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CROSS-CULTURAL POETICS AND DIGITAL EMPOWERMENT NARRATIVE RECONSTRUCTION AND INTERNATIONAL COMMUNICATION OF THE ZHEJIANG EAST TANG POETRY ROAD IN CULTURAL TOURISM INTEGRATION

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Abstract: Amid the integration of globalization and digital technologies, the international dissemination of high-context cultural heritage faces dual challenges of cultural discount and experiential disembedding. This study, centered on the Zhejiang East Tang Poetry Road, proposes the SPACE Synergistic Model (Symbolic Translation, Participatory Immersion, Academic-Industry Collaboration, Cultural Economy, Ethical Localization), integrating semiotics, neuroaesthetics, and blockchain to explore cross-cultural poetic translation and digitally empowered cultural tourism integration. Mixed-methods research reveals: (1) multimodal symbolic translation (e.g., AR tactile narratives) adapts to low-context audiences' cognition; (2) immersive scenarios enhance cultural identity by activating θ waves (35% intensity increase, $p < 0.001$); (3) NFT economic loops synergize with the Cultural Fidelity Index (CFI) to achieve cultural-economic symbiosis. Case studies demonstrate that technology-driven narrative reconstruction increases tourist dwell time by 120%, yet necessitates caution against technological misuse. This research provides an interdisciplinary paradigm for digitizing high-context heritage, propelling innovation in cultural tourism, and contributing theoretical-practical insights to the global dissemination of Chinese culture.
Keywords: Cross-cultural poetics; Digital empowerment; Zhejiang East Tang Poetry Road; Cultural tourism integration; Narrative reconstruction; SPACE model; Neuroaesthetics; Blockchain; Cultural fidelity index

1 INTRODUCTION

1.1 Research Background and Problem Statement

In the context of deepening globalization and digital technology integration, the international dissemination of cultural heritage is undergoing a paradigm shift from "unidirectional export" to "bidirectional dialogue"[1]. The Zhedong Tang Poetry Road, a cultural corridor spanning eastern Zhejiang and connecting cities such as Shaoxing, Ningbo, and Taizhou, epitomizes the poetic essence of Chinese civilization. Rooted in the Tang literati's philosophical pursuit of "harmony between humanity and nature" (tianren heyi), this heritage site functions not merely as a geographical "poetic-pictorial corridor" but also as a repository of high-context cultural symbols. Iconic imagery such as "solitary boat" (guzhou) and "emerald peaks" (qingfeng), immortalized in verses like Li Bai's "The lake moon casts my shadow, guiding me to Shanxi" and Wang Wei's "After rain, the empty mountain greets autumn's dusk," encapsulates the interplay of classical Chinese aesthetics and metaphysics[1]. However, when communicated to low-context audiences, these symbols encounter dual challenges: "cultural discount", where Western visitors often reduce guzhou to a literal "small boat," and "experiential disembedding," where static exhibitions and textual translations fail to evoke profound emotional engagement.

Digital technologies present transformative solutions to these challenges. Digital Twin technology enables the reconstruction of Tang-era landscapes through high-fidelity 3D modeling and dynamic data synchronization, while augmented reality (AR) and virtual reality (VR) transmute abstract poetic metaphors into multisensory experiences. Neuroaesthetic research further reveals that multimodal narratives activate theta wave oscillations (4–8 Hz) in the prefrontal cortex, with wave intensity strongly correlating with cultural identification. Despite these advancements, existing scholarship predominantly focuses on technical functionalities, neglecting systematic analysis of cross-cultural translation mechanisms and the delicate balance between cultural authenticity and economic viability. For instance, AI-generated simplifications of Tang poetry risk diluting philosophical nuances, and NFT-driven commodification of cultural symbols may lead to semantic alienation.

1.2 Theoretical Framework and Research Significance

This study introduces the SPACE Synergistic Framework (Symbolic Translation, Participatory Immersion, Academic-Industry Collaboration, Cultural Economy, Ethical Localization), an interdisciplinary model integrating semiotics, neuroscience, and blockchain technology to bridge the gap between high-context cultural heritage and global audiences. The framework's theoretical significance lies in three dimensions[2]. First, it transcends the "linguistic centrism" of traditional cross-cultural communication by deconstructing implicit cultural genes (e.g., tianren heyi) into multisensory narratives—visual, auditory, and tactile—that resonate with low-context cognitive schemas. Second, neuroaesthetic

experiments validate the neural mechanisms underpinning cultural engagement: theta wave intensity in participants experiencing AR-poetic environments increased by 35% ($t = 4.12$, $p < 0.001$), empirically supporting the concept of "affective economies." Third, the proposed "Cultural Fidelity Index" (CFI) establishes ethical benchmarks for evaluating narrative strategies across semantic depth, technological intervention, and audience feedback, countering risks of technological hegemony over poetic aesthetics.

Practically, this research offers actionable strategies for cultural tourism innovation. Case studies in Shaoxing's Jianhu Lake and Ningbo's Dongqian Lake demonstrate scalable solutions such as AR-driven poetic scene reconstruction and blockchain-enabled NFT economies, which elevate tourist engagement (e.g., 120% increase in dwell time) while ensuring sustainable revenue allocation (30% of NFT proceeds fund heritage conservation). These initiatives exemplify China's transition from "resource-dependent" to "innovation-driven" cultural tourism, providing a replicable blueprint for global heritage sites.

1.3 Paper Structure

This paper is structured into five interrelated sections. The Introduction delineates the research context, theoretical framework, and overarching objectives. The Theoretical Framework and Literature Review critically synthesizes cross-cultural poetics, digital humanities, and cultural economy theories, positioning the SPACE model within broader academic discourse. The Methodology section elaborates on the mixed-methods approach—combining digital ethnography, computational text analysis, and controlled experiments—to dissect the interplay of cultural translation and technological mediation. Case Studies empirically validate the framework through analyses of Jianhu Lake's AR-poetic environments, Dongqian Lake's NFT-driven economy, and the cautionary tale of Hangzhou's failed "Digital Tang Poetry Hall." Finally, the Discussion and Conclusion synthesizes theoretical contributions, practical implications, limitations, and future directions, advocating for interdisciplinary collaboration to harmonize "poetic essence" and "technological innovation" in global heritage dissemination.

By intertwining technological innovation with cultural fidelity, this study not only charts a pathway for the Zhedong Tang Poetry Road's global resonance but also contributes to the evolving discourse on digital narrative reconstruction of high-context heritage worldwide.

2 LITERATURE REVIEW

2.1 Critique and Expansion of Cross-Cultural Communication Theory

Cross-cultural communication research has long been constrained by the "linguistic centrism" paradigm, which inadequately deciphers the implicit cultural codes of high-context heritage. Hall's high/low context theory posits that high-context cultures, such as the symbolic system of Tang poetry, rely on shared cultural knowledge to convey deeper meanings, whereas low-context cultures depend on explicit verbal encoding. For instance, imagery like "verdant peaks and solitary boats" (qingfeng guzhou) in the Zhedong Tang Poetry Road is deeply rooted in the Chinese philosophical concept of tianren heyi (unity of humanity and nature) and the ethos of reclusion[3]. However, when transmitted to low-context audiences, such metaphors often lose their philosophical depth. Western tourists, for example, frequently interpret guzhou (solitary boat) merely as a physical object, overlooking its symbolic connotations of "solitary wandering" and "harmony with nature" (Hoskins & Mirus, 1988). This limitation underscores the insufficiency of linguistic translation alone, necessitating multimodal symbolic reconstruction to adapt cultural meanings across contexts.

Lefevere's rewriting theory offers methodological insights, framing cultural translation not merely as linguistic conversion but as a creative regeneration of symbolic systems within target contexts. For example, in Shaoxing's Jianhu Lake, Li Bai's verse "The lake moon illuminates my shadow" is reimagined through AR projections and tactile feedback devices: visitors traverse a blended physical-digital landscape, where haptic vests simulate river breezes (5–10 Hz vibrations) and ambient sounds of recited poetry and guqin music envelop the senses[4]. This "text → visual → somatic" triadic translation pathway transcends the limitations of linguistic centrism, rendering high-context cultural subtexts perceptible to low-context audiences. Yet, existing studies predominantly focus on technical functionalities, neglecting systematic exploration of cognitive adaptation mechanisms.

2.2 Intervention of Digital Humanities Technologies and Neuroaesthetic Validation

Digital Twin technology serves as a cornerstone for the "sensibilization" of cultural heritage. Building on Grieves' framework of dynamic interaction between physical and digital spaces, this study introduces a "physical-digital-cognitive" triadic model[5]. For instance, LiDAR laser scanning (0.5 mm precision) and Unreal Engine 5.2's global illumination system reconstruct the ethereal landscapes of the Zhedong Tang Poetry Road, while AR glasses overlay dynamic poetic projections synchronized with visitors' gaze patterns (tracked via Tobii Pro Glasses 3). This creates a closed-loop immersive narrative, where digital and physical realms coalesce.

Neuroaesthetic research provides empirical validation for the emotional mechanisms underlying such experiences. Chatterjee and Vartanian demonstrate that multimodal artistic engagement activates the prefrontal cortex and limbic system, enhancing theta wave (4–8 Hz) oscillations. Controlled experiments in this study reveal that participants experiencing AR-poetic environments exhibited a 35% increase in theta wave intensity (mean = 4.7 μV) compared to

traditional text-based tours (3.3 μV; $t = 4.12$, $p < 0.001$), alongside a 41.2% rise in "cultural identification" scores on affective scales ($t = 5.89$, $p < 0.001$). These findings suggest that technology-enabled immersion bypasses linguistic barriers, directly triggering emotional resonance through neural pathways. However, prior research often fixates on singular technologies (e.g., AR or VR) as display tools, neglecting holistic analysis of the "narrative-experience-consumption" ecosystem.

2.3 Theoretical Integration: The SPACE Synergistic Model

Synthesizing the above critiques and empirical insights, this study proposes the SPACE Synergistic Model, comprising five dimensions. Symbolic Translation: AI-driven multilingual interpretation (e.g., GPT-4-generated translations in English, Arabic, Spanish) and multimodal reconstruction (AR/VR/haptics) adapt cultural genes to target contexts. For example, the "moon" motif in Tang poetry is recontextualized as "desert moon" in Arabic narratives, preserving its philosophical essence of "solitude" and "eternity."Participatory Immersion: Gamified tasks like AR treasure hunts ("Journey in Search of Poetry") transform visitors from passive observers to cultural co-creators. In Ningbo's Dongqian Lake, participants exhibited an 87% social media sharing rate and 22% revisit rate, significantly higher than non-participants[6]. Academic-Industry Collaboration: Partnerships between universities and cultural agencies establish "Tang Poetry Research Bases," developing bilingual MOOC courses and certification systems to enhance the scholarly depth of tourism products. Cultural Economy: Blockchain-authenticated NFT collectibles (e.g., The Dynamic Scroll of Shudao's Difficulty) leverage smart contracts to allocate 30% of revenues to heritage conservation, forming a sustainable value loop. Ethical Localization: The "Cultural Fidelity Index" (CFI) evaluates narrative strategies across semantic depth, technological intervention, and audience feedback, mitigating risks of aesthetic distortion.

3 RESSEARCH METHODOLOGY AND DATA SOURCE

3.1 Mixed-Methods Research Design

This study employs a mixed-methods research approach, integrating qualitative tracking, quantitative experiments, and computational analysis to systematically examine the cross-cultural communication efficacy and techno-economic synergies of the Zhedong Tang Poetry Road's cultural tourism integration. The research design follows an explanatory sequential framework, structured into three phases.Phase 1: Digital Ethnography Embedded within the AR-guided systems of Shaoxing's Jianhu Lake and Ningbo's Dongqian Lake, the research team conducted six months of naturalistic observation involving 300 international tourists from Europe, East Asia, and the Middle East. Behavioral data, including visual fixation duration (recorded via Tobii Pro Glasses 3 eye-trackers at 120 Hz sampling rates) and spatial navigation patterns (tracked using high-precision GPS devices with ±0.1 m accuracy), were collected alongside 2,150 user comments from the Steam platform's Poetry Road Journey Beta version. Sentiment analysis using the SnowNLP library categorized feedback into positive, neutral, and negative polarities[7]. Qualitative data, coded via NVivo 14, revealed three core themes: symbolic cognitive barriers, technological interaction preferences, and emotional resonance thresholds. For instance, 73% of European tourists interpreted the guzhou (solitary boat) as a literal object, highlighting cross-cultural cognitive gaps.Phase 2: Computational Text Analysis A specialized corpus of 1,000 Tang poems associated with eastern Zhejiang was constructed from the Complete Tang Poetry database. Utilizing the BERT multimodal pre-trained model, semantic vectorization was performed with parameters set to batch size 32 and 50 training epochs. Co-occurrence networks generated via Gephi 0.10.1 identified core symbolic clusters, such as the "moon – solitary boat – verdant peaks" triad (287 co-occurrences, weight = 0.76), which encapsulates the philosophical motif of reclusion. TF-IDF algorithms further prioritized 20 high-frequency symbols, forming an image priority matrix to guide the design of digital twin scenarios. Phase 3: Controlled Experiment.A cohort of 150 participants from Western cultural backgrounds (50% male, aged 18 – 45) were randomly assigned to experimental ($n = 75$) and control ($n = 75$) groups. The experimental group experienced Jianhu Lake's digital twin environment, featuring AR poetry projections and haptic feedback, while the control group received traditional textual guides. Using a double-blind protocol, subjective emotional responses were measured via the PANAS affective scale, while neural engagement was quantified using Emotiv EPOC X EEG headsets to capture theta (4 – 8 Hz) and alpha (8 – 12 Hz) wave intensities. Data filtered through Butterworth noise-reduction algorithms revealed a 36.4% increase in theta wave activation (4.5 μV vs. 3.3 μV; $F = 12.67$, $p < 0.001$) and a 41.2% rise in cultural identification scores ($t = 5.89$, $p < 0.001$) for the experimental group, confirming the efficacy of multimodal narratives in triggering emotional resonance.

3.2 Multisource Data Integration and Processing

The study harmonized behavioral, textual, and experimental datasets through Python 3.10-based feature extraction and format standardization[8]. Behavioral Data: AR system logs recorded gaze heatmaps, virtual poetry card interactions (mean 2.3 clicks/minute), and GPS trajectories. Social media UGC (6,450 posts from Weibo and Twitter's #TangPoetryRoad) underwent regex cleaning and LDA topic modeling, extracting themes such as "cultural cognition" and "technological experience." Textual Data: The Tang poetry corpus (12,345 tokenized vectors) and GPT-4-generated multilingual narratives (Chinese/English/Arabic) were validated via BLEU scores (mean 0.62) and manual semantic auditing. Experimental Data: EEG signals (.edf files) were denoised (30 Hz cutoff), with theta/alpha power

spectral density (PSD) extracted. Affective scores were Z-standardized, excluding outliers ($\pm 3\sigma$) to retain 142 valid samples. Spatiotemporal behavioral patterns were visualized via Tableau 2023.2, while statistical analyses (ANCOVA, Pearson correlations) were conducted in SPSS 28.0 and R 4.2.1. For example, a significant positive correlation ($r = 0.62$, $p < 0.01$) emerged between AR scene dwell time (mean 8.7 seconds) and theta wave intensity, corroborating the "immersion–emotion" linkage.

4 CASE STUDIES

4.1 Shaoxing's Jianhu Lake: Digital Poetic Environments and Enhanced Cultural Identity

As a pivotal node along the Zhedong Tang Poetry Road, Shaoxing's Jianhu Lake embodies the poetic essence of Li Bai's verse "The lake moon illuminates my shadow, escorting me to Shanxi." To bridge the cognitive gap for low-context audiences, the research team employed LiDAR laser scanning (0.6 mm precision) to reconstruct Tang-era hydrological landscapes, rendered dynamically via Unreal Engine 5.2's global illumination system. Augmented reality (AR) glasses projected poetic verses synchronized with visitors' sightlines, while haptic vests simulated river breezes through 5–10 Hz vibrations, creating a multisensory immersion. Empirical data revealed a 120% increase in average dwell time (14.3 minutes vs. 6.5 minutes in traditional exhibitions), with 73% of international participants reporting an "intuitive grasp of the poet's creative context[9]." Neuroaesthetic experiments further validated these outcomes: AR participants exhibited a mean theta wave intensity of 4.7 μV, a 35% increase over the text-only control group (3.3 μV; $t = 4.12$, $p < 0.001$), alongside a 41.2% rise in cultural identity scores ($t = 5.89$, $p < 0.001$). This case validates the SPACE model's synergy between symbolic translation and participatory immersion, demonstrating how technology enables a triadic mapping of "physical-digital-cognitive" spaces.

4.2 Ningbo's Dongqian Lake: Blockchain-Driven Cultural-Economic Symbiosis

Ningbo's Dongqian Lake leveraged Wang Wei's "Dwelling in the Mountains on an Autumn Evening" as a cultural IP to pioneer blockchain-integrated tourism. A limited-edition NFT collection, "Dynamic Scroll of Mountain Dwelling in Autumn," (500 units) was issued, with smart contracts directing 30% of sales revenue to local heritage conservation funds. By August 2023, secondary market premiums reached 35%, and 12% of NFT holders participated in offline "Autumn Evening Poetry Gatherings," forming a closed-loop ecosystem of "virtual ownership–physical experience–cultural dissemination." Economic metrics showed an 18% increase in per capita tourist spending (from CNY 520 to 614) and a rise in derivative revenue share from 7% to 15%. Social media analytics revealed that 87% of AR task participants (e.g., the "Seeking the Hermit" scavenger hunt) shared their experiences online, generating over 5.2 million impressions for the #TangPoetryRoad hashtag. This case underscores the cultural economy dimension of the SPACE model, highlighting the potential of decentralized autonomous organizations (DAOs) to foster cross-cultural co-creation—evidenced by 23 countries contributing open-source algorithms for poetic symbol translation.

4.3 Hangzhou's "Digital Tang Poetry Hall": Reflections on Technological Hegemony and Cultural Dilution

Hangzhou's ill-fated "Digital Tang Poetry Hall" project sought to simplify Tang poetry narratives using AI (e.g., reducing "tianren heyi" to "harmony with nature") and constructing a "metaverse Tang poetry universe[10]." However, BLEU scores indicated poor semantic fidelity (0.52/1.0) for AI-generated texts, while chaotic scene designs—mixing cyberpunk elements like mechanical Buddhas with holographic bamboo forests—eroded cultural coherence[11]. Visitor surveys revealed 62% perceived a "disconnect between the environment and Tang poetic aesthetics," with TripAdvisor reviews containing 45% negative sentiment (keywords: "confusing," "inauthentic"). Neuroaesthetic data further exposed failure: theta wave intensity averaged 2.8 μV (significantly lower than Jianhu Lake's 4.7 μV), correlating with heightened negative emotions. This case reinforces the necessity of the ethical localization principle in the SPACE model, advocating for the "Cultural Fidelity Index" (CFI ≥ 0.8) and "minimal intervention" to balance innovation with authenticity.

5 CONCLUSIONS

5.1 Theoretical Contributions and Academic Implications

This study advances the discourse on cross-cultural communication and digital heritage revitalization through the SPACE Synergistic Model (Symbolic Translation, Participatory Immersion, Academic-Industry Collaboration, Cultural Economy, Ethical Localization). By transcending the limitations of "linguistic centrism," the model redefines high-context cultural transmission through multimodal symbolic translation[12]. For instance, the integration of AR tactile feedback and dynamic in Shaoxing's Jianhu Lake transformed abstract Tang poetry metaphors like "lake moon illuminates my shadow" into visceral, multisensory experiences, effectively mitigating cultural discount (Hoskins & Mirus, 1988). Neuroaesthetic validation further anchors the model's theoretical legitimacy: the 35% increase in theta wave intensity ($t = 4.12$, $p < 0.001$) among AR participants demonstrates how technology-mediated immersion directly activates neural pathways associated with cultural identification (Chatterjee & Vartanian, 2014). Additionally, the

Cultural Fidelity Index (CFI) introduces a quantifiable ethical framework, addressing tensions between innovation and authenticity—a critical contribution to digital humanities in an era of technological hegemony.

5.2 Practical Significance and Industry Strategies

The empirical success of the SPACE model offers actionable strategies for global heritage sectors. Technologically, AR and Digital Twin integration in Shaoxing's Jianhu Lake increased tourist dwell time by 120%, showcasing the potential for immersive upgrades in cultural tourism. Economically, Ningbo's Dongqian Lake demonstrated the viability of blockchain-driven NFT economies, where smart contracts allocated 30% of revenue to conservation, elevating derivative income from 7% to 15%. However, the failure of Hangzhou's "Digital Tang Poetry Hall" underscores the necessity of ethical safeguards: AI simplification of "tianren heyi" (unity of humanity and nature) into "harmony with nature" reduced semantic fidelity (BLEU = 0.52), while incongruent cyberpunk aesthetics eroded cultural coherence. To navigate these challenges, policymakers and practitioners should prioritize academic-industry partnerships—such as establishing "Digital Poetics Labs" for multilingual MOOC development—and foster decentralized collaboration via DAOs to enhance local adaptability. Governmental support through "Cultural Heritage Digitalization Funds" could further incentivize ethical innovation.

5.3 Research Limitations and Future Directions

Three primary limitations constrain this study. First, participant demographics skewed toward Western cultural backgrounds, necessitating future inclusion of African, South American, and Oceanic cohorts to validate the SPACE model's cross-cultural universality. Second, the high cost of LiDAR scanners (>CN¥300,000) limits accessibility for smaller heritage sites, urging the adoption of open-source tools like Unity ML-Agents for cost-effective digital twin development. Third, while NFT (35%) and tourist spending (+18%) indicate short-term success, longitudinal studies spanning 5–10 years are required to assess the sustainability of blockchain economies and behavioral impacts.Future research should pursue three trajectories: (1) Technological democratization, leveraging AI optimization to reduce dependency on high-cost hardware; (2) Comparative studies, analyzing parallels between the Zhedong Tang Poetry Road and analogous heritage corridors like Japan's Haiku Trails or Europe's Romanticism routes; (3) Ethical standardization, integrating CFI metrics into UNESCO's intangible cultural heritage framework to establish global guidelines for digital narrative ethics.

In the interconnected realms of globalization and digitization, the Zhedong Tang Poetry Road exemplifies how high-context cultural heritage can achieve global resonance through dual drivers of technological empowerment and symbolic reinvention. The SPACE model's triadic synergy—symbolic translation for cognitive adaptation, immersive narratives for emotional engagement, and blockchain economies for value sustainability—provides a blueprint for transitioning cultural tourism from "resource dependency" to "innovation-driven" paradigms. By harmonizing poetic essence with technological rigor, this study not only advances China's cultural diplomacy but also contributes to a global ethic of heritage preservation—one where tradition and innovation coalesce to foster a shared human future.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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