



Study on the Design of Intangible Cultural Heritage VR Experience and Immersive Communication Strategy Based on Flow Theory

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Abstract: In the context of cultural digitalization, VR has become a key approach for communicating traditional culture. This study adopts flow theory to analyze how task design, multi-sensory integration, narrative structures, and skill-challenge balance jointly shape immersive user experiences. Four cases — paper-cutting, Dunhuang murals, shadow puppetry, and Peking Opera — are examined to explore practical applications. Based on comparative analysis, the study proposes a flow-oriented VR design framework, including clear goal setting, sensory integration, narrative-driven interaction, and adaptive challenge design. The findings highlight a shift from content presentation to experience-driven engagement, aiming to enhance users' emotional connection and deepen cultural understanding in ICH communication.

Keywords: intangible cultural heritage (ICH), flow theory, virtual reality (VR), immersive experience, cultural communication strategy

1. Introduction

Intangible cultural heritage (ICH) faces challenges from modernization and technological change. Virtual reality (VR) enables immersive, interactive experiences beyond traditional displays, but current applications often lack psychological depth. Flow theory, emphasizing deep engagement and satisfaction, offers a framework for enhancing immersion. This paper explores flow-based VR design strategies to support effective digital transformation and communication of ICH.

2. Research Status and Progress of the Integration of Flow Theory and ICH VR

2.1 Flow Theory and Its Application in Immersive Design and Communication

Flow, proposed by Csikszentmihalyi, describes a state of deep immersion with altered time perception and reduced self-awareness [1]. In immersive design, it enhances engagement across games, education, and marketing through clear goals, balanced challenges, immediate feedback, and control. These align with VR features like spatial guidance and sensory feedback. Recent studies emphasize guiding users from “viewing” to “experiencing” [2-4]. In cultural communication, flow deepens immersion and reshapes cognition, supporting emotional engagement and effective transmission of intangible cultural heritage.

2.2 Overview of ICH Digitalization and VR Technology Development

Cultural digitalization may suggest that ICH is transforming from traditional handicraft practice to data-driven reconstruction through technologies like 3D modeling, AR, and VR. However, the evidence could indicate that VR enables immersive cultural experiences and has supported virtual performances and simulations [5-7]. Moreover, the significant findings might demonstrate that many projects remain limited by shallow interaction and weak cultural depth. In light of these results, the data may suggest that integrating psychological theories could advance the field from content display to immersive understanding.

2.3 ICH VR Experience Design from the Flow Perspective: Research Status, Key Issues, and Development Trends

Research on flow-based ICH VR may suggest that gamified interaction and multisensory design could enhance immersion significantly [8]. However, the findings indicate that fragmented content–interaction, lack of real-time feedback, and sensory overload remain critical concerns. Furthermore, future work might demonstrate that integrating cultural meaning with adaptive, user-centered models could achieve deeper flow. In light of these results, the evidence may suggest that such approaches appear essential for meaningful engagement. Studies show flow needs coordinated perception.

3 Core Elements for Constructing Flow Mechanisms in ICH VR Experience Design

3.1 Implementation Pathways of Flow Mechanisms in Virtual Reality Experiences

Flow in VR may suggest that a focus–challenge–feedback loop could indicate the critical role of clear goals, adaptive challenges, and immediate feedback. Moreover, the findings appear to demonstrate that systems guide users through structured tasks and multisensory cues. Furthermore, significant evidence could indicate that stepwise processes and skill evaluation sustain engagement in ICH simulations. In light of these results, voice, haptics, and visuals might demonstrate that passive viewing transforms into interactive experiential learning and cultural immersion [9]. Flow loops show VR needs goals, feedback, cues.

3.2 Interactive Mapping Between ICH Cultural Content and User Flow States

Content presentation may suggest that flow activation appears central to ICH VR experiences. Moreover, the findings could indicate that a task-driven approach transforms craftsmanship into interactive challenges, encouraging continuous engagement through imitation and creation [10]. Furthermore, the evidence may demonstrate that systems should adapt to user behavior and emotions in real time to balance difficulty and pacing. In light of these results, significant mapping could suggest that cultural narratives integrate with experiential mechanisms to sustain flow. Systems show narratives deepen immersive understanding.

3.3 Integrated Analysis of Key Design Elements Oriented by Flow Theory

Flow-oriented ICH VR design integrates technical interaction and psychological mechanisms. Key elements include clear goals, balanced challenges, immediate multi-sensory feedback, and user control. Together, they form a dynamic flow loop, enabling cyclical engagement in “goal–challenge–feedback” processes. This supports progressive immersion, guiding users from cognitive understanding to deeper emotional resonance with cultural content, see Figure 1.

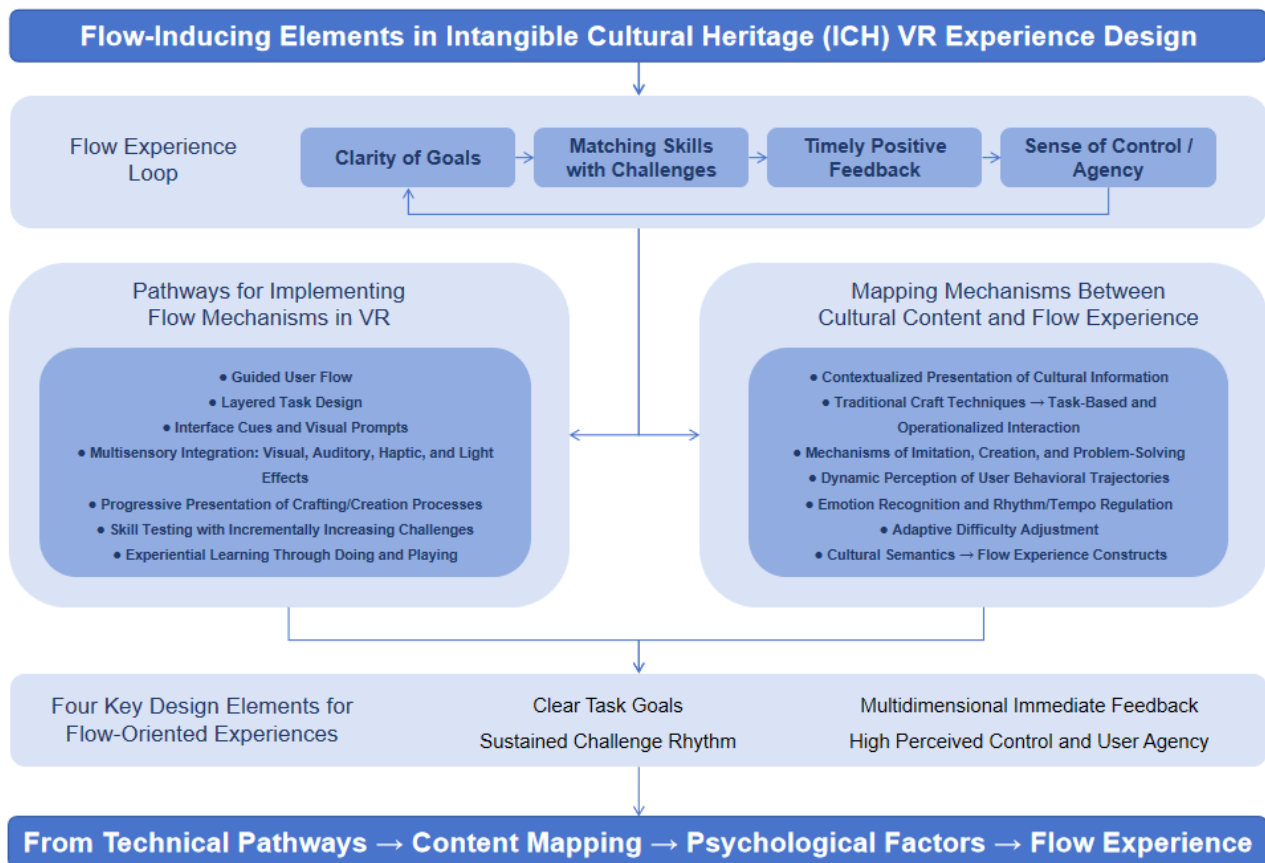


Figure 1. Flow-Mechanism Constructing Elements in ICH VR Experience Design

4. Case Analysis of Immersive Communication in ICH VR Applications

4.1 Paper-Cutting Interactive Experience System



Figure 2. Digital Space of Chinese Paper-Cutting (Source: the Internet)

The “Digital Space of Chinese Paper-Cutting”, developed by the Shanghai Academy of Fine Arts, supports the digital preservation and dissemination of this UNESCO-listed heritage (2009). Using VR, it presents diverse works in an immersive visual environment. The platform showcases regional styles, evolving techniques, and cultural meanings, linking tradition with contemporary interpretation and promoting shared understanding of paper-cutting art.

4.2 Mogao Grottoes Immersive System



Figure 3. Exploring Dunhuang — Digital Dunhuang Immersive Exhibition and Vientiane Dunhuang: Treasures and Sands Project (Source: the Internet)

The “Digital Dunhuang” immersive system, developed by the Dunhuang Academy and Tencent, combines online learning with offline VR experiences centered on Cave 285. It features high-precision 1:1 reconstructions and iconic motifs, enhancing cultural engagement. Projects like Myriad Aspects of Dunhuang further use spatial positioning, multi-user interaction, and real-time rendering to recreate Tang-era scenes, offering highly immersive and interactive experiences.

4.3 Shadow Puppetry VR Interactive Experience Platform

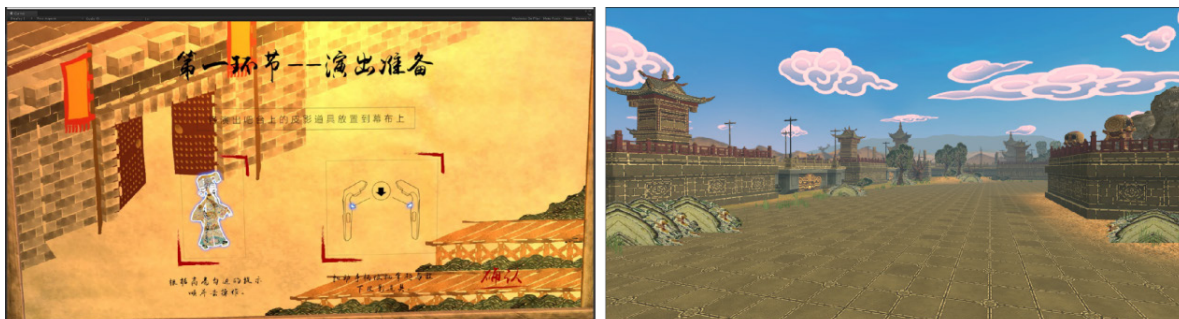


Figure 4. VR Shadow-Puppetry Interactive Experience: Tian Ji Races His Horses (Source: the Internet)

The VR Shadow Puppetry Tian Ji Races His Horses project digitizes traditional theater into an interactive virtual

space. Users select characters, make strategic decisions, and perform actions that shape the narrative. Combining real-time narration, dynamic light-shadow projection, and traditional sound effects, the system integrates visual and auditory stimuli, creating a structured, engaging, and highly immersive cultural experience.

4.4 Opera VR Simulation Design



Figures 5. VR Film Listening to Opera at Huguang Guild Hall (Source: the Internet)

The VR system Listening to Opera at Huguang Guild Hall transforms Peking Opera into a multi-user interactive experience. Supporting up to four participants, it enables collaborative performance through motion tracking and voice interaction. Users can sing, act, and rehearse within a shared virtual stage, shifting opera from passive viewing to immersive, role-based participation across performance, observation, and rehearsal modes.

5. Immersive Communication Strategies: Practical Pathways for Flow Experience

5.1 Clear Goal Guidance Strategy: Construction of Task-oriented Interaction Mechanisms

Clear goals may suggest that structured flow in VR experiences could demonstrate significant pedagogical value. However, the findings indicate that ICH systems design task chains such as “recognition–imitation–creation” and “selection–progression,” guiding users through key interactions. Furthermore, the evidence may suggest that role-based tasks could enhance significant user engagement with cultural content. In light of the results, users might demonstrate that clear objectives and feedback support active control and achievement [12], while culturally embedded contexts could indicate that cognitive engagement appears strengthened. Goals drive flow, tasks structure interaction, feedback builds achievement.

5.2 Multi-sensory Immersion Strategy: Integrating Perceptual Channels to Strengthen Immersion

Multi-sensory integration may suggest that immersive VR could demonstrate significant potential, combining visual, auditory, and kinesthetic channels in coordinated ways. Moreover, the findings from cases like Dunhuang, shadow puppetry, and opera systems might indicate that the evidence supports enhanced realism through sound, motion, and light coordination. Furthermore, the results could suggest that this approach appears to deepen emotional connection and engagement across important cultural contexts. In light of these significant findings, the evidence may demonstrate that cross-modal cultural understanding [13] could enable the transformation of ICH experience from visual perception to embodied, immersive cultural memory. VR integration shows channels enhance realism.

5.3 Narrative-driven Strategy: Immersive Interpretation of Cultural Storytelling

Narrative may suggest that it remains central to ICH communication, guiding users to understand cultural context and values [14]. Moreover, the significant findings could indicate that VR projects embed story-driven interactions — linking paper-cutting, Dunhuang murals, shadow puppetry, and opera — into tasks. Furthermore, the evidence might demonstrate that under flow theory, coherent narratives could sustain attention and emotional engagement. In light of these results, the key data appears to show that the “story–action–feedback” model enables users to both experience and participate in cultural storytelling. Narrative links ICH, VR, flow theory, story model.

5.4 Skill-Challenge Balance Strategy: Design of Hierarchical Tasks and Feedback Mechanisms

The findings may suggest that flow requires balancing skill and challenge in meaningful ways. However, the significant evidence could indicate that VR systems apply hierarchical tasks — e.g., paper-cutting levels, Dunhuang’s phased guidance, and role-based opera tasks — to match user abilities effectively. Moreover, the results might demonstrate that immediate

feedback, including visual, verbal, and operational cues, could support adjustment and motivation. In light of these key findings, the data may suggest that this balance sustains engagement and stabilizes flow. Evidence shows balance enhances ICH communication.

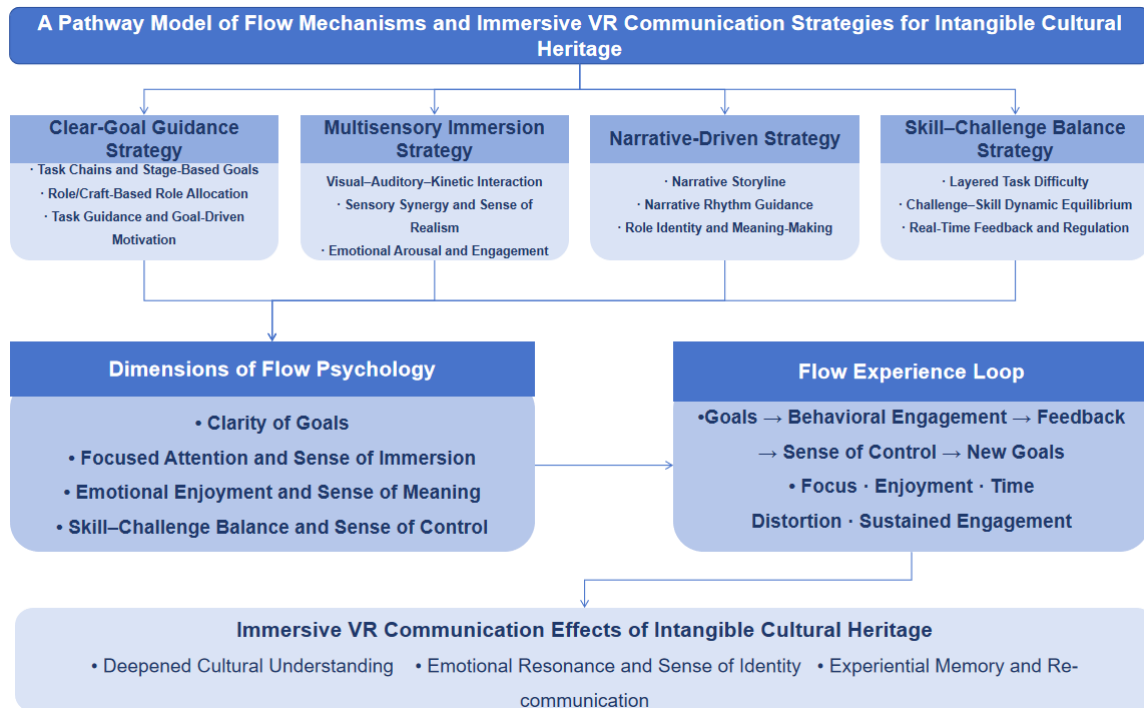


Figure 6. Pathway Model of Immersive VR Communication Strategies and Flow Mechanisms for Intangible Cultural Heritage

6. Conclusion

This study examines ICH communication through VR from a flow perspective, identifying four key factors: clear goals, multi-sensory integration, narrative design, and skill–challenge balance. Case analysis reveals a continuous experiential cycle linking cultural content with psychological engagement. Future development should emphasize user cognition and emotion, enabling ICH to evolve from visual presentation to immersive, emotionally driven cultural experiences.

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