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An Exploration of the Dynamic Inheritance Path of Intangible Cultural Heritage Enabled by the Metaverse

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Abstract: This paper briefly analyzes the difficulties faced by the inheritance of intangible cultural heritage, and discusses how the meta-universe can provide assistance for the inheritance of intangible cultural heritage through its digital intelligent inheritance technology characteristics. As an important trend of the development of Web3.0, the meta-universe will have a profound impact on the structure of human society. The meta-universe uses technical logic such as virtual reality and virtual-real integration, as well as the content creation mode of open editing, to open up a new path for the inheritance of intangible cultural heritage. From the strategic planning, to the construction of immersive experience platform, from the innovative “cloud” tour mode, to the creation of meta-universe virtual performance, and then to the shaping of virtual “inheritors” and the construction of diversified business models, we have deeply discussed the development strategy and implementation path of intangible cultural heritage living inheritance.

1. Introduction

Intangible Cultural Heritage (abbreviated as "ICH") is like the pearls that have traveled through time from the vast starry sky, each one bearing the profound memory and soul essence of a nation and people. However, in this era of rapid change, society is like a river that never stops flowing, and modern communication technologies are like hurricane waves that sweep through every corner. This unprecedented transformation brings unlimited possibilities and opportunities, but also brings unprecedented challenges and crises to the inheritance of intangible cultural heritage. In policy documents such as the "Fifth Five-Year Plan for Non-material Cultural Heritage Protection" [1] and "Opinions on Promoting the Implementation of the National Cultural Digitalization Strategy," [2] China has explicitly encouraged the full use of modern technological means to preserve, protect, inherit, and disseminate intangible cultural heritage. The current situation of intangible cultural heritage protection and inheritance is facing obstacles, and the core of digital technology-based metaverse provides more possibilities and implementation paths to solve this problem. Therefore, we must have a more determined resolve and innovative means to protect this precious cultural heritage [3]. With the rapid development of digital technology, human society has entered a new digital era, and the concept of metaverse has emerged, regarded as an important trend and development direction of Web3.0 era. The metaverse integrates augmented reality (AR), virtual

reality (VR), blockchain and other emerging technologies to create a new space where virtual and reality interact, providing a new perspective and approach for the inheritance and display of intangible cultural heritage. In this multi-dimensional space, not only can cultural heritage be digitally twinned and projected onto reality, but also the real and virtual can be fused to promote the dynamic transmission and innovative re-creation of cultural heritage, thereby exerting a profound influence on the social cultural landscape [4].

2. Dilemmas in the Inheritance of Intangible Cultural Heritage

Intangible cultural heritage refers to the forms of expression, representations, expressions, knowledge, and the tools, objects, crafts, and cultural spaces associated with them, transmitted by communities, groups, and individuals. These heritages not only embody diverse cultural expressions and historical accumulations but also constitute important parts of cultural identity and memory for various communities. According to the definition in the Convention for the Safeguarding of the Intangible Cultural Heritage, intangible cultural heritage can be divided into oral traditions and expressions, including language as a vehicle of the intangible cultural heritage, performing arts, social practices, rituals and festive events, knowledge and practices concerning nature and the universe, and traditional craftsmanship. [5] With the development of society, intangible cultural heritage faces the crisis of being forgotten, disappearing, or degenerating, making its protection and inheritance particularly challenging. Traditional inheritance methods mainly rely on oral transmission or direct teaching between master and apprentice, which poses the risk of broken inheritance chains and is not conducive to the long-term protection of intangible cultural heritage. The aging of intangible cultural heritage inheritors and the lack of interest among the younger generation in intangible cultural heritage result in insufficient inheritance forces and the emergence of a fault line. The techniques of intangible cultural heritage are complex, with long learning cycles and high difficulty in skill inheritance, making it difficult to inherit on a large scale through traditional methods of oral transmission and heart-to-heart teaching. The demand for intangible cultural heritage products in the market is declining, and the link between market demand and economic benefits is insufficient, leading to insignificant economic benefits and difficulty in maintaining the livelihoods of inheritors. Many forms of intangible cultural heritage, such as opera and local folk culture, can only be displayed on specific occasions and in specific regions, limiting their reach to local communities and hindering widespread dissemination. Moreover, intangible cultural heritage is not only spatially constrained but also temporally limited, such as festivals held at specific times, which cannot continuously attract people's attention. In terms of transmission methods for intangible cultural heritage, many rely on oral transmission, oral instruction, book records, or physical displays. Although some forms of intangible cultural heritage have incorporated new media and established digital museums for exhibition, the lack of innovation and interactivity fails to captivate the interest of the Z generation, the digital natives, and many intangible cultural heritage projects still lack sufficient exposure on online channels.

3. The Dilemma of Inheritance of Intangible Cultural Heritage

From the outset of its proposal, the concept of the Metaverse has garnered extensive attention and in-depth discussion. As its technical characteristics continue to evolve and mature, it has gradually become a key driving force for the digital and intelligent inheritance of cultural heritage. The technological system of the Metaverse primarily covers various fields such as Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), blockchain technology, Artificial Intelligence (AI), and 5G networks. [6] With the support of these technologies, the Metaverse constructs a vast virtual space where users can not only experience a highly free interactive environment but also

enjoy seamless integration between real and virtual application scenarios for the inheritance of intangible cultural heritage through digital twin technology (see Table 1).

Table 1: Application scenarios of meta-universe enabling intangible cultural heritage

Basic technology type	Metaverse space characteristics	Intangible cultural heritage application scenarios
Mixed reality technology	The relevant content of the present world is copied into the virtual meta-universe space of digital intelligence	Traditional oral literature and language as its carrier; Medicine and calendar traditional art, calligraphy
Augmented reality technology	The virtual world is superimposed on the basis of the real world, and the two are merged to form a mixed space, achieving a sensory experience beyond reality.	Traditional skills, traditional sports, entertainment and acrobatics; Traditional music, dance, drama, folk art
Virtual reality technology	Directly using virtual reality technology to construct a meta-universe virtual space completely independent of the real world	Traditional etiquette, festivals and other folk customs

As computing power increases, AI plays a crucial role in the metaverse. AI algorithms are constantly optimized to more accurately reproduce the knowledge system of intangible cultural heritage, and natural language processing, image recognition, and generation algorithms are used to realize the dynamic display and intelligent interpretation of intangible cultural heritage. The application of AI makes virtual cultural experiences more immersive and provides new forms and methods for cultural inheritance.

Moreover, blockchain technology plays a role in authentication, transaction, and evidence preservation in the metaverse. It authenticates the digital versions of cultural heritage through non-fungible tokens (NFTs) and builds a new form of cultural asset transaction, ensuring the uniqueness and unalterability of the original content. [7] This technology-based form of cultural assets provides new ideas for the digital inheritance of intangible cultural heritage and pushes traditional culture into a new cultural economic field.

At the same time, the large-scale deployment and high-speed features of 5G networks provide strong technical support for the real-time transmission and interaction of cultural heritage in the metaverse. The introduction of 5G networks not only reduces latency and improves data transmission speed, but also from a cultural preservation perspective, cultural heritage in the virtual world may face the risk of misunderstanding, misinterpretation, or even abuse due to its extremely high accessibility.

Therefore, in studying the impact of the metaverse on intangible cultural heritage transmission, we should not only see the opportunities for the transmission and creation of cultural heritage brought by technological innovation, but also be cautious in addressing the challenges that may arise in the process of cultural preservation. Future research should focus more on how to balance the relationships between tradition and modernity, preservation and innovation, authenticity and creativity, and further explore new modes and strategies for the transmission of intangible cultural heritage in the metaverse era [8].

4. Enabling the Living Transmission of Intangible Cultural Heritage through the Metaverse

4.1 Strategic Planning for Top-Level Design

The government should formulate an overall strategic plan for the development of intangible cultural heritage, and clarify the development goals, development paths and key tasks. This includes determining the technical architecture, content ecology, and business model of intangible cultural heritage in the metaverse, ensuring the orderly digital inheritance of intangible cultural heritage. This study seeks policy support from the government and relevant departments to provide policy support and financial support for the development of intangible cultural heritage in the virtual world. Through policy guidance, this study encourages enterprises, universities and scientific research institutions to participate in the construction and operation of intangible cultural heritage meta-ecology.

4.2 Build Immersive Experience Platforms

The unique way of combining virtual and reality in the metaverse creates a completely new immersive experience for the transmission of intangible cultural heritage. In this metaverse virtual space, audience members, performers, and intangible cultural heritage works exist in digital form, jointly creating a "being present together" atmosphere. Through the metaverse platform, the transmission and experience of intangible cultural heritage become more vivid and intuitive, opening up new possibilities for the inheritance of traditional culture. [9] By using virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies, the generation environment of intangible cultural heritage can be deeply simulated, combined with virtual reality intelligent modeling, retaining the details and immers Through AI and animation technology, virtual characters can be simulated to look lifelike with human appearances, voices, and movements. Real-time interactions between virtual characters, audience members, and each other can be achieved through voice chat, gesture recognition, and facial expression interaction. Personalized customization options are provided, allowing audience members to adjust their virtual avatars and select viewing angles according to their preferences. Social sharing functions are also set up, allowing audience members to share their experiences in the metaverse on social media, thereby expanding their influence.

4.3 Innovation of the "Cloud" Tour Mode

Extended reality technology, as one of the pillars for constructing the metaverse, integrates virtual reality (VR), augmented reality (AR), and mixed reality (MR) to create highly interactive virtual worlds within the metaverse for users. The metaverse reshapes the logical relationships among technology, humanity, and culture, establishing a virtual exhibition hall for the inheritance of intangible cultural heritage. It transcends the shackles of time and space, facilitating the interaction and exchange of intangible cultural heritages from various regions and expanding the audience reach. [10] Presenting intangible cultural heritages on the metaverse platform through extended reality technology can pique the curiosity of the public, innovate the "cloud" tour mode, allowing them to freely navigate the virtual exhibition hall and acquire a comprehensive understanding of intangible cultural heritages. This virtual exhibition hall is not merely an extension of the real-world cultural exhibition hall but also an innovative cultural domain that compensates for the limitations of the real world and forms a distinctive cultural space. The experience of intangible cultural heritages is no longer passive reception but active participation, enhancing the interactivity between viewers and intangible cultural heritages and making the inheritance more vivid and intuitive.

4.4 Creation of Metaverse Virtual Performances

Traditional music, dance, comedy, and quyi culture within the category of intangible cultural heritages can employ 3D modeling technology to create virtual characters, encompassing aspects such as appearance, clothing, and actions. The character design should align with the performance theme and possess a certain degree of distinctiveness and appeal. According to the theme of the show and the target audience, the planner decides the key elements, such as the story, the characters and the setting. Planners use artificial intelligence and animation technology to simulate the appearance, voice and movement of people to make virtual characters look lifelike. In addition, curators use voice chat, gesture recognition and expression interaction to enable real-time interaction between avatars and the audience, as well as between audience members. The curators offer personalized customization options that allow viewers to adjust their avatars and choose viewing angles according to their preferences. Curators build social sharing features that allow audiences to share their experiences in the virtual world on social media and expand their influence.

4.5 Shaping Virtual "Inheritors"

"Virtual inheritors" refer to digital characters created using metaverse technologies, particularly techniques such as artificial intelligence, virtual reality (VR), augmented reality (AR), and 3D modeling, to simulate real inheritors of intangible cultural heritages. These characters not only strive to maintain consistency with the visual appearance of real inheritors but also imitate their unique characteristics and styles in terms of behavioral patterns, skill manifestations, and language styles as closely as possible. Virtual inheritors can showcase various intangible cultural heritage skills, such as dance, music, handicrafts, etc. They can perform these skills in the metaverse, allowing learners to observe and study through virtual reality devices. The display in the metaverse is not limited by time and space and can occur at any time and place. The interaction between learners and virtual inheritors is similar to the communication between teachers and students in the real world, providing a more personalized and immersive learning experience. Virtual inheritors can provide immediate guidance and feedback based on the learners' responses and needs, thereby facilitating more effective learning and mastery of intangible cultural heritage skills. Virtual inheritors are not only conveyors of skills but also disseminators of the cultural background, historical stories, and traditional customs related to intangible cultural heritages. Through this interactive learning, learners can acquire a deeper cultural understanding and knowledge. Real inheritors of intangible cultural heritages might be unable to continue passing on their skills due to factors such as time, space, or personal health, but virtual inheritors can perpetually preserve these skills. Even if real inheritors pass away, virtual inheritors can still impart skills in the metaverse. Through virtual inheritors, we can breathe new life into intangible cultural heritages in the digital world and offer new pathways for the inheritance of traditional skills.

4.6 Construction of Diversified Business Models

The metaverse provides diversified business models for the inheritance of intangible cultural heritages, achieving effective dissemination of intangible cultural heritages while generating more comprehensive profits. [11] For instance, a metaverse cultural exhibition hall for intangible cultural heritages can be established to showcase the historical evolution, technical characteristics, and representative works of intangible cultural heritages. In the metaverse, intangible cultural heritages can be traded in the form of digital collectibles (NFTs), and artists and inheritors can transform intangible cultural works into unique digital assets and sell them on the blockchain to raise funds for the inheritance of intangible cultural heritages. Cultural and creative products related to intangible

cultural heritages can be developed by integrating intangible cultural elements with modern design to launch market-competitive cultural and creative products. Non-material cultural heritage art festivals, online exhibitions, and other activities can be held to attract more users' attention and participation in the inheritance and development of intangible cultural heritages. Users are allowed to participate in the virtual production process of intangible cultural heritage crafts or learn traditional dances. These interactive experiences can be offered as paid services, generating income for inheritors of intangible cultural heritages. These diversified application scenarios and business models not only enrich the expression forms and dissemination channels of intangible cultural heritages but also provide robust support for the commercial operation of intangible cultural heritages.

5. Conclusion

The application of metaverse technology in the field of intangible cultural heritage inheritance has profoundly demonstrated its unique empowerment value. It not only holds great potential in protecting and maintaining the authenticity of the heritage but also provides diversified and effective approaches in expanding traditional cultural dissemination channels, enhancing social public participation, and fostering cultural identity. These achievements strongly attest that metaverse technology is not merely a technological medium but plays a crucial role in cultural inheritance and innovation. The manifestation of intangible cultural heritages in the metaverse has broken through traditional geographical and physical boundaries, transcending the constraints of time and space and achieving a deep integration of cultural essence and technological innovation through digital twinning and virtual reality. From a technical perspective, high-precision 3D modeling and immersive interaction technologies bestow users with immersive cultural experiences, enabling every detail of cultural heritages to be delicately perceived. The integration of AI intelligent algorithms offers boundless possibilities for content creation and editing, promoting the dynamic and sustainable development of cultural inheritance and rejuvenating cultural heritages in the digital world. From a technical standpoint, high-fidelity 3D modeling and interaction technologies allow users to experience cultural heritages in unprecedented ways, while the content logic supported by AI algorithms provides the possibility of open editing, activating and sustaining cultural inheritance. However, an emerging issue is how to ensure the authenticity and cultural connotation of intangible cultural heritages are appropriately protected and disseminated within the intertwined virtual and real metaverse. The intervention of the metaverse not only liberates the preservation of intangible cultural heritages from being confined to cold archives and exhibits but also realizes a magnificent transformation from static display to dynamic inheritance. It utilizes cutting-edge technologies to infuse new vitality into traditional culture, allowing cultural heritages to radiate unprecedented brilliance in the digital era. The digital inheritance of intangible cultural heritages in the metaverse not only pioneers new frontiers and pathways for cultural protection and dissemination but also sets a new paradigm for the integration of traditional culture and modern technology, heralding the advent of an era characterized by the concurrent progress of cultural inheritance and innovation.

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