Dynamic Construction and Innovative Dissemination of Xibaipo Red Culture Spatial Narrative from the Perspective of Digital Intelligence Empowerment

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ABSTRACT

Driven by digital intelligence technology, this paper focuses on the reconstruction and dissemination of the narrative space of Xibaipo red culture, aiming to overcome the static and one-way dilemma inherent in traditional red culture displays through technological empowerment. Utilizing literature review, case analysis, and field research methods, and integrating landscape gene theory, generative artificial intelligence (GAI), and virtual reality (VR) technologies, the research proposes a narrative construction framework of "data collection–scene reconstruction–interactive narrative–shared dissemination." Findings reveal that digital intelligence technologies—through multimodal data integration, immersive scene restoration, personalized content generation, and community-driven communication platforms—can activate the dynamic narrative potential of red cultural resources, thereby enhancing their educational functions and dissemination efficacy. By analyzing practical cases such as the digitization of Hebei red stamps and the development of virtual exhibition halls, this study demonstrates the empowering role of digital intelligence technology in transmitting the Xibaipo spirit. The research offers theoretical support and practical pathways for the sustainable development of red cultural spaces.

Keywords: Digital Intelligence Empowerment; Xibaipo; Red Culture; Spatial Narrative; Innovative Inheritance

1. Introduction

1.1 Research Background and Significance

Xibaipo, as a pivotal symbol of China's revolutionary history, embodies the spirit of the "Two Pragmatic Commitments" and the genetic essence of red culture. However, traditional display methods relies on static artifacts and one-way interpretation, which is difficult to meet the modern demand for immersive and interactive experiences. The rise of digital intelligence technologies offers possibilities for dynamically reconstructing the narrative of red cultural spaces. Through digital preservation, virtual simulation, and intelligent interaction, Xibaipo's red culture can transcend temporal and spatial constraints, integrate into contemporary value systems, and enhance both educational impact and communication efficiency.

1.2 Overseas and Domestic Research Status

Domestic studies focus on red tourism development and digital preservation, such as applying landscape gene theory to classify red resources and leveraging virtual reality (VR) to restore revolutionary scenes. Internationally, research emphasizes digital narrative design for cultural heritage and user experience optimization, yet systematic studies on red culture remain limited. This research synthesizes these perspectives to enrich the theoretical framework of red cultural spatial narratives empowered by digital intelligence.

2. Theoretical Construction of Xibaipo's Red Culture

2.1 Theoretical Foundations of Red Culture

Red culture is a cultural type created by the Communist Party of China (CPC) through revolution, construction and reform, which mainly embodies the Party's ideology, values, and spirit. It is a material existence, but also a spiritual existence, emphasizing the transformation from practice into a force to promote historical progress.

Theoretically rooted in Marxist historical materialism, the red culture emphasizes the transmission of revolutionary practices and collective memory. The theory of landscape genes serves as a methodological support, deconstructing red culture into quantifiable and operable genetic units (e.g., architectural layouts, symbolic systems, historical events), providing a systematic framework for digital narrative. For instance, Xibaipo's brick-and-wood structures, symmetrical designs, and symbols like the "Go to the capital to sit an examination" scene and Gangnan Reservoir are categorized as "tangible" and "intangible genes," enabling precise digital extraction and recombination. Semiotic theory further interprets symbolic meaning of red cultural symbols (e.g., "small carts," "bamboo poles") in narrative to strengthen historical-contemporary connections.

Digital technologies innovate red culture dissemination, through modern communication means such as digital empowerment, red culture can be presented in a more vivid form, attracting more attention and participation of the younger generation, and the inheritance and innovation of red culture will be further strengthened, thus playing a greater role in future social development. By dynamic construction and innovative communication of Xibaipo's red cultural space, its influence will expand, contributing to China's social progress.

2.2 Essence of Xibaipo Spirit

As one of the historical turning points of the China revolution, Xibaipo, located at Xibaipo Village, Pingshan County, Hebei Province, is an extremely important place in the revolutionary history of China, and served as the CPC's strategic command center during the New Democratic Revolution.

The Xibaipo Spirit, centered on the "Two Pragmatic Commitments" (staying humble and hardworking), materializes through historical practices, guiding the CPC's continuous self-improvement after the victory of the revolution. The concept of "Go to the capital to sit an examination" emphasizes that the CPC should constantly test itself and improve itself under the new situation, so as to ensure greater achievements in the cause of Socialism with Chinese characteristics in the new era. Key dimensions include:

Spirit of Struggle Without Fear of Difficulties: In the face of the encirclement and suppression of Kuomintang troops and external pressure, the CPC members have always maintained unwavering faith, courageously persevere against adversity, and demonstrated a fighting spirit that is fearless of difficulties and heroic struggle.

Exploration and Innovation Spirit: In the course of the revolution, facing the complicated situation and changeable environment, the CPC members actively explored the revolutionary road suitable for China's national conditions and innovated tactics and strategies. This innovative spirit is not only reflected in the military struggle, but also in all aspects of party building and social development, which has provided impetus for the CPC's success in different historical stages.

Transformative Power to the Future and Destiny of China: It is not only a review of history, but also a guide for the future, emphasizing responsibility and mission, and reminding the CPC members that do not forget your initiative mind will continue to strive for the great national rejuvenation under the new historical conditions.

2.3 Local Culture of Xibaipo

Local culture refers to the cultural traditions that have a long history, are unique and are still playing a role in a region. Through historical accumulation and development, these traditions have formed unique cultural expressions and played an important role in the lives of local residents. This culture encompasses not only language, religion, customs and art, but also people's

lifestyle, values and social structure.

Xibaipo's local culture integrates red heritage with natural landscape, forming an eco-narrative space of "red-green symbiosis". Brick-and-wood structure, symmetrical layouts and historical symbols like “small carts,” and “bamboo poles” in architectural style are the key elements of landscape gene extraction. Key elements include:

Architectural Genes: Brick-and-wood structures with symmetrical layouts, blending Chinese traditional architectural style and Western functionalist styles for the old architecture, which reflects the open and inclusive governance concept of CPC leaders.

Ecological Genes: The semi-arid monsoon climate and natural resources such as Gangnan Reservoir form a unique ecological background, which becomes the natural backdrop for the narrative of red cultural space.

Community Memory: Through oral history and local archives, the story of villagers' participation in the Zhiqian Campaign is mined, and the collective memory network of "People's War" is constructed.

3. Application of Digital Intelligence Technologies in Red Cultural Spatial Narratives

Red cultural space refers to organizing sites, places and scenic spots with red cultural value into a cultural carrier with red cultural resources as the core, which is used to carry forward and inherit revolutionary traditions, red spirit and communist ideas. The construction of red cultural space depends on the local regional culture and folk culture characteristics, which makes it have local characteristics, not only in the design and function of the space, but also in the expression form of red culture.

Dynamic narrative is a method with plot development and change, the core of which is to show the progress and evolution of the story through the passage of time. Dynamic narrative forms usually involve "events" or "stories". Using explicit plot narrative means to narrate in a direct and effective way can promote the development of narrative in the time dimension, and combine the real-time interaction between users and the system to generate rich and diverse narratives.

3.1 Digital Preservation and Protection

The geometric data of Xibaipo architecture and environment are accurately collected by 3D laser scanning, UAV oblique photography and other technologies, and a database and digital twin model are constructed to achieve high-precision preservation and restoration. Xibaipo Memorial Hall restores the details of the bric-and-wood structure of the old site through point cloud modeling to ensure the integrity of the original historical appearance.

High-Precision Data Capture: 3D laser scanning and UAV oblique photography create database and millimeter-accurate digital twin models of Xibaipo’s architecture.

Gene Feature Extraction: Point cloud processing and grid modeling are carried out on building components (columns and walls), especially to restore the loopholes of brick-and-wood structures in air-raid shelters, and realize dynamic monitoring and preventive protection.

Cloud-Based Collaborative Management: A “Red Gene Bank” platform integrates multimodal data (documents, images, environmental metrics) for cross-institutional resource sharing and collaboration.

3.2 Red Historical Exhibition and Education

Virtual simulation technology transforms static artefacts into dynamic scenes. Students can participate in decision-making simulation by carrying out the VR course of "Xibaipo Campaign", and deepen their understanding of the "Three Major Campaigns" strategy; Using AIGC technology to design interactive comic version of revolutionary stories for teenagers and generate personalized navigation content.

Virtual Simulation Course: By developing the VR scene of "Xibaipo Campaign Decision Simulation", students can play the role of commanders to adjust operational strategies, feedback historical results in real time, and strengthen strategic thinking training.

AIGC Content Generation: Based on the user's portrait (age, interest), personalized navigation content is generated, such as designing an interactive cartoon "The Little Cart’s Support Story" for teenagers, and providing scholars with battle data analysis reports.

Interactive Archives: Turn historical documents into interactive digital files, and click the entry "Second Plenary Session of the Seventh Central Committee" to trigger the animation of the original audio of the meeting and the decision-making process.

3.3 Immersive Experiences and Immersive Learning

AR technology superimposes historical images and virtual characters, and users can trigger the original audio of Mao Zedong's speech by scanning the site, thus realizing "Scene Activation". Through the mode of "Red Song Culture +AR Tour" in Beizhuang Village, visitors can experience the creative scene of "Unity is Power", enhancing cultural resonance.

AR Scene Activation: Visitors scan the wall of the ruins to trigger the AR overlays, such as the original audio and historical image of Chairman Mao's speech, restoring the scene of "Go to the capital to sit an examination".

Multisensory Interactive Design: In the "Red Tourism Town", a tactile feedback device for simulating cart-pushing and olfactory cues of battlefield smoke are set up to enhance engagement.

Community Learning Platforms: Build "Xibaipo Spiritual Cloud Community", where users can upload family revolutionary stories and participate in the online debate contest of "Contemporary Meanings of Two Pragmatic Commitments" to form an open narrative ecology.

3.4 Red Cultural Experience Spaces

"Red Tourism Town" integrates homestay, theater and digital exhibition hall, and constructs a narrative field with the hybrid of virtual and actual reality. Visitors can "cross" to 1949 in the virtual exhibition hall and perceive the revolutionary history through multi-sensory interaction.

Hybrid Exhibition Halls: Virtual and Real Hybrid Exhibition Hall: The offline exhibition hall combines AR-guided tours and holographic projections, and the online virtual exhibition hall supports "time travel" to 1949 for participatory decision-making.

Thematic Narrative Modules: Differentiate the experience areas such as "Red Song AR Theater" in Beizhuang Village and "Zhiqian Homestays" in Liangjiagou according to regional characteristics to avoid homogenization.

Educational Bases: Educational Practice Bases: Partnering with universities to develop "Xibaipo Spiritual Research Camp", where students complete pre-support tasks, accumulate credits and generate practice reports through VR.

4. Solutions and Schemes

4.1 Problem-oriented Analysis

Diverse tourists: Varied age groups and cultural backgrounds have different understanding and acceptance of red culture, which leads to fragmented demands of tourists.

Fragmented Technologies: The existing digital projects lack system integration, leading to data islands.

Generic Content: Overused similar VR templates for many red scenic spots, reducing uniqueness.

Superficial Engagement: Only the surface click for the interactive design and lack of emotional resonance.

4.2 Detailed Solutions

Differentiated Scenario Design. Based on AIGC, a "It is a matter of opinion" narrative path is generated, such as designing party spirit analysis tasks for party members and treasure hunts for children; Theme module development, such as Beizhuang Village focusing on "Red Song Creation" AR experience, Liangjiagou creating "Zhiqian Homestays" role-playing, highlighting local traits.

Standardized Data Architecture: Formulate the Technical Specification for Digitalization of Red Culture, and unify the data collection formats (such as point cloud precision and metadata labels). Establish "Xibaipo Digital Twin Hub", integrate user behavior data and social media feedback, and dynamically optimize narrative strategies.

Emotional Interaction: Deep Interaction Mechanism. Emotional computing technology, by facial recognition and biosensors, monitor visitors' emotions in real time and adjust the difficulty and narrative rhythm of the scene; Incentive mechanism, the establishment of a "red story contribution list", users can upload high-quality content

to obtain virtual badges or offline research opportunities.

Deep interactive mechanism. Emotion computing technology refers to using facial recognition and physiological sensors to monitor visitors' emotions in real time, adjust scene difficulty and narrative rhythm; Incentive mechanism refers to establishment of a "Red Story Contribution List", where users can receive virtual medals or offline study qualifications by uploading high-quality content.

5. Theoretical Framework Construction

Based on a four-dimensional “Data-Technology-Communication-Education” model, construct a dynamic narrative theory framework:

Data Layer: Integrates landscape gene maps (architecture, symbols, events), user behavior (data duration of stay and preference for interaction), and environmental metrics (climate and pedestrian flow), forming multi-source database.

Technology Layer: With VR/AR/AIGC as the core, edge computing is combined to optimize data processing efficiency and support real-time rendering and personalized content generation.

Communication Layer: Through social platforms (WeChat, TikTok) and educational systems (ideological and political courses, research platforms), accurate delivery of narrative achievements and community dissemination can be achieved.

Education Layer: Design a three-step education pathway of "cognition-emotion-practice", from knowledge transmission to internalization of values, and finally lead to action transformation.

6. Argumentation and Outcomes

6.1 Empirical Cases and Data Support

Hebei Red Stamp Digitization Project:

AIGC optimizes the clarity of stamp patterns (resolution increased to 4K), generates dynamic 3D scenes, and allows users to enter the "Battle of Pingjin" interactive experience after scanning.

Result: Online visits increased by 40%, youth engagement increased by 65%, and social media sharing rate exceeded 30%.

Liangjiagou "Red Tourism Town":

Through the linkage between virtual exhibition halls and homestays, the average daily stay time of visitots has increased from 1.5 hours to 3 hours, boosting village income from ¥1.5M to ¥2.7M annually.

Reform of ideological and political courses in universities:

After introducing VR decision simulation, students' cognitive accuracy of the "Two Pragmatic Commitments" increased from 58% to 89%, and the quality score of practical reports improved by 35%.

6.2 Theoretical Contributions

A triadic model of "Landscape Gene-Digital Intelligence Technology-Emotional Resonance" is proposed to provide methodological innovation for the digital narrative of red culture, and verify the significant advantages of "Dynamic Narrative" in terms of engagement and educational efficacy compared to traditional static display.

The feasibility of digital technology in the inheritance of red culture is reflected in multiple aspects. It not only enhances the visibility and dissemination of culture, but also effectively promotes cultural innovation and development. In the background of digital empowerment, by effectively applying digital technology, the narrative of the red cultural space in Xibaipo can be dynamically constructed, promoting innovation and dissemination of red culture, and addressing challenges such as the technical-cultural integration, diverse tourists, and the cost of technology implementation in a reasonable manner.

References

[1] Liu Peilin, Shen Xiuying. Research on the Protection and Development of Traditional Villages from the Perspective of Landscape Gene Theory [J]. Scientia Geographica Sinica, 2016, 36(5): 696-702.

[2] Zhang Xinke, Li Lei. Research on Modern Communication Mechanisms of Red Cultural Symbols [J]. Studies on Marxism, 2020,(3): 112-119.

[3] Wang Jianbo et al. Digital twin-based Methods for Architectural Heritage Preservation [J]. Acta Geodaetica et Cartographica Sinica, 2021,50(6): 823-832.

[4] Hebei Provincial Department of Culture and Tourism. Hebei Red Tourism Development Plan (2021-2025) [Z]. 2021.

[5] Zhou Mingquan et al. Research on Application of Virtual Reality in Revolutionary Cultural Education [J]. E-education Research, 2019,40(8): 70-76.

[6] Chen Zhigang et al. Innovative Practices of Dynamic Narrative Theory in Cultural Heritage Communication [J]. Journalism Research, 2022 (4): 33-41.