

Original Research Article

Research on the image communication of bamboo-based intangible cultural heritage in AR/VR virtual spaces——A case study of the digital preservation and innovation of traditional wood carvings in Liukeng, Le'an

Xinhan Jiang

Communication University of China, Beijing, 100024, China

Abstract: In the era of digital intelligence, Augmented Reality (AR) and Virtual Reality (VR) technologies have pioneered new pathways for the dynamic inheritance and innovative dissemination of Intangible Cultural Heritage (ICH). This paper examines the traditional woodcarving of Liukeng, Jiangxi—A representative bamboo and wood-based craft—Through the lens of the "D-PEICA" model (Digital Platform, Embodiment, Immersion, Credibility, and Alliance). By systematically constructing a theoretical framework for AR/VR-enabled image communication, this study analyzes how these technologies build hybrid communication matrices, facilitate embodied interactions, and create immersive narrative scenes. Furthermore, the paper critically reflects on risks such as the dilution of authenticity, the tendency toward over-entertainment, and ethical conflicts. It ultimately proposes a new paradigm for intelligent digital communication led by humanistic values, aiming to provide practical guidance for the sustainable development of bamboo-based crafts.

Keywords: AR/VR; virtual space; intangible cultural heritage; bamboo craftsmanship; Liukeng woodcarving; image communication; technology empowerment

1. Introduction: Opportunities, challenges, and theoretical responses for ICH communication in the digital age

We are living in an era of deep digitalization. The convergence of mobile internet, the Internet of Things (IoT), big data, and Virtual Reality has not only restructured social-economic operations but also transformed the inherent logic of cultural production and consumption. Within this "digital intelligence" landscape, Intangible Cultural Heritage (ICH), as the living carrier of tradition, faces both historical opportunities and unprecedented tension.

On one hand, the mobile internet has introduced new media that ignite the enthusiasm of diverse communication subjects. On the other hand, the friction between technological instrumentalism and humanistic value remains. The fundamental question is: how can we use technology to revitalize ancient crafts while preventing the "alienation of culture" and ensuring that the authentic spirit of ICH persists?

Liukeng woodcarving, rooted in the fertile soil of central Jiangxi, is a masterclass in the combination of bamboo and wood craftsmanship. Despite its centuries-long history, it currently suffers from limited communication channels and an aging audience. Its image communication has long relied on physical displays or static text, failing to reach global, younger audiences. AR/VR technologies offer a breakthrough, allowing spectators to transcend physical limits and enter the very spaces where these crafts live.

2. Theoretical foundations: Aligning the D-PEICA model with the digital dissemination framework for intangible cultural heritage (ICH)

Before exploring specific technical applications, it is imperative to establish a rigorous theoretical framework. Communication in the digital age has evolved beyond the simple, linear transmission of information; it is now a multi-dimensional process of meaning construction rooted in complex digital social relationships. Research by Xue Ke and Shi Wei highlights that digital social interaction is shaping a novel field for external communication. The characteristics and underlying mechanisms of this field are particularly well-suited for analyzing the digital dissemination of cultural heritage, including Intangible Cultural Heritage (ICH).

2.1. The new dissemination field shaped by digital social interaction: Five core characteristics

The defining traits of this new digital social field serve as the starting point for understanding its communicative logic. Together, these five characteristics constitute the ecological backdrop for the digital dissemination of ICH: ① Platform-based Spaces: Infrastructure for social interaction and algorithmic coordination. ② Embodied Persistence: Digital twins and avatars allowing for remote presence. ③ Virtual Interaction: Interaction between humans and AI agents or "smart bodies." ④ Emotional Resonance: Moving from cold knowledge to "emotional value" transmission. ⑤ Networked Connections: Decentralized, interest-based "fringe circles" of connectivity.

2.2. The D-PEICA model: A systemic framework for communication mechanisms

Based on the five characteristics mentioned above, Xue and Shi further developed the "D-PEICA" communication model. This model utilizes "digitalization" as the contemporary substrate and comprises five core, interconnected stages that form a complete dissemination loop:

D (Digital Platform): The generative space and infrastructure for communicative activities. Platforms aggregate information, consolidate social relations, and facilitate cultural integration, providing the stage for all digital dissemination.

E (Digital Embodiment): The subjective form of user existence in digital space. Through virtual avatars and digital twins, users gain a sense of presence, extending their subjectivity across time and space.

I (Digital Immersion): The core cognitive mode in digital environments. By utilizing multi-sensory immersive environments, users can deeply perceive and understand foreign cultural content, thereby reducing cognitive load.

C (Digital Credibility): The emotional driver that sustains deeper communication. In virtual interactions, trust built on authentic content, reliable technology, and positive engagement serves as the emotional bond between the user and the ICH content, helping to mitigate the "trust deficit."

A (Digital Alliance): The final mode of action and result that maximizes communicative efficiency. Based on digital trust, dispersed individuals or organizations form unified, collaborative communities (such as fan groups or cross-industry alliances), solidifying and deepening the impact of dissemination.

The D-PEICA model provides a systematic analysis tool for ICH. It shifts the focus from purely technical "skill-showing" to a human-centric experience. By mapping out the journey from infrastructure (Platform) to user experience (Embodiment, Immersion) and finally to social impact (Credibility, Alliance), we can better understand how technology reshapes the image of Liukeng woodcarving.

3. Practical pathways: A deep analysis of AR/VR empowerment based on the D-PEICA model

Utilizing the D-PEICA model as a theoretical framework, we can delineate five core practical pathways for AR/VR technology to empower the communication of Liukeng traditional woodcarving images from Le'an, Jiangxi. These pathways are not isolated; rather, they constitute an organic whole that is intertwined and synergistic.

3.1. Digital platform (D): Building the communication matrix

AR/VR transforms ICH communication into a "Virtual-Real Integration" system. We can build VR Metaverse museums or digital villages where users explore high-precision 3D reconstructions of Liukeng's ancient architecture. AR applications allow users to scan physical artifacts and see intricate woodcarving patterns come to life in 720-degree views, revealing micro-textures and hidden symbolic meanings like "magpies on a plum branch."

3.2. Digital embodiment (E): From spectator to participant

Through avatars, users gain a sense of agency. They don't just "watch"; they "do." In virtual workshops, users can interact with "Virtual Artisan Agents"—AI-powered guides that reflect the cultural tone of the heritage.

3.3. Digital immersion (I): Narrative-driven cultural echoes

Immersion aims for "Flow State." Through VR storytelling, users can witness how a piece of bamboo is transformed across centuries—From the Ming dynasty to the present.

3.4. Digital credibility (C): Anchoring trust in truth

Trust in the virtual world stems from precision. High-fidelity modeling prevents the "Uncanny Valley"

effect, while academic rigor in storytelling ensures cultural integrity.

3.5. Digital alliance (A): Synergizing community power

Finally, the "Digital Alliance" fosters a co-creative ecosystem. Virtual studios invite modern designers to collaborate with ICH inheritors.

4. Critical reflection: Structural tensions and humanistic risks under technological empowerment

While AR/VR technology presents an exhilarating future for the dissemination of Intangible Cultural Heritage (ICH), we must maintain a clear critical awareness. The widespread application of these technologies inevitably triggers a series of profound contradictions and risks. If handled improperly, it may result in "dissemination without genuine transmission"—Where information is spread but the heritage is not inherited—Potentially damaging the authenticity of the ICH. Building upon the warnings provided by researchers Huang Yonglin and Wang Yao, this section provides a detailed analysis using the Liukeng wood carving case.

The Authenticity Paradox:Digital "beautification" may strip away the historical texture and wear-and-tear that gives ICH its soul. De-contextualized AR filters focus on visual spectacle rather than deep cultural meaning.

The Gamification Trap:Traffic-driven algorithms prioritize "shock value" or "entertainment" over cultural depth. Shallow clicks replace lasting cultural identity and respect for the craft's difficulty.

The Sensory Gap:Craftsmanship relies on "tacit knowledge" (hands-on feel). Virtual presence lacks the physical "embodied practice" and human emotional warmth of a traditional master-apprentice bond.

Ethical & IP Conflicts:Who owns a 300-year-old pattern when it's sold as an NFT? Digitalization risks cultural privacy and may aggravate the "digital divide" for communities without tech access.

5. The path forward: Constructing a new paradigm of smart transmission guided by value rationality

Passive avoidance of technology is not the answer. The key lies in constructing a new paradigm of "Smart Transmission" where humanistic values serve as the rudder and digital technology as the sail. This requires collaborative innovation across concepts, strategies, and mechanisms.

5.1. Core concept: Asserting the dominance of "value rationality" over "instrumental rationality"

It must be clarified that in digital ICH dissemination, "technology is the means, while culture is the end." All technological applications should be evaluated based on whether they facilitate the accurate, deep, and sustainable transmission of core cultural values.

5.2. Strategic level: Promoting "virtual-real integration" and "deep engagement"

Virtual-Real Symbiosis: AR/VR designs should include clear "funneling" mechanisms toward offline ICH practices. For example, a VR experience could conclude by prompting users to contact inheritance workshops for real classes or purchase products supervised by masters, creating a closed loop of "Online Recognition – Offline Experience – Online Feedback."

5.3. Mechanism assurance: Building a multi-stakeholder governance and ethical framework

Establishing "Informed Consent and Benefit Sharing" Mechanisms: Before launching digital projects, full consultation with the ICH-holding communities is essential. Legal agreements should clarify copyright, usage scope, and revenue sharing to protect the rights of inheritors.

Enhancing Public Media Literacy and Cultural Consciousness: Through education, we can improve the public's ability to critically appreciate digital content, helping them understand that the true value lies in the real culture behind the flashy virtual experience.

6. Conclusion

This study concludes that while AR/VR technologies revolutionary potential to innovate the communication of Liukeng woodcarving, they must be guided by humanistic reverence. The sound of carving in Liukeng has crossed hundreds of years; whether it can echo through the digital universe depends not just on how advanced the technology is, but on whether we have the wisdom to treat technology as a conductor of cultural life rather than a hollow signifier. Heritage digitalization is not a simple "move to the cloud" but a profound transformation of cultural ontology, epistemology, and methodology.

About the author

Xinhan Jiang(2003.12-), a student at the School of Television, Communication University of China, majoring in journalism and mass communication, with a research focus on the development of new media.

References

- [1] Bennett,W.L., Segerberg,A.The logic of connective action:Digital media and the personalization of contentious politics[M] .Cambridge:Cambridge University Press,2013.
- [2] Fuchs,C.Henri Lefebvre's theory of the production of space and the critical theory of communication[J].*Communication theory*,2019,29(2):129-150.
- [3] Farman,J.Stories,spaces,and bodies:The production of embodied space through mobile media storytelling[J].*Communication Research and Practice*,2015,1(2):101-116.
- [4] Tavory,I. A theory of intersubjectivity:experience,interaction and the anchoring of meaning [J].*Theory and Society*,2023,52:865-884.
- [5] Rousseau,D.M.,Sitkin,S.B.,Burt,R.S. Camerer,C.Not so different after all:A cross-discipline view of trust[J].*Academy of management review*,1998,23(3):393-404.
- [6] Mcknight,D.H.,Carter,M.,Thatcher,J.B., Clay,P.F.Trust in a specific technology: An investigation of its components and measures [J].*ACM Transactions on management information systems(TMIS)*,2011,2(2):1-25 .
- [7] Friedman D.D.Future Imperfect:Technology and Freedom in an Uncertain World [M].Cambridge:Cambridge University Press,2008.
- [8] Pramanik,P.K.D.,Pal,S., Choudhury,P.Mobilecrowd computing:potential,architecture, requirements,challenges,and applications[J].*The Journal of Supercomputing*,2024,80(2):2223-2318.
- [9] Van Dij ck,J.,Poell,T., De Waal,M.The platform society:Public values in a connective world [M].Oxford:Oxford university press,2018.
- [10] Kemp,S.Digital 2024July Global Statshot Report [R].Singapore:Kepios.