

The Construction Path of Henan's Red Culture in Immersive Environments through Digital Translation: A Case Study of the "Hongqi Canal"

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Abstract:

This paper, grounded in digital translation technology, takes the Red Flag Canal as a representative case to explore innovative approaches for constructing immersive scenes of red culture in Henan. As a new paradigm for the preservation and dissemination of cultural heritage, digital translation leverages technologies such as 3D modeling and VR to transform tangible cultural resources into interactive and communicable digital forms. Its core lies in the precise translation of cultural connotations and the enhancement of communication effectiveness. The study first analyzes the technical characteristics of digital translation and its value in the field of cultural heritage; then systematically examines the current development status of red cultural resources in Henan, with a particular focus on the historical significance of the Red Flag Canal spirit and the practical challenges in its contemporary transmission; and finally proposes three innovative paths. Through multi-dimensional immersive scene design, these pathways not only enhance public understanding of the historical significance of the Red Flag Canal but also deepen emotional resonance through emotionally engaging interactive experiences, offering a solution that integrates both theoretical value and practical significance for the innovative transmission of red culture.

Keywords:

Digital Transformation, Immersive Environments, Inheritance of Red Culture, Spirit of the Red Flag Canal, Cultural Heritage Preservation

1. Characteristics of Digital Transcoding

Digital translation design is a technology that converts traditional paper-based texts or images into digital formats. It involves scanning or photographing the original materials and transforming them into digital forms, followed by design and layout processes to enhance their visual appeal and readability. Digital translation design is widely applied in various fields, including digital libraries, digital museums, and

digital art exhibitions. With the advent of the data intelligence era and the advancement of technologies such as big data and artificial intelligence, digital translation design has entered a new stage of intelligent and innovative development. This stage is characterized by the integration of generative adversarial networks, convolutional neural networks, style transfer, and crowd intelligence algorithms [1]. provides a wide range of digital technologies and intelligent design tools. Integrating computational thinking with design thinking can create more innovative approaches to preserving intangible cultural heritage. This design methodology not only supports the transmission of red culture but also improves the efficiency and quality of cultural dissemination, while offering users in the digital age more accessible and enriching cultural experiences. For large-scale engineering heritage sites like the Red Flag Canal, high-precision 3D scanning can comprehensively capture their spatial forms, while VR interactive design should adhere to the principle of “user-led exploration” to avoid the fragmented experience caused by linear storytelling.

2. The Current Situation of Red Culture

Red culture refers to a cultural form with distinct Chinese characteristics that was developed under the leadership of the Communist Party of China during the New Democratic Revolution, socialist construction, and various stages of reform and opening-up.

As one of the key birthplaces of red culture in China, Henan boasts a wealth of red cultural heritage and historical resources, including the Red Flag Canal in Anyang, the Erqi Memorial Tower in Zhengzhou, the Jiao Yulu Memorial Hall in Lankao, and the Zhugou Revolutionary Memorial Hall in Queshan County, Zhumadian. Despite its rich red cultural resources, Henan faces practical challenges in the process of preserving and promoting this heritage, such as limited communication effectiveness and a lack of interactive experiences [2]. The growing limitations of traditional communication methods highlight the need for the application of digital transformation technologies.

3. The Importance and Innovative Inheritance of the Red Flag Canal Spirit

3.1. The Importance of the Hongqi Canal Spirit

The Red Flag Canal, originally known as the Project to Divert the Zhang River into Lin County, is located in the northern part of Linzhou City, Henan Province, China, at the junction of the three provinces of Henan, Shanxi, and Hebei. It is renowned as the “Man-Made Heavenly River,” “China's Great Wall of Water,” and the “Eighth Wonder of the World.” As a significant hydraulic engineering site, the Red Flag Canal not only holds deep historical significance but also stands as a testament to humanity's extraordinary achievements in overcoming the challenges of nature.

On October 28, 2022, General Secretary Xi Jinping emphasized during his visit to the Hongqi Canal Memorial Hall: “The spirit of the Hongqi Canal is closely linked to the Yan'an spirit and is an indelible part of the Chinese nation's historical memory.” [3]

3.2. Challenges and Innovative Paths in Preserving the Spirit of the Red Flag Canal

As an important symbol of China's red culture, the Hongqi Canal embodies the spirit of self-reliance, hard work, unity and cooperation, and selfless dedication. However, in the process of passing down this legacy, the spirit of the Hongqi Canal faces a series of challenges. The younger generation lacks a deep understanding of the historical background and spiritual essence of the Hongqi Canal, leading to an underappreciation of its value; the promotion of the Hongqi Canal spirit still relies heavily on traditional educational methods, which lack innovation and interactivity, making it difficult to engage young people; the application of digital technologies remains insufficient, with emerging tools such as virtual reality and augmented reality underutilized in enhancing immersive experiences; there is limited development of cultural and creative products related to the Hongqi Canal, with existing designs lacking originality and appeal; opportunities for on-site experiences and participatory learning are scarce, restricting young people's direct engagement with and deeper understanding of the Hongqi Canal spirit; generational differences in values further complicate intergenerational transmission; disparities in regional economic development affect the local implementation and promotion of the Hongqi Canal spirit; changes in the social environment may shift public attention away from traditional culture; and the integration of the Hongqi Canal spirit into the education system remains limited.

To better inherit and promote the spirit of the Red Flag Canal, existing research has made some progress, but there is still a need to further diversify its modes of dissemination. In response, this paper adopts a design studies perspective, centering on immersive experiences, to explore how the spirit of the Red Flag Canal can be innovatively presented through the design of immersive spatial environments, thereby enriching and advancing research in this field.

4. A Study on the Construction Path of Digital Immersive Scenarios Based on Flow Theory

4.1. Theoretical Framework Construction

In the era of digital transformation, the spirit and culture of the Red Flag Canal are at a pivotal moment of inheritance and innovation. As technology enters a new phase, digital design has opened up entirely new avenues for the development of this cultural legacy. We will focus on establishing key pathways for digital transformation within immersive red culture scenarios, conducting in-depth research into innovations in technology, design, and immersive experiences.

The concept of "immersive experience" is a theory in the field of positive psychology, proposed by American psychologist Mihaly Csikszentmihalyi in 1975. Also known as flow theory or immersion theory, it describes a state in which individuals are fully engaged in an activity, intensely focused on their internal experience, lose track of time, and feel a sense of happiness flowing in an orderly manner when their skills are well-matched to the challenges they face. In this state, people enter an optimal experience. [4] Accordingly, the term "immersion" in the book *The Laws of Design* refers to "a state of complete focus on an activity, to the point of losing all awareness of the real world." [5] Immersive experiences allow visitors to fully engage and enjoy themselves in a specific setting, enabling them to effectively absorb and process information. "For example, in the Hongqi Canal game, players must complete excavation tasks (challenges) with limited resources. The

system sustains a state of flow through real-time progress bars and achievement rewards (instant feedback).”

4.2. Digital Heritage Preservation and Exhibition

To protect and showcase the unique charm of the Red Flag Canal and its surrounding environment, advanced 3D scanning technology can be used to digitally record it with high precision, creating realistic virtual models that serve as foundational data for future virtual reality and augmented reality experiences. Immersive experiences are spatial activities built upon digitally replicated quasi-objects, with spatial environment creation as their core component and a key factor in delivering a sense of immersion to the audience. [6] Virtual scenes constructed through digital technology are central to crafting immersive experiences. By integrating sound, light, electricity, and other elements, they create a distinctive spatial atmosphere. When visitors step into these designed virtual environments, they can instantly feel as if they are truly present—transported through time and space to witness the brilliance of the Red Flag Canal and gain a profound understanding of the spirit it embodies. This immersive experience not only significantly enhances public awareness of the historical significance of the Red Flag Canal, but also inspires a deep emotional connection with the Red Flag Canal spirit, thereby promoting the preservation and development of its culture.

4.3. Using Digital Technology to Develop the Red Flag Canal Game

To better preserve and promote the spirit of the Red Flag Canal, digital technology can be leveraged to develop a management simulation game based on its construction process. By recreating the journey of building the canal, the game enables players to experience firsthand the hardships and challenges faced by the builders of that time, thereby deepening their understanding of and respect for the Red Flag Canal spirit.

Set against the historical backdrop of the canal’s construction, the game allows players to take on various roles such as engineer, worker, or manager, each with specific tasks and responsibilities. It features a series of challenging missions, including solving construction issues, dealing with harsh weather conditions, and coordinating manpower and resources. All of these tasks are designed based on real-life situations encountered during the actual construction of the Red Flag Canal. Through virtual reality and augmented reality technologies, the game creates an immersive experience that makes players feel as if they are truly present at the construction site of the Red Flag Canal. With clear and specific goals and an instant feedback mechanism, the game filters out unnecessary information and fully engages the players, enabling them to focus intensely, enter a state of “flow,” and become deeply immersed in the experience.

Red cultural spaces make use of existing revolutionary relics and historical materials to gamify the dissemination and education of red culture. Developing game-based projects that help visitors understand the social context and historical inevitability of the revolution’s emergence is also one of the key approaches to creating immersive scene-based experiences.

4.4. Building the Hongqi Canal Smart Museum

To vividly showcase the historical and cultural significance of the Red Flag Canal, a Red Flag Canal Smart Museum can be established. This smart museum can enhance

visitor interaction and immersion through a range of advanced technologies. The museum will feature multiple immersive exhibition halls, each meticulously designed to highlight the unique characteristics and major events of different stages in the canal's development.

From multimedia interactive screens in the Origin Hall introducing the background of the canal's construction, to glasses-free 3D animations depicting the living conditions of the early residents of Linxian; from VR experiences and physical exhibits in the Construction Progress Hall, to character profiles and audio recordings in the Heroes Hall; then to panoramic cinema and real-time data displays in the Achievements Hall; and finally, to gamified learning and virtual experiments in the Educational Interaction Zone. These immersive experiences not only help visitors gain a deeper understanding of the significance of the Red Flag Canal, but also spark their interest in and admiration for this remarkable project, making the Red Flag Canal Smart Museum a modern exhibition center that seamlessly combines education, entertainment, and cultural communication.

5. Conclusions

This article explores methods for constructing immersive scenes to present Henan's red culture with the support of digital transformation technologies, using the Red Flag Canal as a case study. It first analyzes the role of digital technologies in cultural heritage preservation and highlights the significance of the Red Flag Canal spirit, along with the challenges in its transmission. It then proposes three innovative approaches: a. Utilizing 3D scanning technology for the digital preservation and presentation of cultural heritage; b. Developing a management simulation game centered on the Red Flag Canal, enabling players to experience its spiritual essence by simulating the construction process; c. Establishing a smart museum dedicated to the Red Flag Canal, featuring immersive exhibition halls through technologies such as multimedia interaction and virtual reality.

These approaches aim to enhance public understanding of the history and spiritual values of the Red Flag Canal, and to promote the inheritance and development of its cultural legacy.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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