

From Symbolic Decoding to Embodied Reconstruction: A Cross-modal Translation Study of Chu Cultural Heritage Based on Generative AI (AIGC)

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Abstract: In response to the issues of style deviation and semantic loss in the generation design of traditional cultural heritage, this study aims to explore an innovative design paradigm of translating from “physical symbols” to “digital embodied experiences”. Firstly, based on the theory of embodied cognition, this study constructed a theoretical model for the embodied translation of visual elements of Chu culture, clarifying the cognitive mapping mechanism of cultural genes in digital reconstruction. At the technical implementation level, a visual style transfer workflow centered on the Stable Diffusion and LoRA models was developed. Through parameterized training and constraining the cultural consistency of the generation space, it solved the problems of aesthetic consistency and style deviation in the digital generation of traditional patterns. Through a series of design practices in “Delta.Studio”, this approach demonstrated its effectiveness in immersive interaction, mobile application, and cultural product development. AIGC technology not only efficiently expands the visual expression dimension of intangible cultural heritage but also realizes the dynamic activation of cultural genes through the closed loop of “human intervention - model training - multimodal output”. This study provides a replicable methodological reference for the protection and innovative design of cultural heritage from the perspective of digital humanities.

Keywords: Chu State Tiger-Seat Bird-Shaped Drum; Generative Artificial Intelligence (AIGC); Visual translation; Embodied cognition

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1. Introduction

Chu culture, as an important branch within the diverse and integrated framework of Chinese civilization, is renowned for its unique shamanistic elements and complex artistic styles. The Tiger-Seat Bird-Shelf Drum, as the pinnacle representative of Chu-style lacquerware, is not only a ceremonial and musical artifact but also a material carrier that embodies the spiritual beliefs of the Chu people regarding communication with the heavens and earth^[1].

Under the national cultural digitalization strategy, the protection of intangible cultural heritage has shifted from emergency documentation to productive protection and digital activation. However, when examining the current digital practices, it can be observed that they mostly remain at the stage of high-fidelity replication of the physical form of the relics or static display on screens. This display method, based on retinal centrism, separates cultural symbols from their original ritual context and bodily perception, leading the audience into a disengaged cognitive predicament^[2].

In recent years, generative artificial intelligence has provided a new approach for the visual reconstruction of cultural heritage. Zhang (2024)^[3] proposed an auxiliary restoration workflow that combines Stable Diffusion with LoRA, successfully solving the problem of completing the complex geometric patterns of Yangshao painted pottery, and demonstrating the efficiency and accuracy of low-rank adaptation techniques in the transfer of specific cultural styles. Zhou et al. (2025)^[4] also explored the application potential of diffusion models in the innovative design of kite patterns. However, existing research still has significant theoretical and technical gaps: on the one hand, some studies only remain at the theoretical speculation of embodied cognition, lacking empirical support for technical implementation; on the other hand, the application of technology often focuses on physical visual restoration at the perceptual level, ignoring the semantic translation at the semantic level. When dealing with Chu culture symbols with specific totemic meanings and ritual norms, general diffusion models often produce cultural illusions, that is, the generated images have formal beauty but lose the original ritual logic and spiritual core.

In view of this, this study introduces embodied cognition theory and constructs an innovative design paradigm of EC-AIGC from the translation of physical symbols to digital embodied experience. The research does not limit itself to the simple restoration of Chu culture symbols, but uses the fine-tuning ability of the LoRA model to extract the visual genes of the Tiger Seat Bird-Shaped Drum, and through multimodal interaction technology, converts them into perceptible digital experiences, aiming to solve the style deviation problem in generative design and explore new paths for the creative transformation of cultural heritage.

2. The deconstruction of the diagram of the Chu Dynasty Tiger-Shaped Bird-Shaped Drum and the construction of design perspective

2.1. From physical remains to computable data

The tiger-shaped bird-shaped drum is not only a physical relic of Chu-style lacquerware, but also a complex cultural system interwoven with symbols, behaviors and concepts. This study, based on Donald Norman's theory of emotional design levels, deconstructs it from the diagram into three levels: visual instinct, behavioral interaction and semantic reflection.

2.1.1. The visual layer of form and color, the flowing life aesthetics

At the visual representation level, the tiger-shaped bird-shaped drum presents the unique "fierce and wild beauty" and "romanticism" tension of Chu culture.

The entire object adopts the suspended structure of "feng bird stepping on tiger", with the head-raising and neck-stretching feng bird and the crouching and curling tiger forming a strong dynamic balance. This "using movement to control stillness" S-shaped curve composition breaks the orderliness and rigidity of the Central Plains bronze ritual vessels, and embodies the Chu people's pursuit of freedom and unrestrained life will.

In terms of color selection, the lacquerware follows the classic three-color system of "red, black, and gold".

The red of cinnabar symbolizes the life heat and the “yang” in the witchcraft belief, the black of ink represents the solemn mystery and the “yin” of the death world, and the gold color is scattered among them, not only strengthening the visual hierarchy, but also constructing a unique Chu-style aesthetic map in the alternation of yin and yang.

2.1.2. The behavioral layer of sound and dance, the intermediary field of the ritual

As a suspended drum, the intrinsic value of the Huozuo Bird-Shaped Drum lies in its “sound-producing” functional attribute. It serves as an auditory medium that connects human and divine thoughts.

- (1) Ming through narration: In the Chuci ritual context, the drum sound is regarded as the voice of thunder, possessing the media function of “reaching up to the heavens and down to the earth”. The act of beating the drum itself is a dynamic coupling between human and the object, and the frequency, rhythm and intensity of the drum sound directly guide the emotional fluctuations of the ritual participants.
- (2) Dance through presence: In the context of pre-Qin music and ritual dance, the performance of the drum often accompanies the body movements of “long sleeves dancing gracefully” and “rhythmic drum beating”. Therefore, this artifact is not a static display item, but an action element that induces physical participation and constructs the ritual field. Its meaning is fully manifested in the body interaction cycle of “beat - dance - listen”.

2.1.3. The semantic layer of meaning and the divine, the projection of the totem’s cosmology

In the deep semantic level, the Huozuo Bird-Shaped Drum is a materialized metaphor of the Chuci people’s cosmology and soul view.

The phoenix bird, as the supreme totem of the Chuci people, stands above the fierce tiger, not only symbolizing the Chuci people’s identity recognition of the “fire god Zhu Rong” bloodline, but also metaphorically representing the subjugation and transcendence of spiritual power over natural wildness.

The Huozuo represents the earth and directions, the bird frame symbolizes the sky and ascension, and the drum sound connects heaven and earth. The construction of this “heaven - earth - human” vertical structure embodies the ultimate spiritual aspiration of the Chuci people to ensure the immortality of the soul and achieve spiritual transformation and ascension, and is a concentrated manifestation of the mythological thinking of Chu culture.

2.2. Embodied cognition and AI translation logic

2.2.1. The body as the foundation of cognition

The embodied cognition theory opposes the Cartesian “mind-body dualism” and advocates that “cognition is the result of the interaction between the body and the environment”^[5]. Merleau-Ponty pointed out that “the body is not only the object of perception but also the subject of perception”. In the process of understanding cultural heritage, the acquisition of meaning should not only rely on the brain’s abstract decoding of visual symbols but also on the body’s kinesthetic awareness, tactile feedback, and auditory immersion in a specific field. The “presence” of the body is a prerequisite for understanding the ritual sense and life tension of the Chu culture’s shamanic ceremonies.

2.2.2. From “gazing” to “engagement”

The traditional digital display in museums mostly adopts the “glass cabinet-style” screen presentation, which is a

disembodied paradigm based on “retinal centrism”. The audience is conditioned to be passive viewers, resulting in a rupture of the cultural context. This study advocates a shift to the “engagement” paradigm, that is, through interactive technology to restore the initiative of the body. Design is no longer a one-way information delivery, but rather constructs an “enviroming field” that is accessible, touchable, and interactive, allowing the audience to re-activate their perception and memory of the rituals behind the cultural relics through physical actions such as tapping, touching, and moving.

3. Practical pathways for visual translation and communication of Chu culture from the perspective of AI

Based on the previous analysis of the Chu culture schema and the exploration of embodied cognition theory, this study proposes the “embodied deconstruction - generation translation - multimodal reconstruction” (EC-AIGC) design model. This model aims to establish a complete translation path from the “physical field” of traditional culture to the “embodied field” of digital experience.

3.1. Embodied deconstruction layer

The transformation from “physical relics” to “computable data” is different from traditional digitization, which only focuses on appearance scanning. EC-AIGC emphasizes the dual deconstruction of explicit and implicit features, converting them into AI-understandable prompt sequences and parameter inputs.

(1) Explicit Feature Extraction: For the physical form of the Hu Zuo Niao Jia Gu, extract visual symbols such as “S-shaped phoenix structure”, “red-black-gold color scheme”, “scroll cloud pattern/triangular pattern”. These elements are encoded into precise visual prompts, such as <red and black lacquerware style>, <phoenix totem>, <intricate patterns>, as the basic dataset for LoRA model training.

(2) Implicit Feature Mining: For the “behavioral layer” and “semantic layer” of the relics, deconstruct the non-visual information associated with them. For example, convert “the sound frequency of beating the drum” into numerical parameters; convert “the solemn atmosphere of the sacrificial ceremony” and “the mysterious sense of communication between humans and deities” into style prompts, such as <mysterious atmosphere>, <ritualistic>, <dynamic flow>, laying the foundation for subsequent atmosphere generation.

3.2. AIGC generation and translation layer

This layer is the core of the model’s processing, fulfilling the functions of “encoder” and “decoder”. Through generative AI technology, it realizes the translation from abstract semantics to concrete experiences and solves the common “style drift” problem in traditional generation.

(1) Style Transfer and Locking: Utilizing Stable Diffusion with an exclusive-trained Chu Culture LoRA model. This model, through deep learning of a large number of Chu-style lacquerware patterns, has locked the unique line evolution rules and color weights of Chu culture. This mechanism ensures that the generated images do not deviate from the aesthetic paradigm of Chu culture, achieving the precise inheritance of “cultural genes”.

(2) Cross-modal Semantic Mapping: Establishing the mapping logic of “auditory/tactile - visual”. The system maps the non-visual input signals into visual variables in the latent space. For example, mapping “drum beating frequency” to the “diffusion speed” of generated particles, and mapping “sound volume” to the “color saturation” of the picture. Through this cross-modal translation, the invisible auditory and tactile sensations are transformed into dynamic, flowing visual particles and generative images, achieving the interchange of sensory

experiences.

3.3. Multimodal reconstruction layer

The output end of the model is a multimodal reconstruction layer, aiming to “re-embodify” the digital content generated by AI, constructing a multi-dimensional cultural experience field, and achieving a value loop from within the screen to outside the screen, and from virtual to physical. It is divided into embodied field reconstruction, cognitive participation reconstruction, and emotional touch reconstruction.

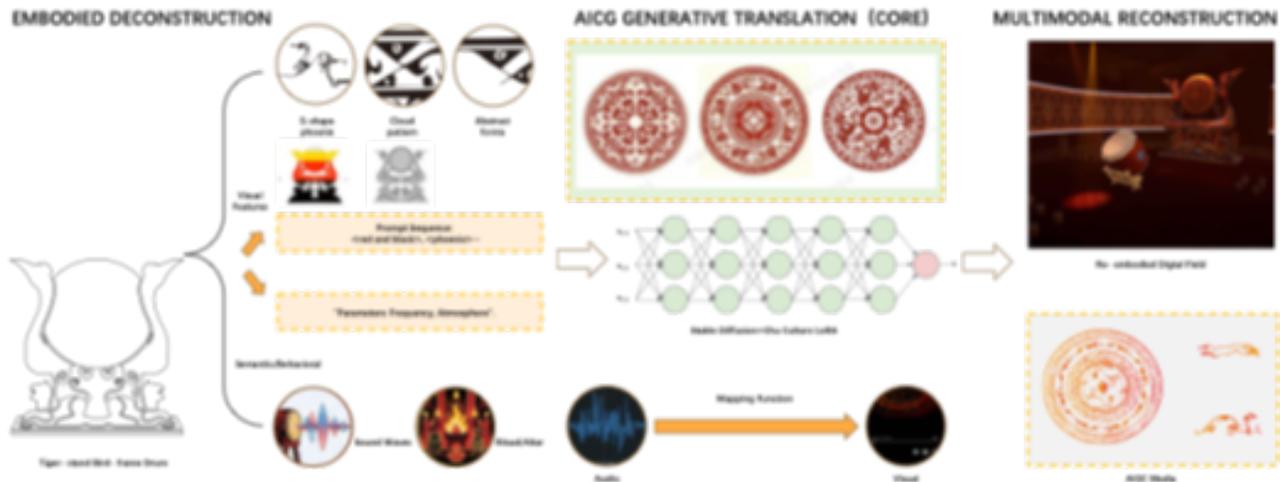


Figure 1. Design model of EC-AIGC.

4. Practical application of visual translation and communication of the Chu culture from the perspective of AI

In recent years, in collaboration with Delta.Studio, based on AI technology, we have carried out diverse practices around the visual translation and communication of Chu culture, transforming abstract narratives into perceptible, interactive, and touchable visual forms, achieving a deep integration of technology and humanities.

4.1. Embodied field reconstruction: immersive interactive installation

The Chu Wind Heritage immersive interactive installation is based on the core design logic of “the body being present”. It uses AI interaction recognition technology and takes the user’s “drumming” action as the trigger point. It synchronously activates visual particle effects, with the heaviness and rhythm of the drum sound directly corresponding to the density and movement trajectory of the particles, forming immediate feedback. From the experience perspective, the installation accurately reproduces the atmosphere of traditional sacrificial scenes. Through the synchronous linkage of auditory and visual perception, it realizes auditory visual translation, allowing users to feel the ritual sense of traditional culture through their body movements, effectively strengthening the sense of the body being present, breaking the limitation of traditional visual display of “passive viewing”, and making the narrative communication more immersive and immersive^[6,7].

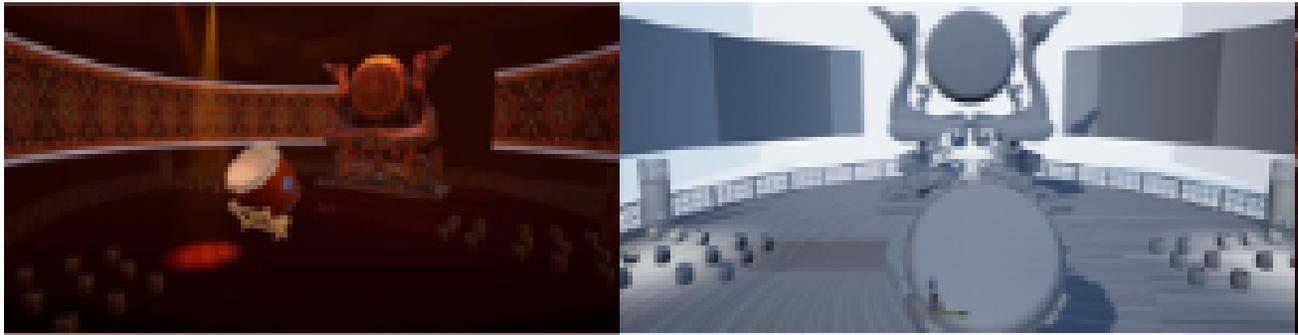


Figure 2. Immersive interactive installation: Sonification of ritual drumming through AI-generated visual particles.

4.2. Cognitive participation reconstruction: “Rongchuang Pi Duo” generative mini-App

The design of this mini-app is supported by AI generation technology. The design logic focuses on enhancing the user’s sense of participation. Users only need to input modern vocabulary, and the AI will quickly generate new patterns that integrate traditional elements with modern semantics based on the Chu-style pattern database trained by the LoRA model. From the perspective of experience, the mini-app significantly lowers the threshold for creating traditional patterns. Users do not need to have professional design skills to participate in pattern innovation. It successfully transforms users from “spectators” of cultural dissemination to “co-creators”, achieving the contemporary translation of Chu-style patterns and deepening users’ understanding and identification with traditional culture through interactive participation^[8].



Figure 3. “Rongchuang Pi Duo” mini-App: AI-powered collaborative creation of Chu-style patterns.

4.3. Emotional design reconstruction: “Wanxiarui” cultural blind fan

This cultural product adheres to the concept of the coexistence of virtual and real worlds. The design logic is to physically realize the high-precision traditional culture images generated by AI through professional printing technology, creating a dual form of “online visual experience + offline tactile sensation”. The experience analysis shows that the blind fan breaks the limitation of AI visual works “existing only on the screen”, allowing users to feel the details and texture of the image through touch, completing a tactile loop from the screen to the fingertips. This not only enriches the presentation form of cultural products but also expands the application scenarios of traditional culture consumption, achieving the two-way empowerment of emotional resonance and cultural dissemination^[9].



Figure 4. “Wanliang Ruirui” cultural and creative blind fan.

4. Conclusion

This study addresses the pain points of context disruption and style deviation in the digitalization of cultural heritage, focusing on the Chu Dynasty’s Tiger-Frame Bird-Shield Drum. It has constructed and verified a cross-disciplinary design model of embodied deconstruction, generative translation, and multimodal reconstruction. The research shows that by introducing LoRA technology to lock cultural genes and combining embodied interaction design, it is possible to effectively achieve a creative translation from physical symbols to digital embodied experiences.

Firstly, a vertical domain AIGC training paradigm for the Chu culture was constructed. Using LoRA fine-tuning technology, the features of the Tiger-Frame Bird-Shield Drum were decomposed to build a database and implanted into the pre-trained model, balancing cultural accuracy and creative transformation. Secondly, multi-dimensional embodied dissemination was achieved. Based on embodied cognition theory, a “body-cognition-emotion” system was constructed, upgrading cultural dissemination from “information transmission” to “meaning construction”, thereby enhancing the depth of dissemination.

Although this study has achieved certain results, it still has limitations. Firstly, the current LoRA model still has certain ambiguity when generating extremely complex ritual vessel details, such as tiny cloud and thunder patterns. Future optimization of the granularity of the training dataset is needed. Secondly, the current interaction forms mainly focus on vision and hearing. Future research can explore the introduction of tactile feedback devices to further enhance the dimension of embodied experience.

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Disclosure statement

The authors declare no conflict of interest.

References

- [1] Zhang Z, Han L, 2023, The Integration of Entertainment and Pleasure – Exploring the Secularization of the Pre-Qin Ritual and Music System through the “Tiger-Seat Bird-Shaped Drum” of the State of Chu. *Journal of Hunan University of Technology (Social Sciences Edition)*, 28(1): 117–124.
- [2] Hou Y, Kenderdine S, Picca D, et al., 2022, Digitizing Intangible Cultural Heritage Embodied: State of the Art. *Journal on Computing and Cultural Heritage*, 15(3): 1–20.
- [3] Zhang X, 2024, AI-Assisted Restoration of Yangshao Painted Pottery Using LoRA and Stable Diffusion. *Heritage*, 7: 6282–6309.
- [4] Zhou Y, Liu Y, Shao Y, et al., 2025, Fine-Tuning Diffusion Model to Generate New Kite Designs for the Revitalization and Innovation of Intangible Cultural Heritage. *Scientific Reports*, 15(1): 7519.
- [5] Ye X, Ruan Y, Xia S, et al., 2025, Adoption of Digital Intangible Cultural Heritage: A Configurational Study Integrating UTAUT2 and Immersion Theory. *Humanities and Social Sciences Communications*, 12(1): 23.
- [6] Cao J, Zhang J, Zhang L, et al., 2023, The Psychological Structure of Interactive Naturalness and Its Influences. *Acta Psychologica Sinica*, 55(1): 55–65.
- [7] Zhang Z, Liu C, 2024, Cultural Common Sense: Transcendent Experiences and Creative Understanding in Immersive Cultural Consumption. *Journal of Tongji University (Social Sciences Edition)*, 35(3): 30–39.
- [8] Wang Y, Zhou Y, 2025, Artificial Intelligence-Driven Interactive Experience for Intangible Cultural Heritage: Sustainable Innovation of Blue Clamp-Resist Dyeing. *Sustainability*, 17(2): 898.
- [9] Li M, Xu S, Tang J, et al., 2025, Design and Research of Digital Twin Platform for Handicraft Intangible Cultural Heritage – Yangxin Cloth Paste. *Scientific Reports*, 12: 43.

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