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Value reconstruction and innovative inheritance of the Bazhong Grottoes in the digital context

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Abstract:
In today's era where digital technology profoundly influences the field of cultural heritage, the Bazhong Grottoes, as a pivotal hub connecting the north and south and integrating official and folk characteristics in Chinese grotto art, is embracing a historical opportunity for value re-evaluation and inheritance innovation. This paper focuses on exploring how digital technology restructures the value recognition system and inheritance paradigm of the Bazhong Grottoes. Through theoretical framework construction and case empirical analysis, it proposes innovative strategies from three dimensions: information expansion, situational restoration, and public participation. The research finds that in the digital context, value reconstruction and innovative inheritance can create a system of interconnected and circular development, elevating the Bazhong Grottoes from a regional archaeological site to an experiential and evocative cultural IP, injecting core impetus into its sustainable protection and revitalization.

Keywords:
Bazhong Grottoes; digitization; value reconstruction; innovative inheritance

1 Introduction

With the advancement of the information and digital era, digital technology continues to expand its application fields and deeply integrates with the protection, interpretation, and inheritance of the Bazhong Grottoes, bringing significant changes to its innovative inheritance and development. Traditional methods fall short in fully showcasing the artistic value and historical heritage accumulated over a thousand years in the Bazhong Grottoes. However, digital technology, with its high-precision scanning, virtual restoration, and immersive experience, can not only preserve cultural relic information for long-term use and facilitate in-depth research, but also break through the constraints of time and space, vividly recreating the religious, artistic, and social life scenes of the past, opening up a new path for the revitalization and utilization of cultural heritage in the contemporary era.

2 Exploration and Inheritance of Multidimensional Value in Bazhong Grottoes

2.1 Deep exploration of historical and humanistic values

The excavation of the Bazhong Grottoes began during the Southern and Northern Dynasties and reached

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its peak during the Tang Dynasty, continuing into the Song and Ming Dynasties. It fully witnessed the entire process and trajectory of political evolution, economic development, religious inheritance, and cultural integration in the Bashu region. The grottoes retain a large number of donor inscriptions, which provide detailed records of core information such as the excavation date of the grottoes, the official ranks and grades of the donors, their place of origin, and family lineage. These inscriptions have become precious primary stone inscriptions for studying the local administrative system, ethnic migration paths, and social structural forms during the Tang Dynasty.

From the perspective of artistic and cultural value, Bazhong, located at a crucial junction on the route from the Central Plains to Sichuan, has developed grotto art with significant transitional and integrative characteristics during its development process. It not only inherits the majestic style and official regulatory paradigm upheld by northern grottoes, but also deeply integrates the unique, agile, and delicate style of Sichuan and secular aesthetic tastes. It serves as a key example for studying the north-south inheritance and local evolution of Chinese grotto art. Furthermore, the statue sequence of Bazhong grottoes from the early Tang Dynasty to the Song Dynasty is relatively well-preserved, exhibiting unique characteristics in many aspects such as the evolution of statue styles, the design of niche shapes, and the craftsmanship of colored painting decoration. The religious beliefs and aesthetic values embodied by the ancient Bashu people are important material witnesses for studying the history of ancient southwest transportation and trade development. The statue themes are mainly based on the Pure Land Sect and Esoteric Buddhism, which were widely popular among the people in the Tang Dynasty. The Buddha statues have a kind and gentle appearance and a natural, relaxed posture, deeply reflecting the deep integration of Buddhist art with Chinese local aesthetic concepts and folk life practices. They have become a core carrier that embodies regional cultural identity and carries the collective memory of the people.

2.2 Digitalization empowers and promotes the transformation of inheritance methods

To promote the high-quality inheritance and development of the Bazhong Grottoes, we must reflect on how to break the limitations of traditional methods in the wave of digitalization, allowing this thousand-year-old heritage to be rejuvenated. The inheritance of the grottoes is not just about physical preservation and static display; it is also about the creative transformation and systematic interpretation of its cultural value, serving the high-quality spiritual and cultural needs of the public. Digital empowerment and brand building are effective practical paths. To this end, based on its own cultural resource endowment and long-term development plan, Bazhong City has made a series of preliminary preparations through systematic planning and precise layout, proposing the creation of the "Four Caves Blessed City" cultural tourism brand in June 2024 [1].Subsequently, with the help of digital technology such as high-precision scanning and virtual reality reconstruction, the Bazhong Grottoes have achieved a leap from physical space to digital space. This transformation is not simply a technological upgrade, but a shift in value cognition and inheritance paradigm. Static physical display is replaced by dynamic digital experience, allowing audiences to immerse themselves in the charm of the grottoes through multiple senses. The interpretation of value also shifts from expert-led to public interactive co-creation. This transformation promotes the focus of cultural heritage work from the preservation of "objects" to the experience and meaning generation of "people". Digital empowerment provides a new path for the rejuvenation of the Bazhong Grottoes and explores a new direction for the inheritance of similar cul-

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tural heritage.

2.3 Adhere to the bottom line of truthfulness, integrity, and academic ethics

To advance the digitization of the Bazhong Grottoes, managers must be clear that the authenticity and integrity of cultural relics protection is the fundamental starting points for all work. Each digitization project should be based on rigorous archaeological research and cultural relics protection principles, utilizing high-precision 3D scanning, multispectral imaging, and other technologies to objectively and comprehensively record the morphology, color, and detailed features of the grottoes, and resolutely prevent any subjective tampering and excessive beautification. Sichuan cultural relics protection experts have developed specialized protective materials and technologies through repeated experiments, which have basically restored the original appearance of the statues at the test site [2]. This practice fully demonstrates the core principles of minimal intervention and scientific restoration. In addition, the digitization project needs to be carried out in an orderly manner under the guidance of experts in archaeology, art history, cultural relics protection, and other disciplines, to ensure that the entire process of data collection, processing, and interpretation conforms to academic norms. At the same time, as a public cultural resource, the digitization achievements of the Bazhong Grottoes need to balance the relationship between open sharing and intellectual property protection. Only in this way can we promote the rational utilization of cultural resources while effectively preventing the occurrence of disorderly abuse and commercial infringement.

3 Multidimensional Analysis of Digital Revitalization and Narrative Innovation of Bazhong Grottoes

3.1 Expand the spatial and temporal boundaries of inheritance

With the construction of a high-precision 3D digital exhibition hall, global audiences can remotely enjoy immersive visits anytime and anywhere, easily breaking the spatial and temporal constraints of physical grottoes. At the same time, relying on multiple terminal platforms such as websites, mobile applications, and social media, lightweight inheritance is carried out through high-definition images, short videos, interactive H5, and other forms, enabling wide coverage and instant access to cultural heritage. For example, the "Digital Ark" project implements millimeter-level 3D scanning of core areas such as Nankang and Shuining Temple [3],creating digital twins that encompass full-dimensional information including geometry, texture, color, and weathering traces, laying a solid data foundation for preventive conservation, virtual restoration, and remote research.

3.2 Innovative artistic presentation modes

Utilizing technological means such as VR/AR, holographic projection, and spatial audio, the original spatial atmosphere, color and light changes of the grottoes are accurately restored, providing the audience with a richer and more diverse multi-sensory immersive experience compared to physical visits. Through carefully designed interactive narratives, role-playing, puzzle games, and other forms, historical knowledge and cultural connotations are cleverly integrated into interesting scenarios, significantly enhancing the participation of the public, especially young people, and deepening their understanding of grotto culture. Taking the Shuining

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Temple cliff sculptures as an example [4], users can seemingly "enter" them through VR technology and feel their grandeur; through AR technology, they can also witness the restoration and overlay effect of the color paintings, thus experiencing the aesthetic concept of "painting with colors" of the Tang Dynasty's colorful sculptures.

3.3 Promote public participation in co-creation

Actively develop digital education courses and research and learning platforms, seamlessly integrating grotto art into the school's aesthetic education system. Host the "I Create the Buddha of Bazhong" global digital cultural and creative design competition, opening up a high-quality library of 3D models and pattern materials to stimulate the public's creative enthusiasm, encouraging them to engage in secondary creation, and subsequently producing a diverse range of cultural products such as digital collectibles, virtual avatars, and dynamic wallpapers. Leveraging social media interactions and online community collaborations, we aim to transition the public from passive information receivers to active participants and co-creators of cultural heritage, propelling the deep integration of Bazhong grottoes into contemporary cultural life and the development of the creative economy.

4 Balanced Strategy for the Digital Preservation of Grottoes in Bazhong

Digital technology has injected new vitality and brought new possibilities into the protection and inheritance of the Bazhong Grottoes. However, it has also triggered multiple contradictions, such as the tension between authenticity and appreciation, preservation and utilization, as well as the tension between technological presentation and cultural depth. We must be keenly aware that finding a precise balance point amidst these contradictions has become the key to the success of the digital inheritance of the Bazhong Grottoes.

4.1 Balance between authenticity and aesthetics

In the process of digital inheritance of Bazhong Grottoes, excessive pursuit of visual presentation effects and entertainment experience often conflicts with the core requirements of emphasizing the authenticity of cultural relics and academic seriousness. The incident of villagers improperly coloring the cliff statues of the Northern Wei Dynasty in the central and southern rivers of Ba in 2023 deeply highlights the irreversible damage caused to the intrinsic value of cultural relics by excessive pursuit of "ornamental value" and neglect of authenticity [5].This case serves as a profound reminder that the digital inheritance of the Bazhong Grottoes must find an appropriate balance between attracting audience attention, enhancing inheritance effectiveness, and upholding the authenticity of cultural relics, and must not neglect one aspect at the expense of the other. The key to resolving this contradiction lies in building a multi-level and standardized information presentation system: at the visual presentation level, we need to rely on high-precision scanning and high-quality imaging technology to objectively and accurately record the existing state of the grottoes, and resolutely eliminate unfounded beautification and subjective tampering; At the same time, we need to use virtual restoration technology to present mature academic research results to the public in a visual way, but we must clearly distinguish between the original remains and virtual restoration content to avoid misleading the audience; By establishing a transparent information annotation system, we need to make the audience clearly aware of the nature and source of the content they are viewing. The technological breakthrough achieved in the improper

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decoration and cleaning work of grotto temples in Sichuan region is a firm practice of the principle of authenticity of cultural relics, which provides us with valuable reference.

4.2 Collaboration between protection and utilization

Digital technology can improve the level of protection of the Bazhong Grottoes, but it may also lead to a shallow cultural connotation due to excessive development. Therefore, we must clarify the boundaries of the use of digital achievements through scientific planning and refined management, and achieve coordinated promotion of protection and utilization. Based on the value sensitivity and preservation status of different areas of the grottoes, a hierarchical management system is established. The core protected area adheres to the principle of protection priority, and the digital utilization layer can be moderately innovated without damaging cultural relics, balancing practicality and inheritance. In addition, it is crucial to establish a collaborative governance mechanism involving multiple parties. We need to integrate the forces of cultural relics departments, local governments, academic institutions, technology enterprises, and community representatives to jointly formulate and adjust balanced strategies. In the evaluation process, it is necessary to consider not only the physical environmental carrying capacity of the grottoes, but also the cultural value perception carrying capacity. Through dynamic monitoring and scientific evaluation, timely optimization and adjustment strategies should be implemented to achieve a positive interaction between protection and utilization, making the two the dual driving forces for the sustainable development of Bazhong Grottoes, complementing each other and promoting together.

4.3 Integration of technological empowerment and cultural depth

In the digital practice of Bazhong Grottoes, we must be vigilant about the risk of "technical showmanship" surpassing cultural connotations, leading to "cultural aphasia". We should be clear that digitization is not the ultimate goal, but an important means to interpret the cultural value of grottoes, promote public awareness, and advance cultural inheritance. In the future, it is necessary to rely on digital technologies such as artificial intelligence and big data to achieve a leap from "digital viewing" to "intelligent understanding", so that the audience can understand the historical and cultural connotations behind the grottoes. More importantly, it is necessary to build an open co creation system, inviting experts, scholars, and team communities to participate together. Through various forms such as virtual restoration and cultural narrative creation, the public can transform from observers of cultural inheritance to participants and creators. Only in this way can the culture of Bazhong Grottoes truly integrate into contemporary social life and achieve dynamic inheritance. Ultimately, the digitization of cultural heritage should always be guided by cultural values, allowing technology to serve the deep exploration, presentation, and inheritance of culture, and avoiding a disconnect between technology and culture.

5 The Practical Path of Digital Innovation and Inheritance in Bazhong Grottoes

The digital innovation and inheritance of Bazhong Grottoes need to be based on reality, building a complete ecosystem from platform construction to product development, and then to service innovation, and relying on

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practical paths to promote the implementation and effectiveness of digital innovation inheritance.

5.1 Build a hierarchical digital platform system

The primary task in promoting the digital inheritance of Bazhong Grottoes is to establish a basic data platform, carry out high-precision 3D scanning of key grotto niches, comprehensively capture their multi-dimensional information such as geometry, texture, color, etc., and create standardized and complete digital archives. Simultaneously building an intelligent data management system, improving storage, retrieval, analysis, and visualization functions, providing customized services based on different user needs, and balancing the dual needs of academic research and public inheritance. A public service platform should focus on user experience, develop applications that are compatible with multiple terminals, and facilitate convenient access for the public. The platform content adopts a layered design, with both cave introductions suitable for quick browsing and specialized content for deep learning, incorporating interactive elements to enhance public participation. At the same time, establish an open sharing mechanism, encourage social forces to participate in content creation while strictly protecting intellectual property rights, and form a healthy inheritance ecology.

5.2 Develop diversified digital cultural and creative products

The development of digital cultural and creative products should adhere to the principle of combining cultural value with economic value, which not only showcases the historical and artistic characteristics of the Bazhong Grottoes, but also meets the needs of the modern market. We should first create basic products such as digital catalogs, virtual exhibitions, and online courses to systematically showcase the artistic and historical value of grottoes; In terms of creative development, we will deeply explore the cultural elements of grottoes, transform them into forms that are popular among modern people, and break down the barriers to traditional cultural inheritance.

Digital collectibles (NFTs) provide a new path for the digital inheritance of Bazhong Grottoes [6].Representative artistic elements of Bazhong Grottoes can be selected to develop limited edition digital collectibles, endowing them with unique cultural connotations and design concepts. Cross-border cooperation is a key measure to expand cultural influence. We should actively carry out in deep cooperation with games, film and television, education and other industries, and quickly expand the coverage and brand influence of Bazhong Grottoes culture with the help of its mature inheritance channels.

5.3 Build a smart cultural and tourism service system

To promote the digital inheritance of Bazhong Grottoes, we need to take the deep integration of online and offline as the core, and build a smart cultural tourism and scientific service system. Offline, by relying on digital technology to build a smart navigation system and utilizing modern digital technologies such as positioning and AR, personalized services are provided to tourists to enhance their visiting experience; By creating a comprehensive tourism service platform online, integrating practical functions and connecting with digital cultural resource platforms, seamless integration and resource sharing can be achieved. We need to focus on the personalization and depth of cultural and tourism experiences, provide customized services through big data analysis, establish resident participation mechanisms and stimulate their initiative, while improving service evaluation and feedback mechanisms, and continuously optimizing the service system. After the imple-

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mentation of this practical path system, digital inheritance can be transformed from theory to practical results, providing actionable solutions for the dynamic inheritance of cultural heritage. Through the collaborative efforts of platforms, products, and services, a win-win situation can be achieved for the protection and development of Bazhong Grottoes, providing reference for similar heritage digital practices.

6 Conclusion

In the digital context of the new era, the digital inheritance and enhancement of Bazhong Grottoes must align with the new characteristics of cultural heritage inheritance, exploring feasible paths for inheritance protection and digital innovation. By deeply analyzing various factors affecting their efficient inheritance, we aim to uncover their profound historical and artistic heritage and cultural connotations, and strive to explore the path of dynamic integration and innovation for Bazhong Grottoes under digital conditions. Based on the reality of Bazhong Grottoes' protection and inheritance, we should deeply consider and practice the practical path of digital dynamic inheritance and enhancement innovation for Bazhong Grottoes from aspects such as digital platform construction, cultural and creative research and development, smart cultural tourism creation, and academic ethics adherence. Guided by the concept of digital integration, we should seize the opportunities of the times, create a digital brand for Bazhong Grottoes that combines contemporary flair with cultural heritage, explore effective strategies for protection and innovation, promote the dynamic transformation of traditional grotto heritage, embody the spirit of "Great Chinese Craftsmen", and provide reference and assistance for the digital inheritance of similar cultural heritage.

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References

[1] Bazhong Daily. "New Rhyme of the Ancient Road"-"Four Niches and Fortunes" IP and Investment Opportunities List Conference was held [N]. Bazhong Daily, 2025-4-25(A1).

[2] Chuanguan News. Cultural China Tour | An important breakthrough was made in the cleaning and protection of improper makeup in Sichuan Cave Temple: the "flower clothes" of Kaya Buddha statue were washed clean [EB/OL]. (2025-8-20). https://cbgc.scol.com.cn/news/6653306.

[3] Today's headlines. Digital Ark carries civilization: the key to decoding cultural heritage[EB/OL].[2025-3-7].https://www.toutiao.com/article/7478561536248791592/.

[4] Chuanguan News. C space is full of colorful sculptures in the prosperous Tang Dynasty. 3D Panoramic Unlocking the Millennium Grottoes of Shuining Temple [EB/OL]. [2025-11-27]. https://cbgc.scol.com.cn/news/7005576.

[5] Tang Hao. A 1400-year-old cliff statue in Bazhong, Sichuan Province was smeared and disfigured by villagers. Cultural protection department: It was discovered soon, but it was too late to stop it [EB/OL]. (2023-

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11-14)]. https://www.cqcb.com/feidian/2023-11-14/5422345_pc.html.
[6] Li Yitong, Liu Junzhe. Exploration of empowering cultural heritage based on NFT digital collection model-taking Dunhuang murals as an example [J]. Art and Technology, 2023, 36(7): 17-19.

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