Digital Preservation, Inheritance, and Innovative Development of Intangible Cultural Heritage from the Perspective of Metaverse

Bing Yu[1,a], Jing Sun[1,b,*], Zhaoxing Wang[1,c], Sanfeng Jin[1,d], Panpan Bai[1,e]

[1]College of Landscape Architecture and Art, Northwest A&F University, Yangling, China
a. yubing@nwafu.edu.cn, b. sj2011@nwafu.edu.cn,
c. cherry9990223@163.com, d. 1045842021@qq.com, e.2275319915@qq.com
*corresponding author

Abstract: With the rapid change of meta-universe technology, the digital inheritance of intangible cultural heritage（ICH）shows unprecedented broad prospects, and injects new vitality into the inheritance and development of ICH. Aiming at the multiple challenges in the process of digital inheritance of ICH, this paper explores in depth the specific application of meta-universe technology in ICH, and proposes a series of innovative strategies such as the digital inheritance of visual language, the construction of immersive experience, the protection of free creation and copyright, and the construction of panoramic interactive venues. These strategies provide a new perspective and practical methodology for the digital inheritance of intangible heritage, and at the same time make a positive contribution to the promotion of the continuous prosperity and innovation of intangible heritage culture. This paper is committed to providing solid theoretical support and practical guidance for the protection, inheritance and innovation of ICH, so as to help ICH culture to be revitalized in the digital era.

Keywords: meta-universe, intangible cultural heritage, digital heritage and innovation, digital heritage

1. Introduction

With the rapid progress of science and technology, metaverse, as an emerging technological platform, brings unprecedented opportunities for the protection and transmission of intangible cultural heritage (ICH) with its highly immersive and interactive characteristics [1]. The uniqueness of metaverse lies in its ability to break the limitation of physical space and provide a brand new dimension for the display and dissemination of ICH [2]. The introduction of metaverse technology is especially important in the context of intangible cultural heritage facing serious challenges such as the loss of traditional skills and low public participation.

This study aims to investigate the use of meta-universe technology in the ICH, emphasizing its distinctive and inventive nature in safeguarding ICH. In order to effectively address the current issues facing ICH and encourage the widespread dissemination and creative development of it, it is necessary to integrate modern scientific and technological means in order to contribute new ideas and

methods for the digital intangible cultural heritage. This will ensure that ICH can be inherited for a long time and glow with new luster.

2. Overview of the Metaverse and the Current State of Digitization of Intangible Cultural Heritage

2.1. Overview of the metaverse

The cutting-edge technologies of Virtual Reality (VR), Augmented Reality (AR), and Blockchain, when combined, create a highly realistic, interactive, and rich virtual realm, form the foundation of the Metaverse, an emergent idea in the digital era [3]. The fundamental feature of the metaverse is its extreme scalability and openness, which allows users to freely explore, create, and interact with one another, creating a whole new social and entertainment environment. The meta-universe also offers businesses and brands hitherto unheard-of marketing and promotion avenues, greatly enhancing their commercial value. From a more macroscopic perspective, the creation of the metaverse transforms the domains of digital culture, education, and entertainment in addition to offering users a brand-new virtual environment with previously unheard-of experiences.
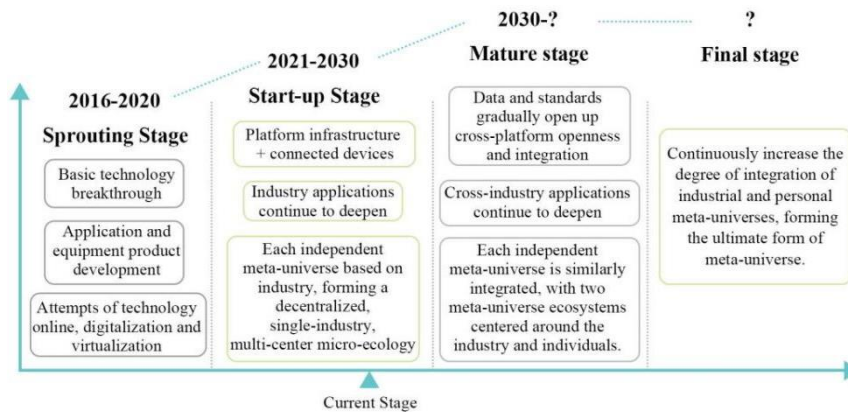

Figure 1: Development Stages of the metaverse

2.2. Current situation of digital intangible cultural heritage

At present, the digital preservation of intangible cultural heritage has surpassed the conventional methods of archiving and static display, and has started to extensively incorporate advanced technologies such as the metaverse [4]. This shift presents fresh prospects for advancement, yet it also entails a range of technical and cultural hurdles.

At the level of digital heritage of visual language, there is the core problem of how to ensure high precision of data collection, high simulation of model construction, and high efficiency of data storage and access; at the level of immersive experience construction, there is the key problem of how to create a virtual environment with high realism, provide colorful interactive experiences, and ensure broad compatibility and popularity of the technology; at the level of creation and copyright protection, there is the problem of how to provide a convenient creative platform while at the same time providing a convenient and convenient platform for creation. At the level of creation and copyright protection, there is the challenge of how to provide a convenient creation platform while guaranteeing the reliability of copyright authentication and the fairness of economic returns for non-legacy digital content; at the level of construction of panoramic and interactive venues, there is the challenge of how to maintain the sustainability of the venues, enhance the user experience, and successfully incorporate socialization and gamification elements into them.

3. Connections between Metaverse and the Digital Preservation of Intangible Cultural Heritage

With the swift advancement of metaverse technology, its fusion with the digital preservation of Intangible Cultural Heritage (ICH) is becoming increasingly intertwined[5], showcasing a noteworthy alignment. The ensuing discourse provides a comprehensive examination of how the metaverse breathes fresh vitality into the digital preservation of ICH through the lenses of technological amalgamation, innovation in cultural experiences, and reshaping of inheritance methodologies.

3.1. Innovative potential of technology convergence

The core of meta-universe technology is comprised of advanced technologies like virtual reality (VR), augmented reality (AR), and blockchain, demonstrating unparalleled innovative potential for the digital preservation of Intangible Cultural Heritage (ICH)[6].

The amalgamation of these state-of-the-art technologies delivers fresh and robust technical backing for safeguarding and passing on ICH. More specifically, VR technology can faithfully recreate historical settings of intangible heritage endeavors, enabling users to sense a journey across time and space to savor the distinctive allure of ICH; AR technology adeptly merges non-heritage elements into the real world surroundings, fostering a more immersive and authentic interactive encounter for users; while blockchain technology ensures secure storage and dependable transactions of non-heritage digital assets, furnishing a solid assurance for the legacy of non-material cultural traditions. By ensuring the secure storage and reliable transactions of intangible heritage digital assets, blockchain technology offers a firm guarantee for the preservation of ICH . This integration not only substantially enhances the efficiency and impact of intangible heritage digital preservation but also presents limitless prospects for the innovation and advancement of ICH.

3.2. Deep innovation in cultural experiences

The meta-universe introduces profound innovation in cultural experiences for the digital preservation of intangible cultural heritage[3]. In the Metaverse virtual environment, users can explore the virtual settings of Intangible Cultural Heritage using VR devices, engage with ICH inheritors in real-time, and develop a deeper comprehension of their creation processes and cultural significance. This immersive encounter allows users to perceive the essence of culture more instinctively and profoundly, thus enhancing their awareness and insight into intangible cultural heritage. Moreover, through the utilization of AR technology, Metaverse effectively integrates elements of intangible cultural heritage into everyday life scenarios, providing users with a richer cultural experience. These novel methods of cultural immersion not only pique users' keen interest in intangible cultural heritage but also pave the way for its wider dissemination and promotion.

3.3. Revolutionary Change in the Heritage Model

Meta-universe technology has led a revolutionary change in the transmission mode of intangible cultural heritage. The traditional inheritance mode is limited by oral transmission and face-to-face teaching, while meta-universe technology breaks this limitation and gathers user groups interested in intangible cultural heritage by means of socialization, forming a virtual community of inheritance. In this community, users can share their experiences and learning results, and have in-depth communication and interaction with other users, so as to jointly promote the inheritance and development of intangible heritage culture. At the same time, Yuan Universe also attracts young users to participate in the inheritance through gamification, designing interesting and challenging game

tasks and reward mechanisms to stimulate users' interest and motivation in learning, so as to make the inheritance of intangible cultural heritage more vivid and interesting[7]. This socialization and gamification mode of inheritance not only expands the channels and audience scope of ICH inheritance, but also injects new vitality into its cultural inheritance.

4. Digital Inheritance Strategies of Intangible Cultural Heritage under the Perspective of Metaverse

4.1. Digital Preservation and Inheritance of Visual Language

In the realm of safeguarding and preserving intangible cultural heritage, the digitization of visual language, serving as its fundamental component, not only forms the basis for the effective continuation of ICH, but also exemplifies a profound integration of contemporary technology and traditional culture. Employing a range of state-of-the-art technological tools, the digital preservation of ICH visual language is accomplished with the substantial support of metaverse technology. Initially, utilizing 3D reconstruction technology within the Metaverse, alongside high-precision tools like laser scanning and photogrammetry, meticulous data collection of the ICH project is conducted. This procedure precisely captures crucial visual aspects of ICH such as shape, color, and texture, establishing a comprehensive and precise database for subsequent digital model construction. Subsequently, sophisticated 3D modeling software is employed to intricately craft models and map textures based on the collected data, resulting in the successful creation of highly realistic digital representations of ICH. These digital models are presented in a multi-dimensional manner within the meta-universe's virtual space, enabling users to fully appreciate the distinctive allure of ICH. Users can engage in interactive experiences, including traversing virtual reality environments and engaging in dialogues with virtual characters, significantly enhancing their overall involvement.

The digital inheritance approach to visual language transcends the constraints of physical space and time in ICH preservation. Users are liberated from geographical and temporal limitations, allowing them to access these digital models via the meta-universe platform at any time and from any location. This access provides a thorough insight into the historical lineage, intricate artisanship, and profound cultural significances of ICH. Additionally, this approach furnishes robust technical backing for ICH preservation, guaranteeing the enduring safeguarding of ICH through digital archiving and dissemination, thereby bequeathing a valuable cultural legacy to forthcoming generations.

4.2. Constructing Immersive Intangible Cultural Heritage Experiences

With the support of metaverse technology, users can deeply engage with and participate in the immersive experience of intangible cultural heritage. This technology allows for the creation of virtual environments closely mirroring real cultural scenes. Through the use of Virtual Reality (VR), users can fully immerse themselves in these virtual worlds, experiencing the authentic atmosphere of cultural heritage projects in great detail[8]. The high level of simulation provided by VR technology enables users to observe and interact with intricate aspects of cultural projects, such as the shapes, colors, and textures of traditional crafts. Additionally, the integration of sound, light, and video further enriches the cultural experience, allowing users to interact with virtual heritage practitioners, gaining insights into the production processes and cultural significance of intangible cultural heritage. Augmented Reality (AR) technology enhances this experience by overlaying virtual elements onto the real world, offering users a more natural and interactive encounter with cultural heritage. For instance, when attending a traditional craft exhibition, users can utilize AR devices to explore the production processes, historical contexts, and other relevant information, providing a seamless integration into the world of intangible cultural heritage.

In order to further enhance the user's immersive experience, it is also necessary to combine the characteristics and historical allusions of regional intangible cultural heritage, and craft various types of ICH classic storylines or skill demonstrations. These contents not only enrich the form of expression, but also strengthen the visual perception of the stage content expression by means of technological empowerment. For example, by utilizing advanced technologies such as naked-eye 3D technology, holographic and sensing technology, AR and mixed reality (MR), an immersive stage that interacts with the stage virtual simulation in real time has been constructed on the building of the existing venue. This kind of stage can bring all-round sensory stimulation to users, making them feel as if they have traveled through time and space, and are in the historical river of intangible cultural heritage, deeply feeling its profound heritage and unique charm.

4.3. Promoting freedom of creation and strengthening copyright protection mechanisms

Stimulating user creativity and imagination through rich creative tools and platform support is crucial in advancing the innovative development of Intangible Cultural Heritage (ICH). Firstly, the establishment of ICH creation communities or professional platforms is vital to provide users with services like material libraries of intangible cultural elements and expert creation guidance. These platforms enable users to freely generate digital content tied to ICH, including unique digital artworks, captivating gaming environments, and realistic virtual characters.These creations significantly enhance the digital representation of ICH while offering users a wide platform to showcase their talents and share creative ideas. Secondly, alongside promoting free creation, it is essential to establish a robust copyright protection framework to safeguard the intellectual property rights of ICH. Leveraging advanced blockchain technology for decentralized copyright registration and authentication services for digital ICH content is crucial. This initiative ensures that every creative work is safeguarded by transparent and equitable rights, effectively protecting the lawful interests of creators.Moreover, the creation of an exclusive digital content trading platform for intangible cultural heritage not only facilitates broad dissemination and market consumption of ICH but also provides creators with economic opportunities. This, in turn, further encourages their creative drive and motivation.

4.4. Construction of panoramic interactive venues

The construction of panoramic interactive venues in the meta-universe can provide a virtual perpetual carrier and interactive space for the inheritance of intangible cultural heritage, and realize the long-term preservation and wide dissemination of ICH. First of all, it is necessary to conduct in-depth research and data collection on ICH projects[9]. First-hand information on ICH is obtained through reviewing literature, field visits and expert interviews, etc., so as to comprehensively understand its historical background, cultural connotations and production process, etc., and lay a solid foundation for the construction of the subsequent panoramic interactive venue.Secondly, after fully understanding the detailed information of the ICH project, the advanced 3D modeling and virtual scene construction technology is used to present this precious information to the users in the form of panoramic interactive. The unique shape and fine structure of the ICH project are truly restored through accurate 3D modeling, while the virtual scene construction technology can perfectly integrate these models into a realistic virtual environment. The perfect combination of these two technologies will create a lifelike ICH virtual world for users.Finally, the construction of panoramic interactive venues lies not only in the use of technology, but also in the design of user experience. In order to allow users to deeply understand the connotation and value of intangible cultural heritage, a rich variety of interactive links can be designed in the venue. For example, users can freely explore the production process of ICH projects in the venue and experience the charm of traditional skills through

virtual operation. Panoramic interactive venues also need to combine socialization and gamification elements to attract more users to participate in the inheritance and interactive experience of intangible cultural heritage. For example, virtual tour guides and interactive games are set up so that users can have fun and gain from interacting with ICH.

5. Conclusion

This paper discusses in depth and systematically the innovative strategies of visual language digital inheritance, immersive experience construction, free creation and copyright protection, and the construction of panoramic interactive venues. These strategies effectively break through the inherent limitations of traditional intangible cultural heritage transmission in physical space and time. This study not only provides new ideas and methods for the digital inheritance of intangible cultural heritage, but also provides solid theoretical support and practical guidance for its protection, inheritance and innovation. Although this paper has achieved significant results in the theoretical aspect, the discussion of empirical research is still insufficient. In the future, we will continue to pay attention to the development of meta-universe technology and explore more application scenarios of meta-universe technology in the inheritance of intangible cultural heritage[10], with a view to making a greater contribution to the protection, inheritance and innovation of ICH, and to promote its continuous prosperity and development in the digital era.

References

[1] WANG, X. 2024. Research on the Protection and Dissemination of Intangible Cultural Heritage with Regional Cultural Characteristics in Shaanxi under the Background of Big Data. Applied Mathematics and Nonlinear Sciences, 9.

[2] CHERNBUMROONG, S., WORRAGIN, P., WONGWAN, N., INTAWONG, K., HOMLA, P. & PURITAT, K2024. Digitization of myth: The HimmapanVR Project's role in cultural preservation. Heliyon, 10, e30052.

[3] Innocente, C., Nonis, F., Lo Faro, A., Ruggieri, R., Ulrich, L., & Vezzetti, E. (2024). A Metaverse Platform for Preserving and Promoting Intangible Cultural Heritage. Applied Sciences-Basel, 14(8), 14.

[4] Zhao, X., Elahi, E., Wang, F., Xing, H., & Khalid, Z. J. H. (2024). Sustainable tourism development for traditional Chinese drama's intangible cultural heritage. 10.

[5] Wang, W. Y., & He, Y. (2023, Jul 23-28). Study on the Digital Inheritance Path of Oral Literature Intangible Cultural Heritage A Case Study of Minnan Nursery Rhymes. Paper presented at the 12th International Conference on Design, User Experience, and Usability (DUXU) Held as Part of the 25th International Conference on Human-Computer Interaction (HCII), Copenhagen, DENMARK.

[6] Schmitt, T. M. (2008). The UNESCO Concept of Safeguarding Intangible Cultural Heritage: Its Background and Marrakchi Roots. International Journal of Heritage Studies, 14(2), 95–111.

[7] Wang, M. K., & Lau, N. (2023). NFT Digital Twins: A Digitalization Strategy to Preserve and Sustain Miao Silver Craftsmanship in the Metaverse Era. Heritage, 6(2), 1921-1941. doi:10.3390/heritage6020103

[8] Kandil, M. (2023). The Role of Museums in Safeguarding Intangible Cultural Heritage Through Documentation Practices.

[9] McLaren, A. E. (2011). Eco-sites, Song Traditions and Cultural Heritage in the Lower Yangzi Delta. Asian Studies Review, 35(4), 457-475. doi:10.1080/10357823.2011.628276

[10] Giovannini, E. C., & Bono, J. (2023, Jun 25-30). CREATING VIRTUAL REALITY USING A SOCIAL VIRTUAL ENVIRONMENT: PHYGITAL EXHIBITION AT THE MUSEUM PASSION IN SORDEVOLO. Paper presented at the 29th CIPA Symposium on Documenting, Understanding, Preserving Cultural Heritage - Humanities and Digital Technologies for Shaping the Future, Florence, ITALY.