

# Research on Digital Communication Paths and Narrative Reconstruction of Xi'an Intangible Cultural Heritage

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**Abstract:** Intangible Cultural Heritage (hereinafter referred to as "ICH") serves as a core cultural symbol carrying national cultural genes and identity markers. Digital communication represents a critical pathway for the living transmission and contemporary transformation of ICH, as well as a new means of perpetuating outstanding cultural traditions. With the rapid advancement of digital technologies, the communication methods of ICH are undergoing a paradigm shift from "static display" to "immersive experience." This study takes Xi'an's ICH as its research object and explores the integrated application of AI-driven interactive narrative technology and VR immersive experiences in the digital communication of ICH. In response to the communication challenges facing Xi'an's ICH, this research constructs an "AI+VR" dual-drive communication model, in which AI interactive narrative enhances personalized participation, and VR immersive experience strengthens cultural identity. An empirical study focusing on Xi'an Drum Music demonstrates that the integrated communication approach significantly outperforms traditional methods in terms of knowledge acquisition, cultural understanding, and emotional identification, thereby providing an effective pathway for the living transmission of ICH.

**Keywords:** Xi'an Intangible Cultural Heritage; AI Interactive Narrative; VR Immersive Experience; Digital Communication; Narrative Reconstruction

## 1. Introduction

As the DNA of national culture, intangible cultural heritage serves as a vital foundation for cultural continuity and confidence [1]. As a world-renowned historical and cultural city, Xi'an possesses 323 ICH resources at multiple levels, including Qin Opera, Xi'an Drum Music, paper-cutting, clay sculpture, and others. The

preservation and dissemination of these resources carry both cultural value and demonstrative significance. However, in the context of globalization and mediatization, Xi'an's ICH faces common bottlenecks such as low awareness among younger audiences, aging inheritor populations, homogenized communication forms, underutilization of digital channels, and a lack of interactive experiences. The traditional model of "static display + one-way output" can no longer adapt to the contemporary communication ecology.

Digital technologies offer new possibilities for the revitalization of ICH. The academic community has reached a consensus that ICH digitization needs to evolve from digital archiving to immersive, intelligent, and interactive communication, achieving a deep integration of technology and culture [2,3]. Existing studies, however, mostly focus on single-technology applications or macroscopic theoretical discussions, lacking a systematic solution tailored to Xi'an's local culture that integrates cutting-edge technologies and covers the entire chain of "preservation, narration, experience, communication, and operation." Based on this, this study adopts AI interactive narrative and VR immersive experience as dual cores to construct a digital communication and narrative reconstruction model suitable for Xi'an's ICH, balancing cultural authenticity with contemporary innovation, and providing theoretical support and practical pathways for high-quality ICH transmission.

## 2. Research Background and Theoretical Foundations

### 2.1 Policy and Technological Background

Since the 21st century, the rapid development of digital technologies has profoundly reshaped the ecology of cultural communication. Emerging technologies such as the internet, mobile terminals, virtual reality, and artificial intelligence have shifted cultural communication

from “static display” to “dynamic experience,” and the communication logic has transformed from “one-way notification” to “two-way co-creation” [4]. At the national level, China has placed great emphasis on the digitization of cultural heritage. Policy documents such as the *Opinions on the Implementation of the Project to Inherit and Develop Outstanding Chinese Traditional Culture*, the \*14th Five-Year Plan for Cultural Development\*, and the *Opinions on Promoting the Implementation of the National Cultural Digitization Strategy* have clearly promoted the digital preservation and communication of ICH, providing strong support for related research.

**Table 1. Proportions of Major Challenges in Digital Communication of ICH in China**

Challenge Type	Proportion (%)
Insufficient awareness among younger generations and intergenerational discontinuity	76.8
Homogenized communication forms and content	72.3
Underutilization of digital channels and weak operation	68.4
Lack of interactive experience and one-way output	74.1
Unsustainable business models and over-reliance on government funding	69.2

As a renowned historical and cultural city, Xi’an possesses abundant ICH resources. As of 2025, Xi’an’s ICH representative project inventory covers various levels, including human, national, provincial, and municipal, encompassing diverse types such as music, legends, crafts, and folk customs. The municipal-level inventory includes 323 items, comprising 15 national-level and 135 provincial-level items. Surveys indicate that Xi’an’s ICH faces four major challenges: first, an aging audience—taking Xi’an Drum Music as an example, only 12.3% of people aged 18–30 can accurately name it, indicating low awareness among younger groups; second, content homogenization, with communication forms dominated by documentaries and graphic introductions, lacking innovation; third, channel singularity, relying on traditional channels such as museums and cultural festivals, with insufficient use of new media; and fourth, a lack of interactive experience, where the “one-way output” model struggles to engage audiences emotionally and foster cultural identity. (See Table 1.)

## 2.2 Core Theoretical Support

The digital transmission of ICH follows the theory of living transmission as its core principle, emphasizing that the key to preservation lies in maintaining the “liveliness” of ICH. Digital means are used to fully restore technical processes, cultural contexts, and community functions, avoiding the reduction of ICH to static, objectified displays. On this basis, immersive communication theory supports experience design: VR technology, through embodied interaction, creates a strong sense of “presence,” transforming audiences from passive observers into active participants and significantly enhancing cultural empathy and identity. Meanwhile, interactive narrative theory, leveraging AI technology, dynamically generates personalized narrative threads based on user profiles, achieving “thousand-person, thousand-face” precise communication and effectively improving audience engagement and memory retention [5,6]. The technology-culture symbiosis theory further clarifies that digital technology is not merely a display tool but an important vehicle for translating cultural meaning, reconstructing narratives, and activating value [7,8]. Together, these four theories constitute the theoretical foundation of the “AI+VR” dual-drive communication model proposed in this study.

In summary, how to address Xi’an’s ICH communication challenges and achieve deep technology-culture integration in the context of a technology-driven communication paradigm shift has become a critical issue requiring urgent resolution. This study focuses on the integrated application of AI interactive narrative and VR immersive experience, exploring a new “immersive + interactive” communication paradigm tailored to Xi’an’s ICH characteristics.

### 3. Current Research and Challenges

Research and practice on the digital communication of ICH, both domestically and internationally, have evolved from the early “digital archiving” model (e.g., the “American Memory” project in the United States) to internet-based interactive communication, and are now moving toward an “immersive communication” model represented by virtual reality (VR) and augmented reality (AR) [9]. Domestic research has developed three main directions: digital preservation and resource construction; media communication and audience studies; and technological application innovation. The four major challenges facing the

digital communication of Xi'an's ICH are as follows:

### **3.1 Outdated Communication Models and Homogeneous Presentation Formats**

The digital presentation of many ICH items remains at the level of "static display" using images and videos, failing to fully reflect the "liveliness" of ICH. Even on emerging platforms such as short video, communication often falls into the trap of fragmentation and homogenization, with content broken into scattered segments lacking systematic, in-depth presentation of technical processes, cultural backgrounds, and spiritual cores. As a result, communication effects remain superficial, making it difficult to build a holistic understanding of ICH culture among audiences.

### **3.2 Superficial Technology Application and Lack of Narrative Innovation**

Current practices often use digital technology merely as a simple display tool, failing to achieve deep integration between technology and cultural meaning, posing a risk of "distorted interpretation of cultural connotations." At the narrative level, content creation lacks sufficient exploration of the unique value of ICH, easily leading to homogenized themes and expressions. Although cutting-edge technologies such as AI and VR have begun to be applied, how to embed them into cultural narrative systems to achieve a deep expression of "technology visible, culture readable, and spirit perceptible" remains a difficult challenge [9].

### **3.3 Unclear Audience Targeting and Inefficient Communication**

Digital communication of ICH often "ignores audience differences," failing to fully utilize big data analysis for segmented and targeted communication. The content and format have limited appeal to younger audiences, making it difficult to break through existing circles. At the same time, ICH inheritors generally face the challenges of aging and low digital technology acceptance, while professionals proficient in digital technology often lack a deep understanding of ICH culture, resulting in a talent gap.

### **3.4 Lack of Systematic Implementation Pathways and Sustainable Business Models**

ICH digitization efforts often appear fragmented,

with scattered resource construction, a lack of unified standards and norms, and the formation of "information silos." The complete chain from resource collection, content innovation, platform construction, effect evaluation, to commercial transformation has not yet been connected. Funding relies mainly on government sources, while social capital is deterred by long project return cycles and unclear economic benefits, leading many projects to fall into the trap of "emphasis on construction but neglect of operation" and making sustainability difficult. Therefore, exploring a sustainable ecosystem integrating technology, content, talent, funding, and operation is key to promoting high-quality development of digital communication for Xi'an's ICH.

### **4. The "AI+VR" Dual-Drive Communication and Narrative Reconstruction Model**

To address the above challenges, this study proposes an integrated "AI+VR" dual-drive communication model. This model is not merely a technical solution but also a theoretical framework integrating cultural communication studies, digital narrative theory, and experience design.

#### **4.1 AI Interactive Narrative Layer – Reconstructing the "Story"**

The core of this study lies in solving the narrative reconstruction problem in digital ICH communication. Using cutting-edge technologies such as natural language processing and generative AI, a knowledge graph and story repository of Xi'an's ICH are constructed to enable intelligent generation and dynamic adaptation of ICH narratives. The system can generate personalized narrative threads in real time based on user interests, cultural background, and other characteristics—for example, creating immersive adventure stories based on historical legends for tourists, or designing interactive plots with knowledge quizzes for students. This transforms audiences from "passive viewers" to "active explorers." Thus, the ICH narrative model undergoes a fundamental reconstruction from "linear and fixed" to "branching and interactive," creating a new paradigm of "thousand-person, thousand-face" immersive interactive communication.

#### **4.2 VR Immersive Experience Layer – Reconstructing the "Scene"**

The core of reconstructing the "scene" is to

solve the experiential problem. Using VR/AR and 3D modeling technologies, the cultural spaces on which ICH depends—such as the Tang Dynasty court where Drum Music was performed, or the Guanzhong courtyard of a paper-cutting artist—are reconstructed with high precision to create immersive virtual cultural fields. Through embodied interaction design, users can not only “watch” but also personally “participate” in ICH technical processes and ritual activities, achieving a transformation from “information reception” to “situational presence,” thereby greatly enhancing cultural identity [10].

On this basis, an “AI+VR” dual-drive synergy mechanism is constructed. The AI narrative system generates personalized narrative threads in real time based on user characteristics, dynamically driving changes in the VR scene content. Meanwhile, user behavioral data in VR is fed back to the AI system, continuously optimizing narrative strategies. The two work in synergy to form a closed loop of “narrative guiding experience, experience deepening narrative,” jointly achieving the dynamic generation and deep transmission of ICH cultural meaning and creating a new paradigm of immersive interactive communication.

### 5. Implementation Pathway Using Xi’an Drum Music as an Example

This study takes Xi’an Drum Music, a national-level ICH item, as an example to illustrate the specific implementation pathway of the above model.

#### 5.1 Resource Digitization and Knowledge Extraction

**Table 2. Comparison of Communication Effects between Traditional Display and VR-Immersive ICH Communication**

Indicator	Traditional graphic/video group	AI+VR immersive group	Improvement (%)
Knowledge accuracy rate	42.3%	85.7%	+102.6%
Depth of cultural understanding	2.47	4.12	+66.8%
Emotional identity and cultural confidence	2.31	4.26	+84.4%
Average dwell time	128 seconds	417 seconds	+225.8%
Willingness to share actively	19.6%	67.3%	+243.4%

Multi-dimensional Communication: The core experience is deployed in Xi’an Museum, university laboratories, and online cloud exhibition platforms, forming a multi-dimensional network of “offline experience centers + online social communication.”

Effect Evaluation: Through user behavioral data

First, high-fidelity digital capture of drum music performance techniques, instrument shapes, musical scores (*suzipu*, or character notation), and performance environments is conducted using motion capture, panoramic audio recording, 3D scanning, and other technologies. At the same time, in-depth interviews with inheritors are conducted to uncover the historical anecdotes, musical philosophy, and community functions behind the drum music, constructing a structured knowledge base [11].

#### 5.2 “AI+VR” Integrated Application Development

VR Immersive Experience: A VR application titled *Echoes of Tang Rhythms* is developed, allowing users to “place themselves” in a virtual Tang Dynasty pear garden, freely choose perspectives to closely observe musicians’ performances, and even simulate striking the *e’gu* (a type of drum) or playing the *shengguan* (a wind instrument) through gesture recognition, experiencing the rhythm of ensemble performance.

AI Interactive Narrative: An AI narrative assistant is embedded in the VR environment. For example, when a user touches a virtual instrument, the AI, speaking as a virtual musician, tells the story of that instrument’s origin. Alternatively, a narrative task can be designed in which users listen to different drum music pieces, and the AI unlocks corresponding historical background stories based on the user’s choices (e.g., the connection between *Lang Tao Sha* and the Silk Road caravans).

#### 5.3 Communication Pathways and Effect Evaluation

(time spent in VR, number of interactions), questionnaire surveys (knowledge tests, cultural identity scales), and in-depth interviews, the communication effects are comprehensively evaluated. Preliminary empirical results show that, compared to watching traditional documentaries, users who experience this

integrated model demonstrate significantly higher levels of drum music knowledge acquisition, depth of cultural understanding, and emotional resonance (See Table 2).

### 6. Conclusion and Future Directions

Addressing the pain points of digital communication of Xi'an's ICH, this study proposes an "AI+VR" dual-drive model centered on "narrative reconstruction" and "experience upgrading." This model not only provides a specific technical pathway from resource digitization to innovative communication for Xi'an's ICH but, more importantly, explores new methods for maintaining the "liveliness" and "authenticity" of ICH in digital space through the deep integration of technology and culture.

Future research can be deepened in the following directions: first, exploring the use of blockchain technology to protect digital copyright and inheritor rights within this model; second, extending the model to other ICH types in Xi'an, such as paper-cutting and Qin Opera, to verify its generalizability; and third, deepening research on business models to promote cross-sector integration of digital ICH achievements with the cultural tourism and education industries, achieving a unity of social and economic benefits, and ultimately contributing a practical and feasible "Xi'an Solution" to the creative transformation and innovative development of outstanding traditional Chinese culture.

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