced perspectives from three key stakeholder groups. All interviews, conducted in Mandarin or English based on participant preference, were audio-recorded with consent, transcribed verbatim, and lasted 45 to 90 minutes to allow in-depth exploration of themes.

To ground perspectives in tangible examples, comparative case analysis examined two digital heritage projects. The VR Henan Opera *The Seven-Rank Minor Office* was selected as the first global VR adaptation of the art form, offering immersive access to a reconstructed 600-year-old historical setting. The second project is the VR Dunhuang Cultural Experience, though not opera-focused, provided a comparative benchmark for analyzing VR's role in preserving Chinese cultural heritage, particularly its impact on user engagement and intercultural accessibility. For each project, the following materials were available: technical documentation and production notes; promotional materials and exhibition descriptions; user reviews from platforms such as Douban, Xiaohongshu, and museum visitor logs. Both cases were analyzed for their technological design, cultural narrative choices, and audience reception data, which drew on textual user reviews and comments, as well as audience feedback collected through informal interviews when accessible. These data sources provided insight into how international audiences perceived, understood, and engaged with cultural content of each project.

Finally, document analysis supplemented primary data by reviewing policy frameworks, industry reports on digital arts trends, technical guidelines for VR/AI cultural projects, and media coverage of public reactions to digital heritage initiatives. This secondary data helped contextualize interview findings and case patterns within broader sociocultural and technological landscapes, ensuring the study's conclusions were both empirically grounded and theoretically informed.

The aforementioned instruments enabled a holistic exploration of how technology reshapes cultural preservation and intercultural communication in Henan Opera.

3.3. Data Analysis

Data analysis followed thematic analysis procedures, combining inductive and deductive approaches (Clarke & Braun, 2017) [10]. Coding was conducted by the first author, who independently coded all interview transcripts, case materials, and documents. To ensure coding reliability, a second researcher independently coded a subset of the data, selected to include interviews from all three participant groups and materials from both case projects. Inter-coder

agreement reached 86%, and discrepancies were resolved through discussion, with coding refinements documented to maintain consistency across the full dataset.

Initial coding identified recurring themes related to cultural distance, technological mediation, and audience experience. Themes were iteratively revised through weekly research team discussions, where alternative interpretations were debated, and ambiguous cases were re-examined against raw data. This process continued until thematic saturation was achieved and the thematic structure adequately captured patterns across all data sources.

Interview-derived themes formed the core analytical framework, capturing participants' perspectives on cultural distance and technological mediation. Cross-case synthesis tested and refined these themes by examining how technological design and audience reception manifested across the two projects; patterns that diverged from interview findings prompted re-examination of both data sources. Document analysis served as a third point of triangulation, corroborating or challenging emerging themes by cross-checking against technical documentation, promotional materials, and user reviews. The final model emerged from this iterative integration process, wherein findings from each data source were systematically compared to ensure the resulting framework was grounded in multiple forms of evidence.

4. Findings

4.1. The Multidimensional Structure of Cultural Distance

Analysis of international audience interviews revealed cultural distance as a multidimensional phenomenon, with distinct but interconnected components:

Linguistic distance was the most immediately apparent dimension. International audiences consistently reported difficulty understanding operatic language, which combines classical Chinese, regional dialect, and poetic conventions. However, linguistic distance proved more complex than simple translation failure. As one participant noted: "Even when I read translations, I feel I'm missing something. The words are there, but the way they're sung, the way the music shapes them... that's not in the translation. It's like the meaning is in the relationship between words and music, not just the words themselves." (IA3 from the UK) This observation suggests that linguistic meaning in opera is not purely propositional but emerges from the integration of verbal content with musical and performative elements, a dimension that conventional translation cannot capture.

Aesthetic distance operated at the level of perceptual frameworks. International audiences encountered unfamiliar conventions of vocal production, bodily movement, and symbolic representation. A participant with theater background articulated this challenge: "In Western opera, the voice is everything—you close your eyes and listen. Here, the voice is different, but also the movement, the costume, the makeup—they're all part of one system. I don't know how to read that system.

I see beautiful things, but I don't know what they mean in relation to each other.” (IA6 from New Zealand) This response highlights the holistic nature of operatic aesthetics: elements function not in isolation but within an integrated symbolic system that audiences must learn to “read”. Without this interpretive framework, aesthetic elements remain perceptible but not meaningful.

Embodied distance emerged as a crucial but previously undertheorized dimension. International audiences reported difficulty connecting with the physicality of performance as the stylized movements, the gestural vocabulary, the relationship between performer and stage space. A participant observed: “I watched a performance, and the movements seemed so controlled, so precise. But I couldn't feel why they moved that way. It was like watching a language I could see but not speak. I knew it meant something, but I couldn't feel the meaning in my own body.” (IA2 from Australia) This response suggests that operatic meaning is not purely cognitive but embodied. It operates through kinesthetic empathy, the audience's capacity to feel performance in their own bodies. Cultural distance disrupts this embodied resonance.

Contextual distance encompassed the historical, literary, and cultural knowledge that operatic narratives presuppose. Participants consistently reported difficulty grasping the significance of characters, situations, and references: “I understood the story... someone was corrupt, someone was clever, justice prevailed. But I knew I was missing layers. The characters seemed to carry meanings I couldn't access. It was like watching a shadow of something more substantial.” (IA8 from Canada) This response captures the experience of narrative without cultural depth—the plot is comprehensible, but the cultural resonance, the accumulated meanings that characters and situations carry across generations, remains inaccessible.

4.2. Emerging Technological Interventions

Analysis of selected cases as VR Henan Opera *The Seven-Rank Minor Office* and VR Dunhuang Cultural Experience revealed emerging technological approaches that address different dimensions of cultural distance.

Specifically, VR Henan Opera *The Seven-Rank Minor Office* represents a pioneering effort to apply VR technology to Henan Opera dissemination. As the project description states, “When the audience becomes part of the content, a new era of theater is about to begin” (HOP2). The VR experience reconstructs a 600-year-old historical county office, enabling viewers to experience the performance from within the virtual stage space. Through thematic analysis of technical documentation and production notes, promotional materials, and exhibition descriptions, three key features of the VR Henan Opera *The Seven-Rank Minor Office* were identified:

- Spatial immersion: Viewers are positioned within the historical setting, surrounded by the performance space.
- Perspectival freedom: Unlike fixed theater seating, VR enables viewers to shift

perspective, choosing what to attend to.

- Embodied presence: Viewers experience the performance as if physically present in the space.

A project professional explained the design philosophy: “Traditional theater has a fixed relationship between audience and stage—the audience looks at the performance from outside. In VR, the audience is inside. They’re not watching the world of the performance; they’re in it. That changes everything about how they relate to what they’re seeing.” (CC1)

This design addresses embodied distance by providing virtual presence, the sense of “being there” that enables kinesthetic empathy. It addresses aesthetic distance by enabling viewers to explore performance elements from multiple perspectives, potentially discovering relationships they might miss in fixed viewing.

As for VR Dunhuang Cultural Experience, though not focused on opera, this project provides valuable evidence about VR’s effects on cultural heritage engagement. It was revealed that task characteristics and technology characteristics significantly influence hedonic motivation, with joy and control emerging as strongest predictors of immersion and behavioral intention. Thematic analysis of user reviews from platforms as Douban, Xiaohongshu, and museum visitor logs indicated audience reception as follows:

- Joy as driver: Emotional pleasure, not just cognitive understanding, drives engagement.
- Control as enabler: User agency in navigating experience enhances immersion.
- Task-technology fit: Alignment between what users want to do and what technology enables is crucial.

These findings suggest that effective cultural heritage VR addresses not only what audiences learn but how they feel and what they can do. For Henan Opera dissemination, this implies designing experiences that prioritize emotional engagement and user agency alongside cultural transmission.

4.3. Synergistic Possibilities

While existing projects focus on either VR or AI, analysis revealed potential synergies when technologies are combined.

A digital heritage researcher envisioned integrated possibilities: “Imagine experiencing a Henan Opera performance in VR, with an AI guide that responds to your questions, explains what you’re seeing, connects it to what you know. The AI doesn’t interrupt the experience... it’s there when you need it, invisible when you don’t. And it learns from you, it adapts its explanations to your cultural background, your level of knowledge, your interests.” (HOP5) This vision suggests integration at the level of user experience: AI providing just-in-time cultural mediation within immersive VR environments. The AI functions not as external instruction but as responsive guide, adapting to user needs.

Another participant, an international audience member with extensive VR experience, imagined the embodied possibilities: “What if the VR let me not just

watch but try? What if I could move like the performer, feel in my own body what those gestures require? The AI could guide me, correct me, show me how my movement differs from the master's. I would feel the art in my body.” (IA7 from the US) This vision suggests integration at the level of embodied learning: VR providing the immersive environment for physical practice, AI providing the instructional guidance that enables skill acquisition. Such would address embodied distance directly, enabling audiences to develop kinesthetic understanding through active participation.

The aforementioned participant visions align with broader developments documented in digital cultural heritage policy and practice. Issued by the General Office of the State Council in May 2022 [11], *The Opinions on Promoting the Implementation of the National Cultural Digitization Strategy* outlines key tasks to establish a national cultural big data system by 2035, with a specific emphasis on developing new immersive cultural consumption scenarios. Industry developments, as reported in media coverage of digital heritage projects in China, note growing investment in immersive experiences (China Daily, 2024) [12], for instance, the Dunhuang Mogao Caves with VR, AR, and game engines, attracted significant public interest and demonstrated demand for interactive, personalized cultural experiences.

5. The AI-VR Integrated Communication Model

5.1. Model Overview

Building on the aforementioned findings, this study proposes the AI-VR Integrated Communication Model (See **Figure 1**) for Henan Opera dissemination. The model conceptualizes how AI and VR technologies work synergistically to address the multidimensional structure of cultural distance. The model comprises three core components:

- **Cultural Distance:** The gaps between source culture represented by Henan Opera and target audiences across linguistic, aesthetic, embodied, and contextual dimensions.
- **Technological Mediation:** The synergistic application of AI and VR technologies, each addressing specific dimensions while enabling the other's effectiveness.
- **Empathetic Communication:** The transformation of audience experience from observation to participation, from cognitive understanding to embodied empathy, from cultural distance to cultural dialogue.

5.2. AI Functions: Achieving Intelligibility

In the integrated model, AI addresses the intelligibility of Henan Opera, which concerns the capacity of audiences to understand what they encounter across multiple dimensions:

Linguistic intelligibility: AI-powered translation systems provide real-time understanding of operatic text. Unlike conventional subtitles, which present static

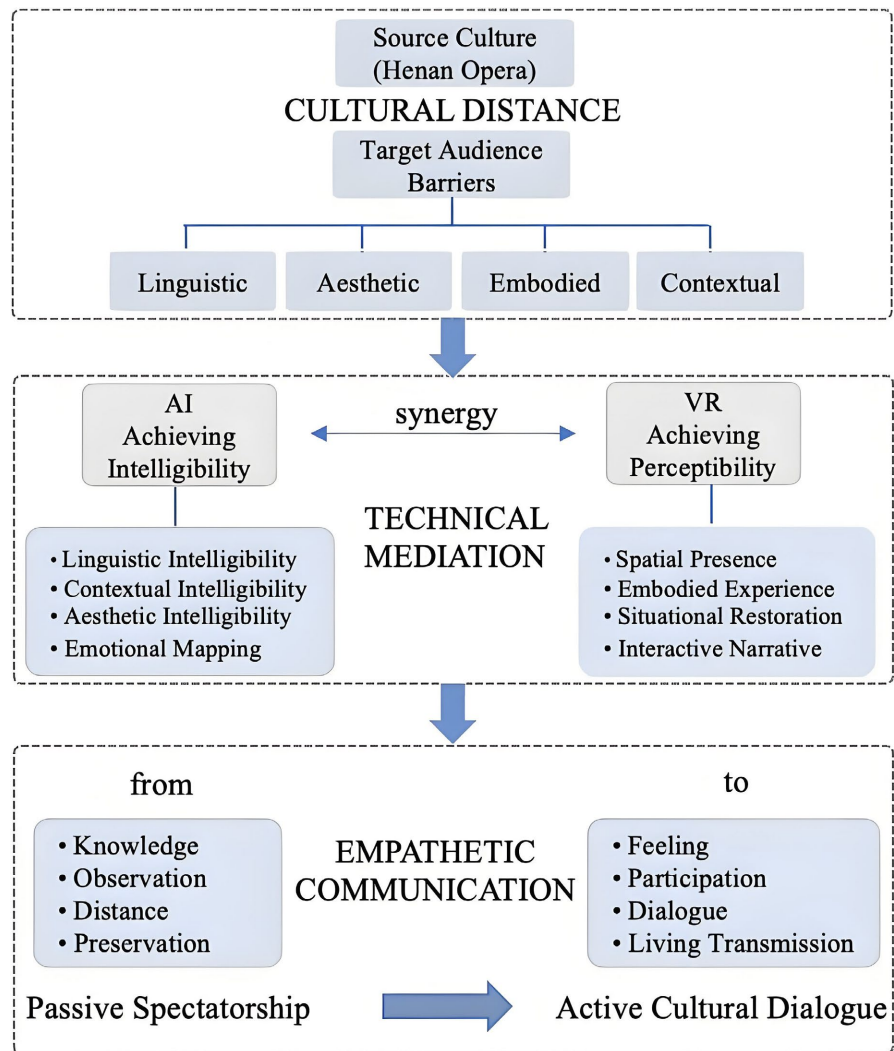


Figure 1. The AI-VR integrated communication model.

translations, AI enables adaptive translation that responds to user needs, providing simpler explanations for beginners, more nuanced renderings for advanced viewers. Neural machine translation, trained on operatic corpora, can handle the distinctive features of poetic and classical language.

Contextual intelligibility: AI generates just-in-time contextual annotations that bridge knowledge gaps without disrupting experiential flow. When audiences encounter unfamiliar historical references, mythological allusions, or cultural symbols, AI provides contextual information tailored to their demonstrated knowledge level. Large language models, trained on comprehensive cultural databases, can generate explanations that are accurate, accessible, and appropriately positioned within broader cultural frameworks.

Aesthetic intelligibility: AI analyzes and explains the aesthetic conventions that structure operatic performance, encompassing the significance of specific gestures, the meanings of costume elements, the emotional associations of musical patterns. By making explicit the implicit knowledge that native audiences possess,

AI enables international viewers to “read” performances with greater interpretive competence.

Emotional mapping: Perhaps most distinctively, AI can facilitate what might be termed emotional translation, helping audiences map unfamiliar emotional expressions onto recognizable affective categories. When a particular vocal technique conveys grief, a specific gesture indicates resolve, or a musical pattern signals danger, AI can guide audiences toward appropriate emotional responses, bridging the gap between cultural expression and universal human affect.

5.3. VR Functions: Achieving Perceptibility

While AI addresses intelligibility, VR addresses perceptibility, the capacity of audiences to experience Henan Opera in ways that engage multiple sensory modalities and enable embodied participation:

Spatial presence: VR situates audiences within performance space, transforming their relationship to the action. Instead of observing from outside, they experience being inside, surrounded by sound, immersed in environment, positioned in relation to performers. This spatial presence enables forms of perceptual engagement impossible in conventional theater.

Embodied experience: Through motion tracking and haptic feedback, VR enables audiences to experience performance physically. They can practice gestures, feel rhythms, inhabit the bodily orientations that structure operatic movement. This embodied engagement addresses the dimension of cultural distance most resistant to conventional mediation, the gap between watching movement and feeling it.

Situational restoration: VR reconstructs the physical and social contexts in which Henan Opera traditionally operates—the temple fairs, teahouses, and rural stages where the form developed. By situating performance within its original contexts, VR provides audiences with experiential understanding of how performance relates to social life.

Interactive narrative: VR enables audiences to participate in narrative, not merely observe it. They can explore story spaces, interact with characters, make choices that affect narrative development. This interactive dimension transforms passive spectatorship into active engagement, enabling audiences to enter the story world rather than merely observe it.

5.4. Synergistic Mechanisms

The model’s distinctive contribution lies in conceptualizing how AI and VR functions synergize, which produces effects that neither technology could achieve alone:

AI enables VR’s cultural specificity: VR environments, however immersive, require cultural content to be meaningful. AI provides that content, including the translations, explanations, and contextualizations that transform immersive space into cultural world. Without AI, VR offers presence without meaning; with AI,

presence becomes culturally significant.

VR enables AI's experiential integration: AI explanations, however accurate, remain external to experience unless integrated into immersive engagement. VR provides that integration, embedding AI guidance within experiential flow, making cultural learning part of embodied exploration rather than separate instruction. Without VR, AI offers knowledge without experience; with VR, knowledge becomes experientially grounded.

Joint transformation of spectatorship: Together, AI and VR transform the fundamental relationship between audience and performance. The spectator is no longer outside looking in, receiving information about a cultural form, but inside participating, experiencing cultural meaning through embodied engagement. This transformation is not merely additive but qualitative—a shift in the mode of cultural encounter.

5.5. Empathetic Communication

The model culminates in what this study proposes as a theoretical concept: empathetic communication. This concept captures the transformed relationship between audiences and cultural heritage that AI-VR integration enables. Empathetic communication differs from conventional cultural communication in several key respects:

- From knowledge to feeling: Conventional approaches prioritize transmission of cultural knowledge, as facts about history, conventions, and meanings. Empathetic communication prioritizes transmission of cultural feeling, involving the emotional and embodied dimensions of cultural experience. Audiences not only know about Henan Opera but feel something of what it feels like to participate in its world.
- From observation to participation: Conventional approaches position audiences as observers, learning about culture from outside. Empathetic communication positions audiences as participants, experiencing culture from within, even if that “within” is technologically mediated. The boundary between cultural insider and outsider becomes permeable.
- From distance to dialogue: Conventional approaches accept cultural distance as inevitable, seeking to bridge it through explanation. Empathetic communication transforms distance into dialogue, a dynamic exchange between cultural traditions mediated by technology that adapts to user response. Distance becomes not obstacle but generative space.
- From preservation to living transmission: Conventional approaches treat cultural heritage as something to be preserved, protected from change, documented for posterity. Empathetic communication enables living transmission, which enables cultural knowledge to continue to evolve through encounter with new participants. Heritage remains alive because it continues to be experienced.

An international audience member who had experienced VR cultural heritage

described this transformation: “I didn’t just learn about this culture, I felt it. For those minutes in VR, I wasn’t an outsider looking in. I was there, part of it, responding to it with my whole body. And when I came out, I didn’t have more facts in my head, rather, I had something harder to describe. A feeling of connection, of having been close to something I could never have been close to otherwise.” (IA 12 from Australia)

This testimony captures the essence of empathetic communication is not increased knowledge but transformed relationship, not information acquisition but experiential connection.

6. Implications

This study offers two perspectives that may contribute to ongoing discussions in digital cultural heritage scholarship. First, it proposes a multidimensional way of understanding cultural distance in performing arts contexts, considering linguistic, aesthetic, embodied, and contextual dimensions as interrelated rather than separate, which might help researchers and practitioners better identify where intercultural communication challenges arise and how they might be addressed. Second, it explores how AI and VR could work together in cultural dissemination, suggesting that their combination may enable forms of engagement that neither technology achieves independently. This line of thinking leads to the notion of empathetic communication as one possible lens for understanding technology-mediated cultural encounters, a perspective that emphasizes emotional and embodied connection alongside cognitive understanding, and that may complement existing frameworks as Task-Technology Fit theory when applied to intercultural performing arts contexts.

In addition, this study has some practical implications for cultural heritage institutions, technology developers, and policy makers.

For cultural heritage institutions: The model suggests that effective intercultural dissemination requires integrated technological strategies rather than piecemeal applications. Institutions should consider how AI and VR can work together to address multiple dimensions of cultural distance simultaneously. This might involve partnerships between cultural organizations and technology developers, interdisciplinary teams that combine cultural expertise with technical knowledge, and iterative design processes that test technological interventions with international audiences.

For technology developers: The model identifies specific design requirements for AI-VR systems targeting intercultural heritage dissemination. AI systems must be trained on culturally specific corpora, capable of generating contextual explanations adapted to user knowledge levels and designed to integrate with immersive environments without disrupting experiential flow. VR systems must provide not just visual immersion but embodied engagement, enabling users to experience performance physically and interactively.

For policy makers: The model suggests that investment in digital cultural her-

itage should support integrated technological approaches rather than isolated applications. Funding programs might prioritize projects that combine AI and VR capabilities and that include rigorous evaluation of audience outcomes. International cultural exchange programs might incorporate digital components that prepare audiences for live encounters or extend the impact of performances beyond the event itself.

7. Limitations and Direction for Future Research

While this study offers a multidimensional model for understanding AI-VR synergy in cultural heritage dissemination, limitations should be acknowledged.

First, the model is inferred from qualitative evidence rather than tested in a fully implemented AI-VR system. The proposed synergy between AI and VR, particularly the claim that their combination effectively shortens cultural distance, remains theoretical at this stage. Future research should develop and evaluate a prototype AI-VR system for Henan Opera dissemination using experimental designs to measure audience outcomes across the four cultural distance dimensions identified in this study.

Second, the qualitative nature of the data limits generalizability. The sample is relatively small and context-specific, focused on two selected VR projects. Future studies could apply the proposed framework to different cultural contexts, art forms, and technological configurations to test its validity.

Despite these limitations, the framework offers a conceptual foundation for future empirical work testing the proposed AI-VR synergy in practice.

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Conflicts of Interest

The authors declare no conflicts of interest.

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