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Cultural Heritage Reconstruction in Immersive Technologies: Digital Authenticity, Cultural Dignity and Regulatory Approaches

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Abstract: In the digital era, immersive technologies—including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR)—are profoundly reshaping the preservation and dissemination of cultural heritage. Focusing on *digital authenticity* and *cultural dignity*, this paper explores the theoretical foundations, practical risks, and legal governance mechanisms of immersive cultural heritage reconstruction. While immersive technologies enhance public engagement and cultural accessibility, they also risk distorting historical contexts and cultural meanings, leading to the erosion of digital authenticity and the violation of cultural dignity. By analyzing the limitations of China's *Cultural Relics Protection Law, Copyright Law*, and *Civil Code*, the study proposes a multidimensional governance framework guided by the principles of "Respect First, Public Interest Orientation, and Collaborative Governance." This framework integrates legal enhancement through digital-specific provisions, ethical regulation via participatory guidelines, and technical safeguards through metadata and traceability standards. The research aims to shift the paradigm of cultural heritage protection from a technology-centered to a culture-centered model, contributing to the interdisciplinary integration of digital humanities and legal governance.

Keywords: immersive technology, cultural heritage reconstruction, digital authenticity

1. Introduction

In October 2025, China proposed in its "Recommendations for Formulating the 15th Five-Year Plan for National Economic and Social Development" to "promote the integration of culture and technology, advance the digital and intelligent empowerment and informatization transformation of cultural development, and foster new cultural industries." Digital technology safeguards cultural heritage, providing more robust guarantees, more efficient working methods, and broader dissemination pathways for cultural transmission, cultural lineage construction, and cultural promotion (Jiang, 2024). It has become a vital force in facilitating the flow of content creativity, production, dissemination, and services across all segments of the digital cultural industry, driving technological innovation and restructuring the value system of the digital cultural sector (Song et al., 2024).

In the digital age, immersive technologies such as virtual reality (VR) and augmented reality (AR) are progressively permeating the fields of cultural heritage preservation and dissemination. Empowered by digital technology, the creation of highly interactive, deeply immersive digital environments can expand the accessibility of cultural heritage while offering the public entirely new ways to experience it (Wang & Liu, 2018).

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Influenced by the UNESCO World Heritage protection framework, China's cultural and museum institutions have actively adopted immersive technologies to drive digital transformation and have also actively explored digital preservation of cultural heritage. Legal frameworks such as the Law of the People's Republic of China on the Protection of Intangible Cultural Heritage and the Law of the People's Republic of China on the Protection of Cultural Relics provide robust safeguards for heritage preservation. In May 2022, the General Office of the CPC Central Committee and the General Office of the State Council issued the Opinions on Promoting the Implementation of the National Cultural Digitization Strategy, emphasizing the need to advance the digital transformation and upgrading of all types of cultural institutions.

At the practical level, the Dunhuang Academy in China is leveraging virtual reality technologies such as artificial intelligence (AI), virtual reality (VR), and the metaverse. The project not only grants a form of digital immortality to Dunhuang's ancient artifacts—particularly its murals—highlights the profound depth and diverse fusion of Chinese culture. Additionally, the Palace Museum has continuously enhanced its digital collection capabilities for ancient architecture and artifacts through the “Digital Palace Museum” initiative, building a digital repository of its cultural treasures (the Palace Museum, 2023).

Immersive technologies are regarded as “enabling tools” for cultural heritage preservation, enhancing heritage vitality and appeal through high-fidelity reconstruction and interactive narratives. Yet as technology becomes deeply embedded, issues begin to emerge. First is the erosion of “digital authenticity.” Authenticity in cultural heritage traditionally refers to its materiality and historical continuity, but digital reconstructions often rely on imagination and algorithmic supplementation, leading to distortions. Particularly in VR reconstructions, cultural heritage may become distorted due to technical inaccuracies, creating a sense of unreality for users. Regarding cultural transmission, while immersive experiences offer strong interactivity, poorly designed implementations may oversimplify complex cultural contexts, fostering misunderstandings. Concerning cultural dignity, digital adaptations risk cultural appropriation—such as unauthorized use of ethnic elements or distorted religious symbols in VR—which infringes upon community integrity. These issues stem from the tension between technology and culture, where technology pursues innovation and efficiency, while culture emphasizes authenticity and dignity. Balancing these priorities is a critical challenge in cultural heritage digitization. When using immersive technologies like VR and AR for digital reconstruction, interpretation, and public dissemination of cultural heritage, how can we define and safeguard its “digital authenticity”? When technical “digital adaptations” risk distorting the inherent meaning of cultural heritage, causing cultural misinterpretation, or infringing upon its dignity, can existing intellectual property laws, cultural relic protection laws, and civil codes (such as provisions on personality rights and public interest clauses) provide adequate remedies? What legal and ethical frameworks should be established to regulate such practices?

China's digital preservation of cultural heritage lacks theoretical underpinnings, features few dedicated projects, and maintains an imperfect protection system—lagging behind developed nations (Xu & Ju, 2023). This paper adopts a digital heritage perspective, anchoring its analysis in digital authenticity. By exploring the intersection of digital humanities and law, it advocates for a paradigm shift in digital cultural heritage research—moving from a technology-centric to a culture-centric approach. It offers regulatory recommendations for cultural institutions and policymakers, thereby advancing sustainable cultural heritage preservation.

2. Literature Review

Cultural heritage is broadly conceptualized as encompassing both tangible and intangible elements that safeguard human history and culture, distinguishing it from mere "cultural property" (Prott

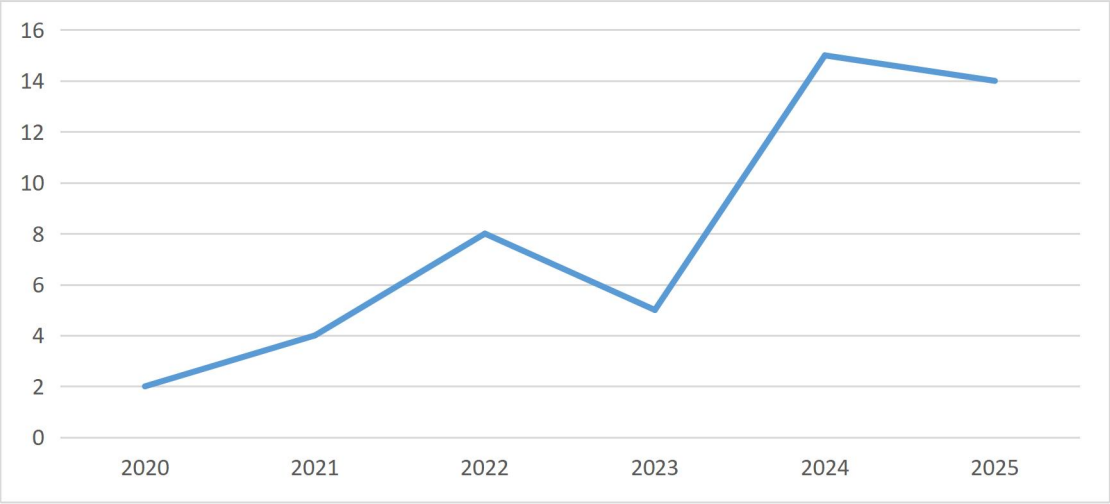
& O'Keefe, 1992). This distinction underscores the intrinsic value of heritage, which extends beyond ownership to include spiritual and societal significance (Harding, 1999; Ding, 2023). Scholars emphasize its role in sustainable development, linking preservation efforts to corporate social responsibility and broader economic strategies (Dowling, 2000; Li & Yu, 2024).

Legal frameworks for cultural heritage address conflicts arising from differing values, such as in land use disputes, and advocate for robust regulatory oversight (Charles, 1998; Harding, 1999). A key tension exists between intellectual property rights and public access, with calls for mechanisms to prevent privatization and ensure equitable digital dissemination (Macmillan, 2013). Ethical responsibilities are paramount in digital reconstructions, where creators must navigate legal and moral obligations to maintain authenticity (Thompson, 2017).

Digitization enhances preservation efficiency and dissemination but introduces risks such as ecosystem weakening, authenticity distortion, and commercialization (Yamada, 2017). It evolves from static to dynamic and living development, following collaborative innovation logic, yet must respect heritage patterns and shift from rescue to holistic approaches (Quan, 2022). Technological advancements, such as AI, digital twins, and linked data, optimize documentation, transmission, and utilization of heritage, driving innovation in digital humanities (Jia, 2020). Libraries play a pivotal role, with policy recommendations urging strengthened digital involvement and learning from international models, such as those in the U.S., Japan, Germany, and New Zealand (Zhao & Tao, 2018; Xu & Han, 2023; Wang et al., 2023, 2025). Comparative studies provide insights for China's efforts, identifying strengths and threats in overseas projects (Yao & Liu, 2022).

In the field of cultural studies, we searched for thesis titles using the keywords “cultural heritage” and “immersive”. The CNKI database shows the following trend in the number of research papers on cultural heritage and immersive experiences as of November 31, 2025.

Table 1: Trends in the Number of Research Papers on Immersive Cultural Heritage



Compiled based on CNKI data

With the widespread application of immersive technologies, the number of research papers on immersive cultural heritage in China has generally shown a gradual upward trend.

3. Core Conceptual Definitions and Theoretical Foundations

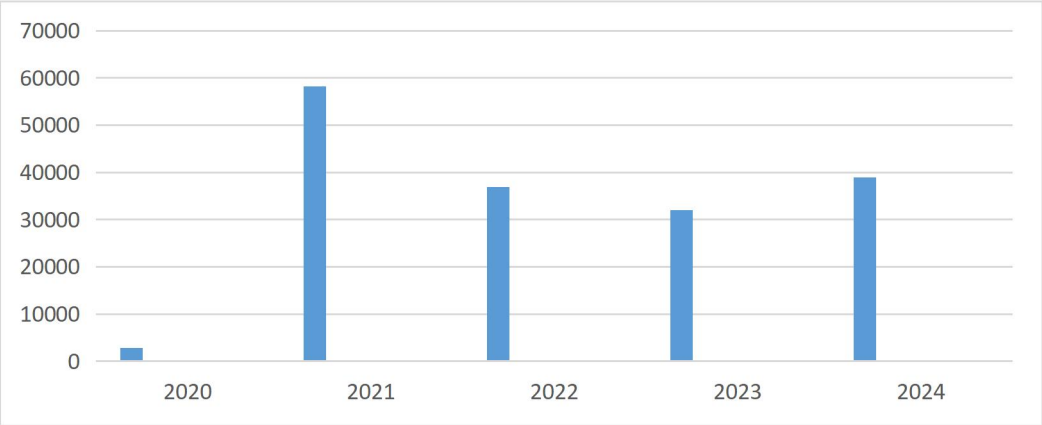
3.1 The essence of immersive technology reconstruction

Immersive Technology refers to extended

reality (XR) technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR), characterized by immersive experiences. By integrating cloud computing, computer graphics, and sensor technology to blend the real and virtual worlds. This creates highly immersive, interactive environments that merge reality and virtuality at the user interface (Zhang, 2025). VR technology enables users to immerse themselves in computer-generated virtual environments and interact with them in real-time through natural means, such as speech and gestures. AR builds upon VR by overlaying virtual digital information onto the real environment, presenting this blended scene through display devices to effectively enhance the user's perception of the real-world surroundings (Zhou & Xu, 2017).

The Beijing Municipal Bureau of Statistics conducted a thematic survey on the application of technology in museum development. Results indicate that over 40% of museums have implemented collection storage environment monitoring systems; 34.4% utilize collection databases and information management systems; and 28.1% employ virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies (Beijing Municipal Bureau of Statistics, 2024). By 2023, China had reached 32,024 immersive experience projects, created nearly 928,000 jobs, and projected an additional 200,000 positions in 2024. Among 26 countries with mature immersive industries globally, China leads worldwide in project volume, consumer market scale, investment size, and total output value (Phantom Realm International Immersive Industry Platform,2024).

Table 2: Number of Immersive Experience Projects in China



White Paper on the Development of China's Immersive Industry

Digital technologies can enhance the documentation, research, and sharing of cultural artifacts and experiences, improving the accessibility and interactivity of cultural heritage, thereby safeguarding it for future generations (Jiang et al., 2025). Unlike traditional heritage preservation focused on physical entities, immersive technologies enable multidimensional digital reconstruction based on historical data and cultural context. Through laser scanning and 3D modeling, they recreate vanished or inaccessible heritage within virtual spaces, allowing the public to experience history without physical contact. Such reconstructions are dynamic and inclusive, emphasizing user participation. This approach not only enhances public engagement and educational impact but also minimizes disturbance to physical heritage sites. It can be said that applying augmented reality, virtual reality, and mixed reality technologies in cultural heritage achieves multiple objectives. By building user-centered presentation systems, these technologies enable digital accessibility to cultural heritage—a value particularly evident when physical access is restricted (Bekele et al., 2018).

3.2 The concept and construction of digital authenticity

3.2.1 The meaning of digital authenticity

Digital Authenticity is a key concept emerging in the fields of cultural heritage preservation and research within the digital era. It refers to the comprehensive, accurate, and credible representation and transmission of a cultural heritage object's historical, aesthetic, scientific, and cultural value achieved through the collection, processing, storage, and reproduction of its information using digital technologies during the digitization process.

Digital authenticity serves as the cornerstone for ensuring the "trustworthy" preservation of cultural heritage in the digital realm. As a systematic endeavor, it transcends mere technical replication, encompassing the entire process from data collection and processing to value interpretation and cultural transmission. It stands as the key benchmark for measuring the professionalism and depth of cultural heritage preservation efforts in the digital age.

3.2.2 Constructing digital authenticity

The digital reconstruction of cultural heritage must adhere to scientific rigor and transparency to ensure digital authenticity. Digital authenticity of cultural heritage must be constructed across four dimensions. First is informational authenticity. Second is contextual authenticity. Third is interpretive authenticity. Fourth is experiential authenticity. Experiential authenticity requires guiding participants during engagement to respect and understand the core values of cultural heritage, remaining vigilant against cognitive illusions that immersive experiences may induce, and strengthening participants' emotional connections.

The construction of digital authenticity faces multiple challenges. From a technical perspective, the precision of digital acquisition, the fidelity of color reproduction, and the integrity of geometric structures directly determine the "fidelity" of digital copies. Any missing or distorted data compromises authenticity. Regarding contextual integrity, the value of cultural heritage lies not only in the artifacts themselves but also in their connections to history, environment, and community. Cultural heritage digitization must integrate associated non-spatial information—such as documentation, oral histories, and traditional knowledge—to form a complete digital archive. Moreover, as cultural heritage itself may undergo constant change, its digital representation should reflect these transformations promptly. For certain sacred or sensitive cultural assets, the accessibility of the digitization process and its outcomes also raises issues of cultural ethics and community-informed consent.

3.3 "Cultural Dignity" as a legal and ethical value

Cultural Dignity, as an interdisciplinary concept originating from philosophical theories of dignity, has gradually evolved into a legal and ethical value (Ding, 2022). In cultural heritage preservation, it emphasizes that heritage is not merely a physical vessel but the spiritual core of a community, integral to identity, historical memory, and spiritual beliefs. As a collective spiritual interest, "Cultural Dignity" demands protection against defamation, distortion, or commercial exploitation. Rooted in the extension of human dignity principles, it is regarded as an embodiment of communal dignity. As a collective right, it safeguards minority cultures from erosion by dominant cultural forces. Cultural dignity holds both legal and ethical value. As the foundational principle for safeguarding cultural rights, it can be translated into concrete constitutional principles, administrative law protection standards, digital copyright systems, public policy responsibilities, and benefit distribution mechanisms. As a normative orientation toward justice, respect, and coexistence, it demands respect for cultural subjects, participatory design, and opposition to digital colonization and cultural hegemony in digitalization projects (Wang, 2014).

4. Analysis of Practical Risks and Infringement Patterns in Immersive Reconstruction of Cultural Heritage

4.1 Patterns of infringement against digital authenticity

The conflict between digitization and authenticity manifests in the inability to faithfully preserve and transmit the original state of cultural heritage during its protection through digital

technologies. This leads to risks of cultural distortion, alienation, or even distortion of its expressive forms during digitization (Song & Wang, 2015). As the core value of immersive reconstruction, "digital authenticity" is compromised through distortions of historical information and cultural context. This stems from developers' arbitrary data processing or commercially driven exaggerations, causing virtual representations to deviate from the essential characteristics of cultural heritage.

The practice of "magically modified" reconstructions of ancient architecture in virtual reality (VR) or adding non-existent, flashy effects to cultural relics in augmented reality (AR) applications not only undermines the accuracy of information but may also foster public misconceptions, thereby jeopardizing the sustainability of cultural heritage preservation. When digitally reconstructing historical sites, developers often arbitrarily incorporate modern elements to enhance visual appeal, disregarding the rigor of archaeological data. This results in virtual models that contradict historical evidence. Without thorough historical verification, developers "beautify" original structures through restoration, adding decorative elements that never existed. Such "magic modifications" not only violate transparency requirements for digital heritage visualization but also distort public perceptions of cultural heritage value. These virtual environments fail to accurately convey historical contexts, compromising contextual authenticity and disconnecting user experiences from real-world settings.

The manifestations of digital authenticity violations reveal the risks inherent in immersive reconstructions that prioritize innovation over authenticity. The solution lies in establishing standardized protocols requiring developers to disclose data sources and algorithmic details to ensure the objectivity of digital reproductions. This not only helps prevent distortion but also provides actionable grounds for legal regulation. Specifically, it is essential to clearly distinguish between different types of digital technology applications and their levels of intervention. Priority should be given to non-intrusive, high-fidelity recording techniques, and digital storage of intangible cultural heritage resources must be accompanied by detailed metadata to ensure technological applications align with the fundamental purpose of cultural preservation.4.2 Forms of "Cultural Dignity" Infringement: Spiritual Violations and Rights Imbalances in Digital Reconstruction

As the spiritual interest of cultural communities, "cultural dignity" centers on preserving the integrity of communal identity, historical memory, and belief systems. In recent years, with the widespread application of immersive reconstruction technology in cultural heritage preservation, new forms of "cultural infringement" have emerged. Developers' commercial or entertainment-driven reinterpretations of culture have led to the flippant treatment of sacred cultural elements, undermining cultural dignity. This phenomenon not only disrupts the spiritual order of communities but also risks exacerbating cultural inequalities.

As an inevitable trend in the technological era, cultural heritage digitization has indeed expanded the reach of cultural dissemination and enhanced preservation stability. However, it simultaneously introduces potential ethical risks. Cultural dignity emphasizes the autonomy, integrity, and sacredness of cultural subjects in their transmission. If the digitization process lacks cultural sensitivity and ethical constraints, cultural content risks being instrumentalized, fragmented, or even decontextualized, thereby diminishing its spiritual value and social significance. When digitization prioritizes visibility over meaning, culture risks becoming soulless digital specimens (Peng, 2020). Technology's "manifestation power" cannot replace culture's "intrinsic depth." Protecting cultural dignity must transcend the level of technological presentation and focus on the dimension of cultural self-understanding.

The logic of digital commercialization further amplifies the risk of infringing upon "cultural dignity." When cultural heritage becomes replicable digital products, its economic value is prioritized for

extraction, while cultural stakeholders struggle to share in the profits. The virtual reconstruction of North American Indigenous totem ceremonies exemplifies this issue. Developers adapted sacred rituals into interactive games where users could "participate" through virtual avatars or even modify ceremonies to "complete levels." This approach disregarded the rituals' sanctity, commodifying them into entertainment products and severely infringing upon Indigenous communities' cultural dignity. Similar occurrences emerged in Australian Aboriginal heritage digitization projects, where some content was publicly released without community consent, leaving communities feeling stripped of their identity (Wagner & de Clippele, 2023). Manžuch (2017) further notes that digitalization processes excluding community participation often reinforce biases and dominant discourses, undermining cultural autonomy among minority groups.

4.2 Conflicting interests

In immersive reconstruction practices, a complex dynamic tension exists among technological innovation freedom, public right to know, cultural dignity rights, and commercial development rights. On one hand, technological innovation expands possibilities for cultural heritage representation; on the other, unrestrained innovation may infringe upon cultural dignity or exacerbate social inequality. This clash of multiple rights constitutes a core ethical challenge in digital cultural governance.

(1) The Antagonism Between Technological Innovation, Freedom and the Right to Cultural Dignity. Technological innovation freedom emphasizes breakthroughs and experimentation, yet in the cultural heritage domain, its boundless expansion often conflicts with the right to dignity.

(2) The tension between public access rights and commercial development rights. Public access rights demand that digital cultural heritage resources be as open as possible, while commercial development rights impose access restrictions based on market logic.

(3) Ethical Balance Between Cultural Dignity and Public Access Rights. In the digital reconstruction of tragic sites and conflict memories, the right to cultural dignity often conflicts with the right to information.

(4) Synergy and Risks Between Commercial Development Rights and Technological Innovation Freedom. Commercial development rights and innovation freedom exhibit a mutually reinforcing relationship in the digital cultural sphere. However, without regulation, both may jointly infringe upon cultural authenticity and social justice.

5. Current Legal Regulatory Challenges

The application of immersive technologies in cultural heritage reconstruction signifies a paradigm shift in heritage preservation within the digital age. This reconstruction involves not only technological innovation but also raises profound legal regulatory challenges. China's current laws and regulations, primarily designed for physical heritage entities, face significant applicability dilemmas when addressing issues of digital authenticity and cultural integrity due to the instability and lag in regulatory frameworks.

As China's core legislation for cultural heritage protection, the Cultural Heritage Protection Law adheres to the principle of "prioritizing protection, emphasizing rescue, promoting rational utilization, and strengthening management." While Article 17 stipulates that the state shall enhance information infrastructure for cultural heritage protection, encourage digital preservation efforts, and advance the digitization, collection, and utilization of cultural resources, the law primarily regulates physical artifacts. Consequently, it struggles to effectively cover reconstruction activities within the digital domain. When cultural heritage is digitally reconstructed through immersive technologies such as VR/AR, this requirement for "integrity" becomes difficult to apply directly.

While the Copyright Law provides some protection for digital expressions, its limitations lie in failing to cover historical facts themselves and cultural values. The ambiguity surrounding the

boundaries of "fair use" further exacerbates application challenges. The core of this law is to protect works possessing originality (Article 3 of the Copyright Law). In immersive technology reconstructions, digital models or virtual scenes possessing originality (e.g., unique 3D modeling designs) may qualify for copyright protection. However, the law explicitly excludes "mere factual information" (Article 5 of the Copyright Law), leaving historical facts within cultural heritage (e.g., ancient architectural structures) and cultural values (e.g., ethnic symbols) without explicit protection. In digital reconstruction projects, while virtual models based on historical facts may protect their expressive forms, the factual core remains freely usable by others, leading to dilution of cultural authenticity (Wei & Wei, 2022). Furthermore, the "fair use" provision (Article 24 of the Copyright Law) permits use for personal study, research, and similar purposes, yet its boundaries remain ambiguous. In commercial immersive experiences, defining what constitutes "fair" use is challenging, often triggering infringement disputes. In judicial practice, the absence of established criteria for assessing originality in digital cultural heritage often leads courts to rely on subjective judgments in cases, further amplifying regulatory uncertainty. This not only fails to safeguard cultural dignity but may also encourage commercial abuses in the digital realm, such as unauthorized virtual tourism products.

Under the legal protection model for property rights, intangible cultural heritage (ICH) digitization outcomes are treated as objects of property rights. Recognizing that ICH digitizers hold exclusive rights to these outcomes enables them to exercise exclusive utilization and free disposal of such outcomes according to their own free will. This enhances the rights holders' control over ICH digitization outcomes and their sense of stewardship (Fei & Qin, 2023). While the "public order and good morals" principle in the Civil Code may serve as a catch-all provision, it lacks specific criteria for judgment and thus struggles to effectively fill the gaps in the aforementioned laws.

The current domestic legal framework faces significant challenges in regulating immersive technology applications for cultural heritage reconstruction, primarily manifested as regulatory gaps, outdated provisions, and inadequate enforcement mechanisms. Regulatory gaps manifest in the absence of mechanisms to safeguard digital authenticity and cultural integrity; outdated provisions stem from legislation failing to anticipate rapid digital advancements; and weak enforcement arises from fragmented judicial practices and inconsistent standards. These challenges not only hinder the sustainable utilization of cultural heritage but also amplify ethical risks in the digital realm. Urgent legislative amendments or judicial interpretations are needed to address these shortcomings and meet the protection demands of the digital age.

6. Establishing a Multi-Dimensional Collaborative Regulatory Framework

6.1 Legal framework: enhancing statutory rules

In the digital era, the reconstruction of cultural heritage often involves the interplay of multiple legal dimensions—including intellectual property rights, privacy rights, and cultural rights—necessitating a dual approach of interpretive and legislative pathways to activate existing laws and drive new regulations.

Interpretive Approach. As the foundation of China's civil law, Article 8 of the Civil Code explicitly stipulates that civil subjects must not violate public order and good morals in their activities. This provision holds broad applicability in the cultural heritage domain, particularly addressing potential violations of cultural dignity within immersive technologies. When reconstructing ethnic minority cultural heritage in virtual reality (VR) environments, unauthorized modifications of cultural symbols by developers that lead to misinterpretation or offensive representations may be deemed violations of public order and good morals.

Legislative Approach. It is recommended that the revised Cultural Heritage Protection Law (2024)

include a dedicated clause on "Digital Utilization of Cultural Heritage," clearly defining prohibited unauthorized digital tampering, commercial misuse, or virtual simulations involving sensitive cultural content. It should also ban the addition of fictional elements in digital reconstructions without source attribution to uphold digital authenticity.

Whether digitized cultural heritage constitutes a work under copyright law hinges on whether the outcome possesses originality (Shao, 2014). Supreme People's Court Guiding Case No. 80: Copyright Infringement Dispute between Hong Fuyuan and Deng Chunxiang v. Guizhou Wufufang Food Co., Ltd. and Guizhou Jincai Ethnic Culture R&D Co., Ltd. (Guiyang Intermediate People's Court of Guizhou Province (2015) Zhu Zhi Min Chu Zi No. 17) The ruling holds that where the expression of a derivative work based on folk literature and art is independently created and possesses originality, and meets the characteristics of a work protected under copyright law, the author shall be deemed to hold copyright over the original portions.

6.2 Ethical dimension: establishing soft law principles

Ethical regulation employs flexible norms to guide self-discipline among actors, serving as a supplement to hard law. In immersive technologies, ethical issues often involve subtle infringements on cultural dignity, such as embedded biases in digital reconstruction or neglect of community rights. Establishing soft law principles can foster ethical awareness through industry guidelines and review mechanisms.

Advocate for the development of the "Ethical Guidelines for Cultural Heritage Digitization," establishing a "pre-ethical review" mechanism that mandates consultation with relevant experts and stakeholder communities for significant projects.

6.3 Technical level: embedding regulatory standards

Technical regulation focuses on embedding norms at the tool level, ensuring compliant application of immersive technologies through standardization. This not only safeguards users' right to know but also preserves digital authenticity, preventing cultural distortion caused by technological misuse.

Promote the establishment of industry technical standards requiring digital reconstruction projects to provide "metadata annotations" that clearly label which parts are authentic, speculative, or derived, safeguarding users' "right to know." Metadata descriptions must be embedded within digital files.

A multidimensional collaborative regulatory framework forms a closed-loop governance system through legal enforcement, ethical guidance, and technological embedding. This framework not only upholds the dignity of cultural heritage but also fosters sustainable innovation in immersive technologies.

7. Conclusion

Immersive technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) play a double-edged role in cultural heritage reconstruction. On one hand, they offer innovative pathways for heritage preservation and dissemination, breathing new life into inaccessible sites through digital reconstruction while enhancing public engagement and educational impact. On the other hand, they pose significant challenges, including potential distortions of digital authenticity and risks of infringing upon cultural dignity.

Within China's current legal framework, the Cultural Heritage Protection Law emphasizes heritage preservation but contains vague provisions on digital utilization, failing to effectively address emerging risks such as digital tampering or privacy violations. Traditional principles of intellectual property law struggle to adapt to the complexity of virtual reality experiences in the digital age, necessitating a balance between innovation and protection.

This study primarily focuses on domestic Chinese cases, which, while representative, fail to encompass diverse global contexts—such as intangible cultural heritage digitization practices in Africa or Latin America—potentially introducing

regional biases in conclusions. In ethical discussions and practical implementation, community diversity and divergent opinions complicate consensus-building. While addressing legal, ethical, and technical dimensions, the study incorporates limited economic or psychological perspectives, hindering a comprehensive assessment of user behavior on regulatory outcomes. These limitations offer avenues for future research refinement. The future of cultural heritage reconstruction lies in balancing innovation with humanistic care, achieving sustainable preservation and transmission through multidisciplinary collaboration.

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Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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Phantom Realm International Immersive Industry

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