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Reframing Rural Heritage and Visual Identity in Shaoxing through Augmented Reality as Cultural Interface

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Abstract: *This study explores how augmented reality (AR) functions as a "cultural interface" mediating between rural heritage and contemporary visual identity. Using Shaoxing, an ancient water-town in eastern China, as a case study, it examines the symbolic, spatial, and narrative transformations of heritage through AR visualization. Combining visual semiotics, participatory design, and ethnographic observation, the research proposes a model of "Cultural Interactive Visualization." It argues that AR reshapes cultural authenticity by turning passive viewing into interactive cultural participation, thus reconstructing local identity and deepening public engagement with intangible heritage.*

Keywords: *Augmented Reality; Cultural Interface; Visual Identity; Rural Heritage; Digital Humanities; Shaoxing*

1. Introduction

In recent years, the integration of digital technology and cultural heritage has transformed the way in which people perceive, experience, and participate in traditional culture[1]. Among emerging technologies, Augmented Reality (AR) has become a pivotal medium that extends the boundaries of cultural representation. Unlike traditional virtual reality that isolates users in a fully digital space, AR overlays virtual information upon physical environments, creating a hybrid field of perception where the tangible and intangible coexist[2]. This hybridization offers a unique opportunity to reimagine the relationship between technology, culture, and local identit—particularly in rural contexts where cultural symbols are both spatially grounded and socially lived.

Shaoxing, a historic city in eastern China, provides a fertile case for such inquiry. Known for its water-town landscapes, calligraphic traditions, and intangible heritages such as Yue Opera and rice-wine craftsmanship, Shaoxing represents a living archive of southern Chinese cultural memory[3]. Yet, like many heritage-rich rural regions, it faces the dual challenge of preservation and modernization. While conventional digital documentation preserves artifacts and spaces, it often fails to capture the sensory, emotional, and participatory dimensions that constitute living heritage. AR technology, by contrast, enables the creation of interactive cultural interfaces—immersive environments that allow audiences to see, hear, and even perform the past within the present[4].

The notion of a"cultural interface", first articulated by Lev Manovich, emphasizes how digital systems mediate human engagement with cultural content. Building upon this concept, this study redefines AR as a cultural interface through which rural heritage and visual identity are continually reframed[5]. By embedding local cultural symbols into AR visualizations, Shaoxing's heritage is not merely represented but reactivated, forming new circuits of meaning between residents, visitors, and the historical environment. This interactive process transforms cultural experience from passive observation to participatory construction, enabling a renewed sense of place-based identity.

Most AR heritage studies emphasize technology, visualization, or tourism, with little attention to their semiotic, aesthetic, or sociocultural dimensions, especially in rural contexts. How AR affects authenticity, emotion, and collective memory remains insufficiently explored. This study addresses these gaps by framing AR as a cultural interface that reshapes visual identity in the digital age. Using qualitative analysis, participatory design, and field observation in Shaoxing, it examines how AR reconfigures symbols, space, and narrative in rural heritage. The research proposes the Cultural Interactive Visualization (CIV) model, linking symbol, experience, and identity, and demonstrates its

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value for sustainable digital heritage and cultural branding.

2. Literature Review and Theoretical Background

2.1 AR and Cultural Heritage: From Visualization to Interaction

Over the past two decades, the use of Augmented Reality (AR) in cultural heritage has evolved from a technological novelty to an established research field bridging digital humanities, design, and museology. Early applications(Verma R, Kotwal M.) focused primarily on the technical feasibility of overlaying digital images onto physical structures[6]. These pioneering works laid the foundation for the visualization of cultural artifacts and architectural reconstructions. As hardware and spatial mapping algorithms matured, AR began to play a pivotal role in digital heritage preservation, enabling virtual reconstructions of damaged sites, guided tours, and educational simulations[7].

In recent years, research has shifted from technological enhancement to experiential engagement. Projects such as the Acropolis AR Reconstruction in Greece[8] or the Digital Dunhuang initiative in China exemplify a new paradigm in which visitors are not passive observers but active participants in heritage interpretation[9]. This transition from visualization to interaction reflects a growing recognition that cultural heritage is not only a collection of objects but also a living process of meaning-making and participation (Ranjan & Chaturvedi, 2023). However, most existing studies remain limited to urban or museum contexts, leaving rural heritage—where tangible and intangible cultures are deeply intertwined relatively underexplored.

2.2 Interface Theory and Cultural Mediation

The concept of the "interface" is central to understanding how AR mediates cultural experience. Rosado T L.(2001) defined the cultural interface as the zone where human perception, technological mediation[10], and cultural form converge. In this view, interfaces are not neutral channels but active structures that shape cultural cognition and aesthetics. When applied to heritage studies, the interface becomes a symbolic and experiential filter that reorganizes how audiences perceive time, space, and authenticity.

Building upon Manovich's framework, later scholars have extended the discussion toward affective and participatory dimensions.]Güzelis C and Pompermaier A. (2025) proposed that digital interfaces transform spectatorship into a reflexive process—users simultaneously experience and interpret mediation itself. Similarly[11], Prasittisopin L. (2025) argued that mixed reality reconfigures the materiality of culture by embedding algorithmic agency into the sensory field[12]. These perspectives suggest that AR, as a hybrid interface, operates at both epistemic (knowledge-making) and aesthetic (experience-making) levels. In this sense, it functions as a cultural apparatus that reconstructs how individuals and communities engage with heritage.

2.3 Visual Semiotics and Cultural Identity

The theoretical linkage between visual semiotics and cultural identity provides the interpretive basis for analyzing AR-mediated heritage. Drawing from Roland Barthes'semiotic model, visual artifacts are systems of signification wherein meaning arises from the relationship between signifier and signified[13]. When traditional symbols—such as Shaoxing's bridges, calligraphy strokes, or operatic costumes—are recontextualized through AR, their semiotic codes are expanded: new digital layers coexist with historical meanings, forming what Barthes might call a mythic palimpsest[14].

Cultural identity, as Stuart Hall conceptualized, is not a fixed essence but a dynamic process of positioning[15]. Through this lens, AR does not merely reproduce identity but participates in its re-articulation. The user's interaction within an AR heritage environment becomes a dialogic act of meaning negotiation—between the digital and the physical, the local and the global, the past and the present. This semiotic interactivity underpins the notion of visual identity transformation, wherein the authenticity of heritage is co-constructed by technology, designers, and users alike.

2.4 From Representation to Participation: Theoretical Gaps

Despite increasing research on AR and heritage, three key gaps remain. First, many studies still treat AR mainly as a visualization tool, overlooking its cultural mediation role. Second, rural and

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vernacular heritage are underexplored, with limited attention to their sensory and participatory dimensions. Third, the integration of visual semiotics, interface theory, and cultural identity lacks systematic theorization, especially on how AR reshapes the semiotic structure of place-based heritage.

To address these gaps, this research advances the concept of AR as a Cultural Interface, positioning it as both a representational and participatory system that reconfigures rural visual culture. It proposes a theoretical synthesis—Cultural Interactive Visualization—that integrates interface aesthetics, semiotic analysis, and identity formation. This framework not only contributes to the scholarly understanding of AR's cultural agency but also informs practical design strategies for sustainable digital heritage development.

3. Methodology and Case Context

3.1 Research Design and Rationale

This study uses a qualitative, multi-method approach grounded in design research and digital humanities. It views AR not just as technology but as a cultural interface mediating meaning, participation, and identity. Three complementary methods are employed: visual semiotic analysis, participatory design, and ethnographic observation. The semiotic analysis decodes how Shaoxing's cultural symbols—bridges, calligraphy, and crafts—are reinterpreted in AR interfaces. Participatory design workshops with local designers and residents ensure that prototypes reflect authentic cultural values. Ethnographic observation documents users'real experiences, revealing emotional resonance and identity reconstruction. This triangulated method offers a holistic understanding of AR's cultural impact from both symbolic and experiential dimensions.

3.2 Research Site: Shaoxing's Cultural Landscape

Shaoxing, located in Zhejiang Province, is one of China's oldest cultural cities, renowned for its canals, black-awning boats, whitewashed walls, and intricate stone bridges. Beyond tangible heritage, Shaoxing embodies a rich repository of intangible traditions—Yue Opera, yellow rice wine brewing, ink-making, and calligraphy—that define its local identity. The city's rural hinterlands, such as Anchang, Keqiao, and Dongpu, retain traditional spatial patterns and social rituals, making them ideal for studying AR-mediated cultural experiences.

For this research, two pilot sites were selected:(1) Anchang Ancient Town, a well-preserved water-town featuring historical architecture and living craft workshops.(2) Dongpu Rice-Wine Heritage Area, where AR is used to visualize brewing processes and oral narratives of local artisans.These locations were chosen for their representativeness of Shaoxing's dual heritage form—tangible architectural heritage intertwined with intangible craftsmanship. They also provide the physical context for prototype deployment and user observation.

3.3 Data Collection Procedures

Data were collected from March 2024 to June 2025 in three phases corresponding to the project timeline:

Phase 1–Preliminary Fieldwork (March–August 2024)

Phase 2–Prototype Development (September 2024–February 2025)

Phase 3–User Observation and Evaluation (March–June 2025)

3.4 Analytical Framework

To synthesize insights across these data sources, the study employs a Cultural Interactive Visualization (CIV) analytical framework, consisting of three interpretive layers:(1) Symbolic Layer—decoding how AR transforms traditional symbols into digital signs.(2) Experiential Layer—analyzing how users engage through spatial immersion and sensory interaction.(3) Identity Layer—interpreting how participants reconstruct local belonging and cultural authenticity.By mapping findings across these layers, the research aims to articulate how AR, as a cultural interface, operates simultaneously as a semiotic system, a design medium, and a social practice.

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4. The AR–Cultural Interface Mechanism

4.1 Symbolic Reactivation: Translating Heritage into Digital Signification

At the core of AR as a cultural interface lies the process of symbolic reactivation, in which traditional heritage symbols are translated into digital semiotic systems. In Shaoxing's AR-based heritage prototypes, this translation occurs across both visual and experiential dimensions.For instance, the arched stone bridges of Anchang—emblems of connection between human and water—are reinterpreted in the AR environment as floating 3D models layered with flowing calligraphic lines that respond to user motion. Similarly, the ink brush strokes of Wang Xizhi's calligraphy are transformed into dynamic visual trails that appear when visitors gesture with their hands, symbolizing the continuity of literati aesthetics in the digital era.

This process of translation is not mere replication; it constitutes an act of cultural re-signification. By embedding traditional motifs into algorithmic forms, AR renews the semiotic vitality of heritage—each digital gesture becomes a negotiation between memory and code, history and interface. The result is a new symbolic grammar that integrates cultural memory with computational logic, allowing users to experience heritage as a living language of symbols rather than a static exhibit.

4.2 Spatial Immersion: Constructing the Mixed Reality of Place

Beyond symbols, AR creates spatial immersion by merging Shaoxing's rural landscape with virtual narratives. In the Anchang AR route, users scan QR codes to reveal scenes of merchants, craftsmen, and scholars, turning walking into a temporal journey that connects tangible and intangible heritage. Through movement and gesture, users experience an embodied presence within history. This illustrates remediation, where reality and virtuality coexist, allowing visitors to co-perform heritage rather than merely observe it.

4.3 Narrative Participation: Reconfiguring Cultural Authorship

The third mechanism of the cultural interface is narrative participation—the transformation of audiences from passive viewers into co-authors of cultural storytelling. In traditional museum or documentary contexts, heritage narratives are predetermined by curators or institutions. AR, however, decentralizes authorship by enabling users to navigate, select, and even generate content.

In the Dongpu Rice-Wine AR experience, for example, users can interact with holographic characters—local brewers, storytellers, and community elders—each sharing different oral histories about the brewing process. As users choose which stories to follow, their pathways diverge, producing individualized narrative trajectories. These participatory interactions form a polyphonic narrative network, where cultural knowledge is distributed and dynamically recombined.

This participatory model aligns with post-structuralist views of authorship (Barthes, 1977), where meaning emerges not from a singular origin but through the reader's activity. AR extends this notion into the spatial and sensory domain, allowing cultural narratives to be performed rather than consumed. The audience thus becomes an active collaborator in sustaining and reinterpreting heritage.

4.4 Integrative Dynamics: The Interface as Cultural Mediation

Synthesizing these mechanisms, the AR–Cultural Interface in Shaoxing operates through a triadic dynamic (Table 1):

Table 1: The triple mechanism of Shaoxing's AR cultural interface.

Mechanism	Function	Cultural Effect
Symbolic Reactivation	Translates traditional symbols into algorithmic forms	Revives dormant meanings through digital renewal
Spatial Immersion	Fuses real landscapes with virtual layers	Generates embodied experiences of place-based memory
Narrative Participation	Enables user co-authorship of heritage stories	Democratizes cultural expression and identity formation

Together, these mechanisms constitute a cultural mediation system, where AR functions not as a transparent lens but as an active cultural operator. It negotiates between the preservation of authenticity

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and the creation of novelty, transforming heritage from a fixed archive into a living, participatory network.

In this sense, Shaoxing's AR heritage practices exemplify a broader shift from representation to relation, where culture is no longer displayed but continuously enacted through digital interaction. The cultural interface thus becomes both a site of memory and a platform for identity re-articulation in the post-digital era.

5. Model Building and Discussion

5.1 Conceptualizing the Cultural Interactive Visualization (CIV) Model

This study proposes the Cultural Interactive Visualization (CIV) model, explaining how AR acts as a cultural interface linking symbols, experience, and identity. The model includes three interrelated layers:

(1) Symbolic–reactivating cultural signs;

(2) Experiential–enabling embodied and sensory interaction;

(3) Identity–fostering local belonging and meaning.

These layers form a feedback loop where digital experience shapes cultural understanding, and cultural knowledge guides design. The CIV model highlights reciprocity between technology and culture, seeing AR not as a display tool but as a participatory semiotic system that transforms how heritage is experienced and sustained.

5.2 Layer One: Symbolic Reconstruction and Algorithmic Culture

AR serves as an algorithmic translator, turning heritage symbols into dynamic digital forms. In Shaoxing, motifs like ink strokes and water patterns are reinterpreted through algorithms, extending tradition as living code that evolves through interaction and links culture with technology.

5.3 Layer Two: Experiential Interface and Embodied Cognition

AR enables multisensory immersion, allowing users to engage with heritage through sight, sound, and motion. The body becomes a sensorial interface, transforming observation into lived experience. Authenticity thus depends on emotional and sensory depth rather than material accuracy.

5.4 Layer Three: Identity Formation and Participatory Heritage

Users co-create narratives, rebuilding local identity through interactive experiences. In Dongpu, participants felt part of the story, not mere viewers. AR acts as a mediator of belonging, reconnecting communities—especially younger generations—with regional culture.

5.5 Discussion: From Representation to Relation

The CIV model elucidates a paradigm shift in digital heritage—from representation (displaying the past) to relation (co-creating cultural meaning). Traditional heritage frameworks emphasize preservation and documentation, often treating culture as a static object. In contrast, AR-enabled interfaces generate relational authenticity, where meaning emerges through interaction among human, technological, and environmental agents.

In Shaoxing's case, this shift has three major implications: (1) Epistemological — AR challenges archival epistemology by introducing iterative, experiential modes of cultural knowledge. (2) Aesthetic —it redefines visual communication as participatory performance, merging design and ritual. (3) Social — it fosters collective agency, empowering local communities to narrate their own heritage stories.

This model can inform future research and practice by offering a conceptual map for analyzing how digital technologies mediate cultural identity. It also provides practical guidance for designers and policymakers seeking to integrate AR into heritage conservation and rural revitalization strategies.

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6. Conclusion and Future Work

6.1 Conclusion

This study examines how Augmented Reality (AR) serves as a cultural interface linking technology, heritage, and identity, using Shaoxing as a case of rural cultural renewal. Through AR experiences in Anchang and Dongpu, traditional elements such as bridges, calligraphy, and crafts are reactivated via digital storytelling. The proposed Cultural Interactive Visualization (CIV) model explains AR's mediating role through three layers:

(1) Symbolic reactivation – translating cultural codes into digital form;

(2) Experiential immersion – enabling embodied interaction;

(3) Identity reconstruction – fostering local belonging through participation.

Findings show that AR transforms heritage from static representation to a living, participatory system, shifting digital heritage from preservation to co-creation. Theoretically, the CIV model redefines AR as a semiotic and participatory medium, enriching dialogue among design, heritage, and digital humanities. Practically, AR supports rural branding and community revitalization, enhancing engagement, understanding, and cultural pride—offering a scalable model for culturally sustainable innovation.

6.2 Limitations

Although the study fulfilled its main objectives, certain limitations remain. The research was limited to the Shaoxing region, which may not fully represent the diversity of rural Chinese heritage. The prototype design focused primarily on visual and interactive dimensions without long-term evaluation of user learning or behavior. In addition, reliance on mobile interfaces restricted the depth of immersion. Future studies should adopt broader and longitudinal approaches to assess AR's long-term cultural impact on community identity, education, and heritage transmission.

6.3 Future Work

Looking ahead, this research suggests several directions for future work. The integration of AI and AR can enable adaptive cultural storytelling and digital reconstruction of lost heritage. Building participatory platforms would allow communities to co-create localized AR content, turning heritage into a shared ecosystem. Applying the CIV model across different cultural contexts can test its broader relevance, while integrating AR modules in education may foster cultural literacy among younger generations. Overall, Shaoxing's AR heritage initiative illustrates how technology, when culturally grounded, can act as a catalyst for continuity and renewal—transforming AR from a visualization tool into a cultural language for reimagining history and identity.

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