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Immersive Countryside Design through Augmented Reality in Shaoxing

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Abstract: *This study explores how Augmented Reality (AR) can revitalize rural visual culture through immersive design, using Shaoxing as a case. Integrating fieldwork, participatory workshops, and prototype development, it examines how AR transforms local symbols—bridges, waterways, and crafts—into interactive experiences that connect tradition and modernity. The proposed Immersive Countryside Design (ICD) model explains AR's role as a cultural interface across three layers: symbolic translation, spatial immersion, and emotional resonance. Findings show that AR enhances belonging and empathy, reframing heritage as a living system and contributing to sustainable rural branding and design innovation in the post-digital era.*

Keywords: *Augmented Reality; Immersive Design; Rural Visual Culture; Cultural Branding; Shaoxing*

1. Introduction

In the era of digital transformation, design increasingly intersects with cultural sustainability. Within China's national agenda of rural revitalization, cultural heritage is recognized not as a relic to be preserved but as a living resource for design-led innovation. This shift foregrounds a critical question for designers and researchers: how can digital technologies—especially AR—mediate between tradition and modernity to reimagine rural identity?

Shaoxing, an ancient water-town in the Yangtze River Delta, embodies the tension between continuity and change. Its bridges, canals, and black-tiled architecture are iconic of Jiangnan aesthetics, while its traditions of calligraphy, rice-wine brewing, and craftsmanship remain vital expressions of cultural identity. Yet modernization, tourism, and urban expansion risk homogenizing its visual culture. The design challenge, therefore, lies in activating Shaoxing's cultural distinctiveness through immersive, participatory, and empathetic design practices.

AR, as a medium that overlays digital layers upon physical space, has the potential to visualize intangible heritage and cultivate new forms of interaction. However, in current heritage design practice, AR is often treated as a technological showcase rather than a cultural design process. This research reframes AR as a design-driven cultural interface that enables users to engage bodily, sensorially, and emotionally with rural identity.

The research objectives are threefold:

(1) To examine how AR can reinterpret Shaoxing's tangible and intangible heritage through visual and spatial design;

(2) To develop the Immersive Countryside Design(ICD) model as a theoretical framework connecting symbol, experience, and identity;

(3) To assess how immersive design fosters authenticity, participation, and local belonging in rural contexts.

By synthesizing cultural theory, design methodology, and digital experimentation, this study contributes to the emerging discourse on design for cultural continuity, proposing a new model for how AR can enhance the communicative and experiential dimensions of heritage.

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2. Literature Review and Theoretical Background

2.1 Immersive Design and Experience

Immersion in design has evolved from technological spectacle to experiential philosophy. Following Sung E C. 's(2021)notion of the "experience economy," design scholars have reinterpreted immersion as a process of embodied participation[1]. Upadhyay V, Swami A.'s(2025)concept of "art as experience" provides a foundational perspective, framing aesthetic experience as an active, integrated process between individual and environment[2].

In digital design, immersion entails both spatial and emotional involvement. Cohen J.'s (2025)theory of "flow" further contextualizes immersion as a state of focused engagement and meaningful interaction[3]. Within cultural heritage studies, immersive design extends beyond visualization; it constructs a sensory environment where knowledge is lived rather than observed (Mao K, Qian S., 2025)[4].

2.2 Augmented Reality as Cultural Interface

AR differs from Virtual Reality in that it augments rather than replaces the physical environment. It offers opportunities for contextual storytelling and situated experience(Lynam H, Dascalu S, Folmer E. , 2025)[5]. Darley A. 's(2002)theory of "remediation" describes how digital media refashion prior cultural forms—a concept directly relevant to heritage design. AR, by blending real and virtual, embodies this dual logic: it mediates between presence and representation, enabling users to perceive cultural artifacts as both material and symbolic[6].

Awad A, Qutqut M H, Ahmed A, et al.(2024)describes software as the "cultural layer" of modern experience, asserting that digital tools encode aesthetic and ideological values[7]. In this sense, AR acts as cultural software—its algorithms carry semiotic weight, translating heritage into dynamic systems of meaning. The design challenge lies in ensuring that these translations maintain cultural authenticity and emotional resonance.

2.3 Cultural Branding and Visual Identity

Cultural branding situates design within processes of identity formation. According to *Haynes P.* (2025), brands operate as symbolic resources through which communities construct meaning[8]. In rural heritage contexts, visual branding must balance global visibility with local specificity. AR enables this balance by embedding branding into interactive spatial narratives, allowing users to co-construct identity through engagement.

Rickly J, Sharma N, Canavan B. (2025) introduced the concept of "experiential authenticity," describing how mediated experiences can still evoke genuine emotional connection[9]. For Shaoxing, authenticity arises not from historical accuracy alone but from the emotional truth of participation—when users feel part of a living cultural story.

2.4 Digital Locality and Design for Place

Pink S, Horst H, Lewis T, et al.(2015) defines "digital locality" as the mediation of place through networked technologies[10]. In immersive design, locality is not erased by the digital but rearticulated through sensory experience and user agency. This study extends Pink's notion by integrating design methods that foreground situated creation—design that emerges from specific cultural and environmental contexts.

Appadurai's (1996) concept of "ethnoscapes" also informs this research, emphasizing the fluid and translocal nature of cultural identity[11]. In the digital era, Shaoxing's heritage exists simultaneously as a local lived space and a global visual narrative, mediated by AR interfaces that allow for reinterpretation and participation.

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3. Methodology and Case Context

3.1 Research Design

This study employs a design-led qualitative approach, consistent with practice-based research traditions in design studies. The process integrates methods from participatory design, digital prototyping, and ethnographic observation, enabling iterative cycles of creation, reflection, and evaluation (Sanders & Stappers, 2008)[12]. The rationale is to investigate AR not as a finished product but as an evolving design process rooted in context and collaboration.

The research process unfolds in three phases:

(1) Field Research and Cultural Mapping: Documenting Shaoxing's heritage through photography, 3D scanning, and interviews with local stakeholders.

(2) Co-Design Workshops: Engaging local designers, students, and artisans in creating AR concepts and visual assets inspired by Shaoxing's aesthetics.

(3) Prototype Development and Testing: Using Unity 3D and ARKit to build and deploy immersive AR experiences in Anchang Ancient Town and Dongpu Rice-Wine Village.

3.2 Data Collection and Analysis

Empirical data were collected through semi-structured interviews(n=12), field observations, and user testing sessions (n≈60). Qualitative data were transcribed and coded using NVivo, applying thematic analysis to identify recurring patterns related to symbolism, engagement, and identity.

Three key analytical lenses guided the process:

1) Visual Semiotics: How AR reinterprets cultural symbols.

2) Embodied Interaction: How users experience heritage through sensory immersion.

3) Participatory Co-creation: How AR facilitates community involvement and emotional ownership.

3.3 Case Context: Anchang and Dongpu

Anchang and Dongpu represent contrasting but complementary cultural environments. Anchang preserves its canal-based spatial morphology, making it ideal for exploring AR's potential in architectural storytelling. Dongpu, home to Shaoxing's rice-wine heritage, offers rich material for intangible cultural expression through sensory narratives—sound, gesture, and ritual.

The selection of these sites aligns with the research objective to bridge material and immaterial dimensions of heritage. AR installations were positioned in real environments, transforming everyday spaces into interactive cultural interfaces.

3.4 Design Ethics and Collaboration

Ethical considerations were embedded throughout the project. Participants were informed of research goals and consented to data usage. The design team emphasized cultural respect, avoiding commercial stylization that might distort local meanings. Collaboration between academic researchers and community participants ensured that design outcomes reflected authentic local voice rather than external appropriation (*Table 1)*.

Table 1: Summary of Research Design

Phase	Focus	Main Activities	Outputs
1. Field Study	Cultural documentation	Site visits, photography, interviews	Visual archive, heritage data
2. Co-Design	Collaborative ideation	Workshops with designers and artisans	Concept sketches, design prototypes
3. AR Testing	Immersive evaluation	Unity 3D prototyping, user observation	AR modules, user feedback

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4. Design Mechanisms of the Immersive Countryside

Three interdependent design mechanisms define how AR mediates cultural experience: symbolic translation, spatial immersion, and emotional resonance. Together, they constitute the operative logic of the Immersive Countryside Design (ICD) framework.

4.1 Symbolic Translation

At the symbolic level, AR functions as a design language that translates traditional motifs into algorithmic visual forms. In Anchang's AR environment, water patterns were transformed into flowing brushstrokes, connecting the rhythm of rivers with the movement of calligraphy. Such translation reanimates cultural codes while maintaining their symbolic integrity.

This process exemplifies *Versteegen P L.*'s(2024)idea of "cultural software," where computation becomes a site of aesthetic expression[13]. The symbolic layer enables heritage to evolve as living code, continuously reinterpreted through user interaction.

4.2 Spatial Immersion

The spatial layer focuses on the integration of narrative and environment. In Dongpu's AR installation, users scanned markers embedded in historical sites to reveal layered digital scenes—artisans weaving bamboo, merchants trading wine, scholars reciting poems. Walking through space became a form of temporal storytelling, merging physical movement with digital memory.

The design applied principles of environmental storytelling, using light, sound, and motion graphics to evoke multisensory engagement[14]. AR thus transforms spatial navigation into cultural participation, allowing users to inhabit history rather than merely observe it.

4.3 Emotional Resonance

Emotional resonance constitutes the deepest layer of immersion. It concerns how users construct affective connection and identity through AR experiences. Interviews revealed that participants described the experience as "being inside a living painting." Such responses highlight how empathy replaces observation as the primary mode of cultural engagement.

This aligns with Hussein Z A's (2025)theory of emotional design, which posits that meaningful interaction arises from affective response[15]. In AR-mediated heritage, authenticity becomes relational—it emerges through participation and empathy rather than objective accuracy.

5. Model Building and Discussion

5.1 The Immersive Countryside Design (ICD) Model

The ICD model integrates the three mechanisms—symbolic, experiential, and identity layers—into a cohesive framework for design research. It illustrates how AR operates simultaneously as a technical system, a semiotic medium, and a social practice.

(1) The symbolic layer emphasizes the translation of heritage symbols into dynamic visual expressions.

(2) The experiential layer engages multisensory participation through spatial and narrative immersion.

(3) The identity layer foregrounds emotional and communal reconstruction of belonging.

These layers form a feedback loop in which digital experience shapes cultural perception, while cultural knowledge guides design adaptation (Figure 1).

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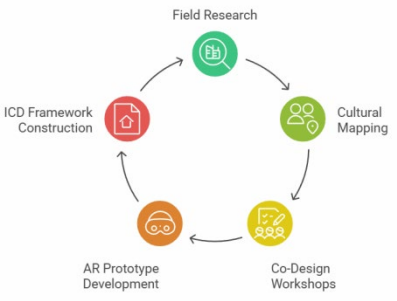

Figure 1: Research-to-Design Process of the Immersive Countryside Study

5.2 Theoretical Contribution

The ICD model extends existing frameworks such as the Cultural Interactive Visualization (CIV) model (Wei G, Ji Z., 2025)by emphasizing participatory co-creation[16]. It shifts the focus from technological representation to cultural process, integrating semiotics, sensory design, and identity theory within one coherent system.

Furthermore, it contributes to design research by articulating AR as a mediating infrastructure rather than an output. This perspective situates design not as problem-solving but as meaning-making—an iterative dialogue between artifact, designer, and user.

5.3 Global Relevance

While rooted in Shaoxing, the ICD framework is adaptable to other cultural contexts. Comparative application to Mediterranean fishing villages or Nordic craft communities could reveal shared patterns of digital heritage mediation. The framework's emphasis on empathy and co-creation aligns with current global discourses on human-centered and place-based design.

6. Conclusion and Future Work

6.1 Summary

This research has explored how Augmented Reality can function as a design medium for reimagining rural visual identity. Using Shaoxing as a case study, it demonstrated how AR-based immersive design transforms heritage from static representation to interactive experience. The Immersive Countryside Design (ICD) model theorizes this transformation across symbolic, experiential, and identity dimensions, offering a holistic understanding of AR's cultural potential.

6.2 Contributions

Theoretically, the study reframes AR as both cultural interface and design methodology, integrating semiotics, embodied experience, and participation. Methodologically, it contributes a design-led qualitative framework that unites creation, observation, and reflection. Practically, it provides actionable insights for rural branding, community revitalization, and cultural education.

6.3 Limitations and Future Directions

The research was limited to two sites within Shaoxing and primarily employed mobile-based AR interfaces. Future studies may expand to wearable or spatial computing systems to enhance immersion. Longitudinal research could also measure the sustained social impact of AR on community identity and intergenerational engagement.

Looking ahead, integration of AI and AR presents promising possibilities for adaptive cultural storytelling. Community-driven AR platforms could enable collaborative authorship, turning heritage into an open, evolving ecosystem. Embedding such approaches into design education will cultivate future designers capable of balancing technological innovation with cultural empathy.

Ultimately, the Shaoxing case demonstrates that when design is culturally grounded, technology

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becomes a catalyst for continuity and renewal—a medium through which memory, design, and identity can be experienced anew in the post-digital age.

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