Research on the Digital Interaction Design Paradigm of Traditional Cultural ScenariosT

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Abstract: This article focuses on the digital interaction design paradigm of traditional cultural scenarios and explores its theoretical framework and practical path in the context of the integration of cultural inheritance and digital technology. By analyzing the digital characteristics and interaction design requirements of traditional cultural scenarios, a design paradigm centered on users, with cultural narratives as the context and technical adaptation as the support is proposed, aiming to provide theoretical references for the digital protection and dissemination of traditional cultural scenarios.

Keywords: Traditional Cultural Scenes; Digital Interaction Design; Paradigm Research; Cultural Inheritance

1. Introduction

1.1 Research Background and Significance

With the rapid development of digital technology, the digital protection and dissemination of traditional cultural scenarios have become an important issue in the cultural field [1]. Traditional cultural scenes carry historical memories, cultural values and national spirit, but their physical forms are gradually fading away due to the influence of factors such as time and environment. For instance, the murals in the Mogao Caves of Dunhuang are facing problems such as color fading and structural damage due to natural erosion and human destruction. The ancient architectural complex of the Forbidden City is threatened to survive due to hidden dangers such as aging wood and foundation settlement. Digital technology, through means such as virtual reality (VR), augmented reality (AR), and 3D modeling, provides new approaches for the preservation and reproduction of traditional cultural scenes.

Interaction design, as a key link in the integration of digital technology and cultural scenarios, can enhance the communication effect and cultural identity of traditional cultural scenarios through user participation, emotional resonance and cultural narrative. For instance, the "Digital Dunhuang Immersive Exhibition" jointly launched by the Dunhuang Academy and Tencent uses VR technology to recreate the three-dimensional space of Cave 285 in the Mogao Caves. Users can interact with the characters in the murals through gesture interaction and enjoy an immersive cultural experience. However, at present, the digital interaction design of traditional cultural scenarios still has problems such as insufficient technical adaptability, shallow expression of cultural connotations, and single user experience. Therefore, establishing a systematic digital interaction design paradigm is of great significance for promoting the creative transformation and innovative development of traditional cultural scenarios.

1.2 Research Objectives and Methods

This research aims to construct a digital interaction design paradigm for traditional cultural scenarios, clarifying its design principles, technical paths and implementation strategies. The research adopts literature analysis method, interdisciplinary research method and system analysis method, and combines relevant theories such as cultural studies, design studies and digital technology to sort out the digital characteristics and interaction design requirements of traditional cultural scenarios, and proposes a universal design paradigm.

In terms of literature analysis, this study focuses on the academic achievements at home and abroad in the past five years regarding the digitalization of cultural heritage, interaction design, and the application of digital technology. For instance, Peng Qiang et al. [4] proposed that in user experience design, value awareness can be enhanced through storytelling. Mason et al. [5], from the perspective of user experience, constructed an evaluation model for digital

interaction design of cultural heritage, providing a quantitative basis for design optimization.

In terms of interdisciplinary research, this study integrates theories from multiple disciplines such as cultural anthropology, cognitive psychology, and computer science. For instance, the theory of cultural anthropology provides methodological support for exploring the cultural symbols and narrative logic of traditional cultural scenarios. Cognitive psychology theory guides interaction design on how to conform to users' cognitive habits and emotional needs. The system analysis method systematically sorts out the key elements and interactive relationships of digital interaction design in traditional cultural scenarios by constructing a three-dimensional analysis framework of "culture - technology - user".

2. Digital Characteristics and Interaction Requirements of Traditional Cultural Scenarios

2.1 Digital Characteristics of Traditional Cultural Scenarios

The digital characteristics of traditional cultural scenes are reflected in three aspects: First, spatial virtualization. Through technologies such as 3D modeling and panoramic photography, the spatial forms of traditional cultural scenes can be digitally reproduced, breaking through the limitations of physical space [7]. Second, dynamic time. Digital technology can simulate the historical evolution process of traditional cultural scenes, such as the changes in architectural styles and the reenactment of festival ceremonies, enhancing the temporal dimension expression of cultural scenes [8]. Thirdly, content is multimodal. The digital content of traditional cultural scenarios encompasses various forms such as text, images, audio, and video. Through multimodal interaction design, it achieves a three-dimensional presentation of cultural information.

2.2 Interaction Design Requirements for Traditional Cultural Scenarios

The interaction design requirements for traditional cultural scenarios are closely centered around users' in-depth demands for cultural experience. In terms of cultural cognition needs, users are eager to break through the limitations of traditional displays through interaction design, and gain a deeper understanding of the historical context, cultural implications and artistic essence behind the scenes, such as learning about the construction techniques of ancient buildings through virtual tours. In terms of emotional resonance needs, interaction design should rely on scene restoration, role-playing and other means to create an immersive cultural atmosphere, making users feel as if they were in a historical scene, establishing an emotional connection with cultural elements and enhancing their sense of cultural identity. The demand for participation and experience is reflected in users' expectations of actively participating in the construction and interpretation of cultural scenes through various means such as gesture operation and voice interaction, such as personally "restoring" virtual cultural relics and participating in virtual sacrificial ceremonies, to achieve in-depth interaction among "people, scenery and culture", thereby obtaining a richer and more three-dimensional cultural experience.

3. Theoretical Framework of Digital Interaction Design Paradigm for Traditional Cultural Scenarios

3.1 User-Centered Design Principles

There are significant differences among various user groups in terms of cultural background, age groups and interest preferences, which requires designers to conduct detailed user stratification. For teenage users, who are full of vitality and curiosity and have a high acceptance of new things, gamified interaction design can be adopted. By setting up task challenges, role-playing and other sections, such as building virtual traditional culture adventure games, teenagers can gain a deeper understanding of traditional cultural scenes while completing tasks like finding clues of traditional craftsmanship and solving historical puzzles, thereby stimulating their interest in participation. For elderly users, considering that they may have difficulty with complex operations, the operation process needs to be simplified. It provides clear visual guidance, such as large fonts, high-contrast interface design, and considerate voice prompt functions, making it convenient for them to use it easily.

User feedback is the key to improving the quality of interaction design. Through user testing, users of different levels are invited to participate in the experience, their operation processes and reactions are observed, and direct

usage feelings are collected. Meanwhile, by using behavioral data analysis technology, we track users' behaviors such as clicking, browsing and staying during the interaction process to identify potential problems. Based on this feedback information, continuously optimize the interaction design, adjust the interface layout, interaction logic, etc., to enhance the smoothness and satisfaction of the user experience, and make the design more in line with user needs.

3.2 Design Logic with Cultural Narrative as the Thread

By combining linear narrative with nonlinear narrative, a multi-level cultural narrative framework is constructed. Linear narrative is like a clear thread, used to present the historical development process of traditional cultural scenes. For instance, when presenting traditional architecture, it should be narrated in a chronological order, from the origin of the buildings, the evolution of styles in various periods to modern protection and inheritance, allowing users to have a comprehensive understanding of the development of architecture. Non-linear narrative grants users more autonomy. By setting up branch plots, hidden tasks and other means, it provides users with space for independent exploration. Users can choose different exploration paths based on their own interests to discover more little-known details and stories in traditional cultural scenarios.

Deeply explore narrative elements such as symbols, rituals and stories in traditional cultural scenes and present them artistically through digital means. The patterns and colors in traditional architecture are rich in cultural implications and can be transformed into visual elements of interactive interfaces. For instance, designing exquisite window lattice patterns as menu buttons not only serves a decorative function but also reflects the characteristics of traditional culture. Music and dance in festival ceremonies are important carriers of culture. They can be transformed into dynamic sound effects and animations for interactive scenes. When users trigger specific interactions, corresponding music is played and dance animations are displayed, allowing users to feel the lively atmosphere of the festival as if they were there.

3.3 Design Path Supported by Technical Adaptation

Based on the types and interaction requirements of traditional cultural scenarios, precisely select appropriate digital technologies. For historical building scenes, their spatial structure is complex and they have high historical and cultural value. 3D modeling and VR technology can be adopted. Through 3D modeling, the appearance and internal structure of the building are precisely restored. Combined with VR technology, users feel as if they are inside the building, enjoying an immersive spatial experience and closely appreciating the details and features of the building. For folk festival scenes, which feature the combination of real scenes and virtual content, the approach of integrating AR technology with mobile terminals can be adopted. Users can scan real scenes through mobile devices such as mobile phones to see virtual cultural elements superimposed on reality, such as virtual festival decorations and performances, enhancing the sense of integration between reality and virtuality.

Enhance the overall effect of interaction design through the collaboration of multiple technologies. Combining voice recognition, gesture recognition and haptic feedback technologies to achieve multi-sensory interactive experiences. Users can control the interactive interface through voice commands, operate with gestures, and at the same time receive haptic feedback, such as the vibration when touching virtual cultural relics, enhancing the sense of reality and immersion in the interaction. Applying big data analysis and artificial intelligence technologies to user behavior prediction, based on users' historical interaction data, analyzing their interest preferences, and providing personalized interaction services, such as recommending traditional cultural content that aligns with users' interests, can enhance users' satisfaction and loyalty.

4. Implementation Strategies for Digital Interaction Design Paradigms in Traditional Cultural Scenarios

4.1 Digital Translation of Cultural Content

The digital translation of cultural content is the foundation of interaction design. First, cultural decoding. Conduct in-depth interpretations of cultural symbols, values and artistic forms in traditional cultural scenarios, and extract their core cultural elements. Second, cultural coding. Transform the decoded cultural elements into

digital language and present them through forms such as 3D models, animations, and sound effects. For instance, by transforming the mortise and tenon structure in traditional architecture into an interactive model, users can understand its construction principle through operations such as dragging and rotating. The singing and body movements in traditional operas are transformed into dynamic animations, allowing users to experience the art of opera through imitation and learning.

4.2 Design Optimization of the Interactive Interface

The design optimization of the interactive interface is the key to enhancing user experience. First, interface layout. Adopt a simple and clear interface layout to highlight the core position of cultural content. For instance, divide the interactive interface into a cultural display area, an operation navigation area and a user feedback area to avoid information overload. Secondly, visual design. By applying the colors, patterns and fonts from traditional culture, a visual style with cultural characteristics is created. For instance, the blue and white color scheme of blue and white porcelain and the title design in calligraphy fonts are adopted to enhance the cultural recognition of the interface. Thirdly, interactive feedback. Provide timely interactive feedback through dynamic effects, sound effect prompts and other means. For instance, when users click on cultural elements, the interface can display dynamic effects such as zooming in and rotating, accompanied by corresponding cultural explanation sound effects.

4.3 Hierarchical Construction of Scene Experience

The hierarchical construction of scene experience is the core of enhancing cultural identity. First, the basic experience layer. Provide basic information display and simple interactive functions of traditional cultural scenes, such as scene browsing and cultural explanation, to meet users' initial cognitive needs. Second, the deep experience layer. Through interactive designs such as role-playing and task challenges, users are guided to deeply participate in the construction and interpretation of cultural scenarios. For instance, users can play the role of artisans in traditional architecture and complete the assembly of building components through virtual tools. Or play the role of a participant in a festival ceremony and complete the ritual actions through gesture operation. Thirdly, the emotional experience layer. Stimulate users' emotional resonance through methods such as creating a scene atmosphere and designing emotional resonance. For instance, in traditional architectural settings, the cultural atmosphere of buildings in different historical periods is restored through the simulation of lighting and sound effects. In festival scenarios, dynamic effects of collective celebration are triggered through user interaction to enhance users' sense of belonging.

5. Conclusion

This study has constructed a digital interaction design paradigm for traditional cultural scenarios, and proposed design principles and implementation strategies centered on users, with cultural narratives as the context and technical adaptation as the support. This paradigm has achieved in-depth protection and innovative dissemination of traditional cultural scenarios through the digital translation of cultural content, the design optimization of interactive interfaces, and the hierarchical construction of scene experiences.

Future research can further explore the following directions: First, interaction design in cross-cultural scenarios. Study the user demands and interaction preferences in different cultural backgrounds, and construct a universal cross-cultural interaction design paradigm. Secondly, the interactive application of technological innovation. Pay attention to the potential applications of emerging digital technologies such as the metaverse and brain-computer interfaces in the interaction design of traditional cultural scenarios. Thirdly, sustainable interaction design. Study the long-term operation and maintenance mechanism of digital interaction design for traditional cultural scenarios to ensure the continuous exertion of their cultural value and technical effects.

The digital interactive design of traditional cultural scenarios is an important practice of the integration of cultural inheritance and digital technology. Through the construction of a systematic design paradigm, new paths can be provided for the protection and dissemination of traditional cultural scenarios, promoting the creative transformation and innovative development of China's fine traditional culture.

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