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From Heritage to Innovation: Design Experiments on Bird-Worm Seal Script for Modern Cultural Creative Products

Shengdong Zhou[1] , Eakachat Joneuraratana[2*] and Veerawat Sirvesmas[3]
[1, 2,3] Faculty of Decorative Arts, Silpakorn University, Bangkok, Thailand
[1]E-mail: Zhou_S3@su.ac.th, ORCID ID: https://orcid.org/0009-0000-9046-8229
[2*]Email: Ejeak9@gmail.com, ORCID ID: https://orcid.org/0009-0001-4813-7327
[3]Email: sirivesmas_v@su.ac.th, ORCID ID: https://orcid.org/0000-0002-6041-0365

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Abstract

Background and Aim: The Bird-Worm Seal Script, an ancient Chinese calligraphic style characterized by decorative, zoomorphic features, embodies significant cultural and symbolic meaning. However, its dense visual complexity presents challenges for modern design integration, especially in cultural and creative product contexts. This study aims to explore how algorithmic methods, particularly fractal geometry, can reinterpret this traditional script into scalable and symbolically rich visual language suitable for product packaging and symbolic design.

Materials and Methods: This research employed a multi-stage methodology that included symbolic deconstruction of the script, fractal algorithm modeling, human aesthetic refinement, and application to packaging design. Software tools such as Illustrator, Rhino, and Grasshopper were used to apply fractal rules like self-similarity, iteration, and scaling to script elements. Manual curation followed each generative stage to ensure cultural authenticity and visual coherence. The resulting motifs were then applied to a zodiac-themed blind-box product prototype, accompanied by user testing and feedback collection.

Results: The findings revealed that fractal logic provides a structurally effective and semantically sensitive means of adapting Bird-Worm Seal Script for modern visual communication. Visual motifs retained symbolic richness across scales and media formats, achieving both aesthetic appeal and cultural recognition. The human-AI collaboration maintained a high manual involvement ratio, ensuring that design outcomes reflected cultural values and emotional resonance.

Conclusion: This study demonstrates a feasible model for revitalizing intangible heritage through a fusion of visual tradition and computational design. The integration of fractal geometry with symbolic analysis opens a new pathway for transforming historical scripts into dynamic visual systems. It reinforces the role of human designers in interpreting cultural narratives while leveraging AI as a generative tool. The findings offer a strategic framework for future cultural product innovation under the growing paradigm of human-machine collaboration.

Keywords: Bird-Worm Seal Script; Fractal Geometry; Cultural Creative Products; Algorithmic Design; AIGC; Intangible Cultural Heritage

Introduction

The Bird-Worm Seal Script stands out as one of Chinese epigraphy's most visually unique scripts because of its detailed zoomorphic qualities. The Bird-Worm Seal Script emerged during the Qin and Han dynasties as an evolution of the seal script tradition with strokes representing birds and insects along with abstract designs to merge visual art with textual expression (Wang, 2021). The script stands as evidence of early Chinese calligraphic beauty while serving as a symbolic record of ancient cosmology and imperial thought according to ritual practice (Guo, 2022). The script's intricate style shows a visual language that goes beyond text to express deep cultural significance and spiritual depth. The Bird-Worm Seal Script's semiotic depth creates significant hurdles for its application in today's cultural and creative sectors. The artistic significance of its stylization creates difficulties for interpretation and reproduction when faced with digital platform limitations alongside minimalistic aesthetics and scalable manufacturing requirements (Dai, Peng & Xie, 2024). The challenges intensify when working in fields where legibility alongside brand consistency and visual economy matters most, such as consumer product design and packaging, as well as cross-media branding. The work of Zhao and Zang (2024) shows how modern design systems prefer standard modular designs, which struggle to represent irregular historical scripts such as the Bird-Worm Seal Script. The growth of the digital cultural economy has increased the significance of design languages that incorporate cultural elements. The Bird-Worm Seal Script serves as an invaluable resource for

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designers to build symbolic depth and narrative texture in response to consumer demand for authentic cultural resonance (Chen & Ding, 2007). Heritage-based visual systems enhance brand identity while preserving cultural heritage and fostering digital-age innovation. Designers need to create adaptive strategies that maintain this ancient script's integrity while ensuring its legibility and relevance in modern design practices (Zhao & Zang, 2024).

To address this gap, this study explores the application of fractal geometry as a methodological framework for reinterpreting the Bird-Worm Seal Script into modern packaging and symbolic product design. Fractal logic, with its principles of self-similarity, iteration, and scale-invariance, provides a powerful tool to preserve the complexity and rhythm of ancient script forms while allowing flexibility in layout and application. As Chen Ning and Ding Hao (2007) have shown, fractal structures possess high potential for maintaining visual harmony in nonlinear and recursive graphic systems—an ideal match for the layered aesthetics of Bird-Worm script. Furthermore, new design technologies, particularly AIGC (Artificial Intelligence Generated Content), have opened opportunities for blending historical content with computational generation. Zhao and Zang (2024) argue that under semiotic principles, AIGC can enable the cultural reinterpretation of traditional Chinese symbols, giving them renewed communicative power in contemporary design contexts.

This research is significant in that it does not treat the Bird-Worm Seal Script as a static relic, but as a dynamic symbolic system capable of being reactivated through visual logic and human-machine collaboration. It provides a design path that respects the historical integrity of the script while pushing its aesthetic boundaries to align with modern visual culture. In doing so, the study offers an innovative approach to heritage revitalization through algorithmic creativity, contributing to ongoing dialogues in design research, cultural sustainability, and intelligent art systems.

Objectives

1. To explore the integration of fractal logic in the visual-symbolic transformation of the Bird-Worm Seal Script, focusing on how mathematical aesthetics can reinterpret and extend traditional cultural symbols.

2. To develop and apply a practical design methodology that transforms Bird-Worm Seal Script into usable visual assets for cultural and creative product packaging.

Literature review

Bird-worm seal script, as a distinctive form of ancient Chinese writing, is deeply rooted in symbolic aesthetics and cultural memory. According to Guo (2022), this script, rich in ornamental features inspired by birds and worms, originated in the Warring States period and reached maturity during the Qin and Han dynasties. Its hybrid visual system blends ideographic writing with zoomorphic imagery, functioning not only as a script but also as a vehicle of spiritual and cultural identity. Guo emphasized its value as a visual archive of early Chinese cosmology and ritual symbolism, and proposed that its inheritance depends on the ability to contextualize its forms through contemporary media.

Wang (2021), in a detailed exploration of the creation logic behind the bird-worm seal script, systematically analyzed its stroke patterns, recursive curvature, and compositional symmetry. Wang argued that although visually rich, the script's complexity presents difficulties for direct contemporary use—especially in design scenarios demanding clarity, scalability, and user engagement. Wang proposed modular decomposition and symbolic abstraction as essential strategies for effective reinterpretation, which directly support the integration of fractal logic in visual transformation.

In addition to traditional art scholarship, the rise of digital tools has opened new possibilities for reinterpreting complex heritage forms. Dai, Peng, and Xie (2024) examined the application of AI-driven visual Transformers in extracting Miao embroidery patterns. Their study showed how algorithmic modeling can preserve cultural patterns' semantic integrity while allowing flexible reuse in product design and creative industries. Although the case focused on textile heritage, the methodological implications are

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highly transferable to the digital redesign of bird-worm seal scripts, particularly in generating layered, scalable motifs.

Zhao and Zang (2024) further contributed to this discourse by exploring AIGC (AI-generated content) within the semiotic framework of cultural product design. Drawing from Peirce's triadic model, their research demonstrated how AI can support human designers in decoding traditional signs and restructuring them into new communicative forms. Their discussion underscores the role of semiotics in bridging historical scripts like bird-worm seal script with modern product narratives, especially when paired with intelligent design tools that preserve symbolic layers while enhancing visual accessibility.

Chen Ning and Ding Hao (2007) explored the mathematical foundations of fractal sets within hyperbolic symmetry and highlighted their application potential in design and geometry visualization. While their study is grounded in theoretical mathematics, it offers valuable insight into the structural logic that supports recursive design patterns. The precision, repeatability, and self-similar properties of fractals described in their work provide a solid foundation for understanding how these concepts can be applied to reinterpret ancient script forms like the Bird-Worm Seal Script. Their work reinforces the view that mathematical symmetry and visual tradition can be seamlessly integrated through algorithmic design.

Conceptual Framework

The conceptual framework of this study illustrates how the Bird-Worm Seal Script serves as the central cultural element, which is deconstructed and transformed through three core methodological components: symbolic analysis, fractal geometry, and human-AI collaboration. These three domains interact to facilitate a comprehensive visual transformation process that culminates in the creation of culturally embedded and aesthetically compelling cultural creative products. Symbolic analysis ensures cultural depth, fractal geometry provides visual scalability and harmony, and AI-enhanced tools support generative expansion—together enabling the reinterpretation of ancient epigraphic elements into modern design applications (Figure 1).

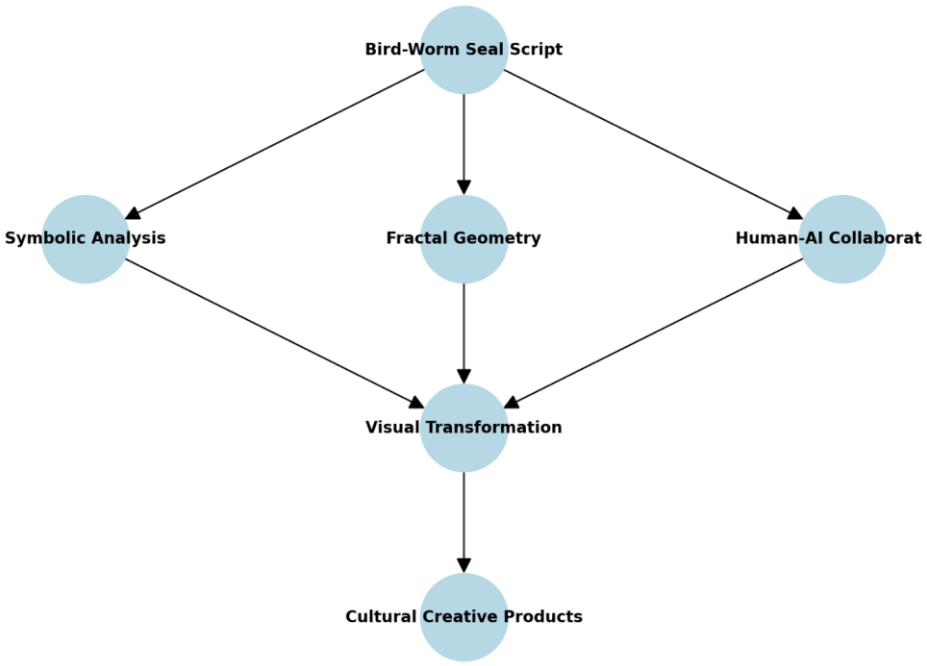

Figure 1 Research Framework
Note: Constructed by the researcher

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Methodology

1. Symbolic Analysis of Bird-Worm Seal Script

This research began with a qualitative symbolic analysis of the Bird-Worm Seal Script, focusing on its unique visual language and historical significance. As an ancient epigraphic form rich in metaphorical structure, the script features complex visual elements such as avian heads, spiral tails, bifurcated strokes, and rhythmic curves. These elements were systematically analyzed and categorized as semiotic units, enabling their abstraction into reusable graphic modules. The goal was to preserve both the visual distinctiveness and the symbolic meaning embedded in the characters, laying a solid foundation for subsequent digital transformation. In this process, reference was made to historical calligraphy studies, traditional Chinese typographic evolution, and previous academic analyses of symbolic calligraphy.

2. Fractal Design and Algorithmic Transformation

The second phase involved applying principles of fractal geometry to reinterpret and expand the Bird-Worm Seal Script. Based on theoretical models of self-similarity, scaling, and iterative generation, fractal logic was employed as a visual strategy to translate the ancient script into dynamic design motifs. Visual design software such as Adobe Illustrator, Rhino, and Grasshopper was used to implement fractal algorithms, allowing the researcher to digitally reconstruct characters with recursive elegance and visual harmony. Each fractal iteration was designed to reflect a balance between abstraction and cultural specificity, ensuring that the spirit of the original script was preserved while enabling diverse modern adaptations.

3. Manual Refinement and Aesthetic Curation

In parallel with computational design, this study emphasized the importance of human intervention and aesthetic judgment. Fractal-generated outputs were subjected to a manual curation process, where visually excessive, chaotic, or semantically diluted forms were eliminated. Designers applied artistic filters, compositional rebalancing, and symbolic integrity reviews to ensure that each visual motif aligned with cultural expectations and contemporary aesthetic standards. Additional adjustments, such as introducing cumulus cloud models to enhance texture or reconfiguring stroke weight for better material application, helped refine the visual quality of each product-ready design.

4. Product Application and User Feedback

In the final stage, the curated designs were applied to actual product prototypes—specifically, a set of zodiac-themed badge blind boxes. These applications served as real-world testbeds for evaluating the effectiveness of the visual-symbolic system. Packaging structures were selected based on user ergonomics and sustainability, and symbolic annotations were integrated into the design to enhance cultural communication. Informal qualitative feedback was collected from potential consumers to assess their emotional engagement, cultural recognition, and aesthetic preferences. This feedback loop provided valuable insights into the social applicability and communicative success of the design transformation.

Results

1. Design Concept: Integrating Fractal Logic into Visual-Symbolic Transformation

In this design experiment, the core concept centers around using fractal geometry as a bridge between ancient symbolic systems and contemporary product design. The goal is to explore how the Bird-Worm Seal Script, a unique typeface from Chinese epigraphy characterized by elaborate and decorative forms, can be transformed into a system of symbolic, fractal-based visual language suitable for application in modern cultural creative products, particularly packaging and giftable items with wide public reach.

1.1 Fractal Geometry as a Tool of Cultural Reinterpretation

Fractal geometry, originally a mathematical construct describing naturally occurring self-repeating patterns, has gained wide application in design and computer graphics for its ability to convey complexity and harmony. In this project, fractals are used as both a visual and conceptual tool to reinterpret the intricate strokes of the Bird-Worm Seal Script. The algorithmic basis of fractal structures offers a

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method to preserve the internal logic, rhythm, and repetition inherent in the script, while enabling flexibility in reformatting and layering for aesthetic purposes.

The first step in this transformation involves identifying visual similarities between the Bird-Worm Seal characters and fractal structures, particularly their recursive curves, elongated tails, spirals, and symmetrical wings. This resemblance allows for an organic integration of fractal logic without disrupting the core identity of the script. In this context, fractals serve not merely as decorative embellishments but as a semiotic strategy, reaffirming the cyclical, eternal, and nature-inspired values embodied in Chinese tradition (Figure 2).

1.2 Self-Similarity: Preserving Symbolic Integrity Across Scales

Self-similarity is one of the defining characteristics of fractals. It refers to the replication of patterns at different levels or scales, where the smaller parts resemble the whole. In the context of the Bird-Worm Seal Script, this principle was used to replicate certain visual components, such as hook-shaped strokes, bifurcated lines, and spiral endings, within characters, across adjacent characters, and even as modular design elements on packaging surfaces.

Through self-similar transformation, the ornamental essence of the script is retained whether the motif is scaled down for product labels or enlarged for posters or exterior packaging (Figure 2). The design ensures that the formal features and symbolic cues of the script—like bird heads, worm-like extensions, and complex curvature—remain visually intact and culturally identifiable at all levels of magnification. This method also solves a practical issue in cultural product design: maintaining readability and aesthetic balance when scaling script-based decoration across different product categories. With the self-similarity principle, the design achieves visual coherence and symbolic unity, making it possible to reuse the same core visual identity in vastly different applications.

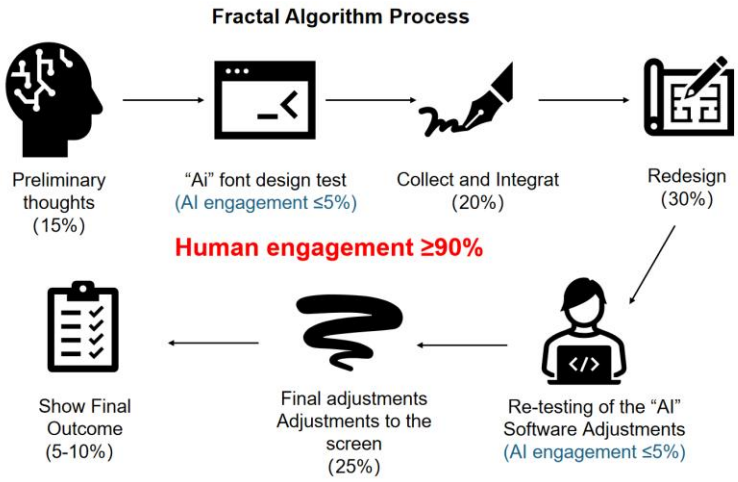

Figure 2 Fractal Algorithm Process
Note: Constructed by the researcher

1.3 Scaling: Flexible Deployment Without Distortion

In traditional typesetting or graphic adaptation of Chinese scripts, distortion often occurs when characters are forcibly resized or reshaped to fit commercial design contexts. Scaling in the fractal logic avoids this issue. Here, scaling refers not just to resizing but to preserving proportional relationships among visual elements during transformation. It ensures that the semantic rhythm and stroke harmony of the script are not sacrificed for fitting into packaging templates.

This logic is applied in product lines that range from small trinkets to medium-sized consumer packages. Each design unit derived from the Bird-Worm Seal Script is built with the potential for scale

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transformation. The visual rules—angles, stroke weights, and curvature ratios—are encoded into fractal algorithms and interpreted with design software (e.g., Illustrator, Rhino, or Grasshopper) to allow consistent replication across platforms.

This approach supports a design methodology that is both computationally efficient and culturally faithful, enabling wide adaptability while maintaining the script's spiritual elegance.

1.4 Iterative Patterns: Layered Complexity with Cultural Depth

The third fractal principle applied is iteration—the repeated application of transformation rules to a form, generating complexity over time. In this project, iteration was used to create multi-layered compositions from single radicals or full characters of the Bird-Worm Seal Script. By applying spiraling commands, radial distribution, or recursive geometry, new motifs were developed that simultaneously evoke traditional symbolism and modern aesthetics.

The use of iteration allowed the project to maintain a sense of narrative continuity between past and present. The resulting visuals appear complex and rich, echoing the layered meanings of the original script, where each component (bird, worm, god, symbol) played a role in cultural storytelling. In this way, the iteration principle did not just generate patterns—it generated semantic structures that resonate with the cultural memory embedded in the ancient typeface.

1.5 Bridging Symbolism and Modern Aesthetics

At the heart of this design concept is the desire to create a symbolic visual system that does not merely copy or decorate but translates the cultural and aesthetic codes of the Bird-Worm Seal Script into a modern, market-facing context. The choice to merge fractal theory with cultural symbolism is grounded in a desire to construct a dynamic design language—one that honors tradition but is not confined by it.

By establishing a visual relationship between algorithmic aesthetics and historical epigraphy, the project paves a path for culturally creative design that is both computationally generative and semiotically deep. The result is a design system that allows for scalability, uniqueness, cultural memory, and emotional recognition, making Bird-Worm Seal Script not only visible again, but truly alive in the public visual domain.

2. Application Process

In the second stage of the design experiment, this study focused on the visual application and packaging transformation of the Bird-Worm Seal Script by combining its cultural symbolism with modern design strategies. Building upon the theoretical foundations of fractal logic and symbolic encoding, the process integrated algorithmic intervention with manual curation to create culturally resonant and visually dynamic outcomes. This section outlines the full development process, from symbolic extraction to product-ready packaging design.

2.1 Symbolic Deconstruction and Radical Integration

The starting point of the application process involved selecting radicals from the Bird-Worm Seal Script and pairing them with symbolic motifs from both Chinese and Western cultural systems. These included mythical animals, constellations, and archetypal signs. For example, certain bird-headed glyphs were mapped onto the structure of the Scorpio constellation, while worm-like extensions were conceptually aligned with serpentine or spiral iconography. These pairings were not arbitrary but based on formal resemblance and symbolic logic. The aim was to form a symbolic hybrid visual system that retained historical legitimacy while enabling modern reinterpretation. A set of base patterns was generated from this hybrid logic, forming the initial visual library for further design operations (Figure 3).

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Figure 3 Initial pattern (below)
Note: Constructed by the researcher

2.2 Fractal Transformation Process

Using the base patterns, a six-step fractal intervention process was carried out to create progressively complex visual outcomes (Figure 4):

Initial Algorithmic Fracturing: The head region of the base pattern was selected for localized fractal operations, where recursive algorithms were applied to mimic organic branching. This step maintained semantic clarity while introducing generative structure.

Partial Expansion: The second step extended the fractal operation to larger areas, including the main body of the pattern. Spiral and scale-based commands were used to add rhythmic repetition.

Full-Image Decomposition: The entire composition was subjected to fractal breakdown. The layout was intentionally disrupted to explore formal plurality and layered complexity.

Spiral Command Enhancements: Spiral logic was implemented across the entire image, simulating both cosmic and natural growth metaphors that align with Chinese cosmological aesthetics.

Pattern Reconfiguration: Adjustments were made to global proportions and local details. Fractal scaling and orientation were applied to reorganize the spatial balance of the motif.

Final Focused Refinement: A return to localized transformation was made, targeting the head or center region again to create closure and reinforce identity within the complexity.

Figure 4 Transform pattern part 1
Note: Constructed by the researcher

2.3 Manual Curation and Artistic Optimization

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While algorithmic processes contributed to the generative output, manual intervention played a central role in visual refinement. The design team manually selected forms they considered "aesthetically optimal," removing excessive lines or structurally chaotic regions. This phase emphasized artistic intentionality over purely computational output. In a subsequent step, visual references were drawn from cumulus cloud formations, and graphic modifications were made to enhance three-dimensional texture. These adjustments were crucial for increasing visual depth, improving embossing adaptability, and preparing the motifs for multi-material reproduction. At this stage, the final visual patterns were fully curated, layered, and adapted to design contexts with high portability and clear symbolic impact. These patterns formed the foundation for the packaging graphics and product interfaces (Figure 5).

Figure 5 Transform pattern part 2
Note: Constructed by the researcher

2.4 Packaging Design and Public Interface

The completed patterns were applied to a cultural and creative product form—a blind-box series featuring twelve zodiac constellations, each represented by a unique fractalized Bird-Worm Seal Script motif. The outer packaging used selected complex motifs from the prior steps, offering both aesthetic depth and symbolic legibility.

From a design perspective, the packaging adopted a cylindrical paper box structure with a rotating lid. Each badge was accompanied by a description of the symbolic structure and its relationship to both the original script and the zodiac motif. The color palette included traditional cinnabar red, ink black, and imperial gold, creating a bridge between ancient Chinese visual tradition and contemporary luxury aesthetics.

Statistical surveys conducted among a small participant group indicated that patterns incorporating spiral logic and three-dimensional texture were more positively received in terms of both aesthetic preference and cultural recognition.

2.5 Material Selection and Environmental Considerations

Material choices were guided by sustainability and manufacturability. Based on preliminary user data and production requirements, eco-friendly paperboard was chosen as the main packaging material. The surface finish used soy-based ink and non-toxic sealants, emphasizing the product's alignment with modern environmental values. These considerations also increased acceptance among younger consumers, particularly those within environmentally conscious demographics.

2.6 Human-AI Collaboration Ratio

Throughout the process, the degree of human involvement remained high. Approximately 90% of visual decisions and refinements were conducted by human designers. Less than 10% of visual output was generated directly by AI without post-editing. This reflects the project's underlying philosophy: AI as a tool, not as an author. While AI fractal processes enabled rapid exploration of form, only human judgment could ensure alignment with cultural aesthetics and symbolic intention.

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Through this integrated process, the Bird-Worm Seal Script was effectively transformed from a historical writing system into a multi-layered visual identity system for creative cultural production. By combining traditional symbolism, fractal geometry, and hybrid design logic, the resulting packaging design achieved the dual goals of cultural continuity and visual innovation. More importantly, this experiment provided a model for how intangible cultural heritage can be reinterpreted through digital creativity, not merely to preserve the past, but to actively engage it in future-facing visual languages.

Discussion

The integration of fractal logic into the visual transformation of the Bird-Worm Seal Script represents a unique strategy in the modernization of intangible cultural heritage through computational design. This study not only demonstrated the feasibility of using fractal geometry to preserve and amplify symbolic aesthetics but also provided practical design outcomes that bridge traditional cultural forms and contemporary consumer interfaces.

A key point of alignment with existing research can be observed in the work of Li Yuanfeng et al. (2024), who explored the use of AIGC-assisted technology in the design of smart public transportation facilities. Their study emphasized how algorithmic intervention can optimize spatial layouts, improve user experience, and maintain urban semantic consistency. Similarly, this study leveraged algorithmic tools (specifically fractal generation and semiotic design rules) to enhance not spatial usability, but visual-symbolic expressiveness in product applications. The shared value across both studies lies in the collaborative role of algorithm and designer, where AIGC offers structural possibility, but human intervention secures semantic and aesthetic relevance. Both projects affirm that machine intelligence should serve as a generative aid, not a replacement for cultural intention or emotional resonance.

The respective design approaches display significant differences in both cultural depth and representational focus. The research by Li, Wang, and Tang (2024) focused on optimizing smart public infrastructure through AIGC technology, whereas this study emphasizes heritage semiotics to promote cultural continuity and symbolic translation. The Bird-Worm Seal Script possesses a deep mythological, philosophical, and historical meaning, which stands in contrast to the abstract geometric forms typically employed in engineering practices (Guo, 2022; Wang, 2021). This design transformation goes beyond formal aesthetics to involve ethics and semiotic responsibility while requiring careful balance between historical authenticity and cultural symbolism to ensure modern audiences receive a clear interpretation (Zhao & Zang, 2024). While industrial AIGC design paradigms focus on efficiency and scalability through simplification, this research maintains symbolic depth using complex and layered representations across multiple scales and materials. The design logic featured in this research rejects reductionist aesthetics in favor of symbolic density, which allows visual artifacts to function as utilitarian products and convey historical narratives and cultural stories (Dai, Peng & Xie, 2024). The research methodology demonstrates an advanced interaction with heritage design theory and opposes the common belief that automated digital creation results in aesthetic simplification or cultural dilution.

The proportion of human-AI cooperation stands out as a significant point of distinction. Most current AIGC-assisted design processes allow humans to only launch tasks and make final tweaks while generative algorithms perform most of the decision-making steps (Zhao & Zang, 2024). The research approach stands apart by adhering to human-centered design principles where human creators make more than 90% of the essential visual and conceptual decisions. The collaborative model provides evidence that generative tools boost creative exploration, yet authentic symbolic design requires human interpretation and judgment to maintain cultural fidelity. Research within cultural semiotics and ethical design scholarship warns of the necessity to apply AI systems carefully when working with symbols that are culturally embedded to ensure appropriate context sensitivity (Chen & Ding, 2007; Bhabha, 1994).

In summary, this study extends the discourse on human-AI collaborative design into the realm of visual heritage transformation, offering a model where symbolic systems and fractal aesthetics converge to produce emotionally engaging, culturally rooted design results. It both complements and critiques current

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AIGC trends by reaffirming the irreplaceable role of human authorship in meaning-making processes. Future research may continue to explore this dynamic interplay, particularly in broader product systems, immersive interfaces, or interactive cultural storytelling applications.

Conclusion

This study explored a novel design approach that integrates fractal geometry with the Bird-Worm Seal Script, aiming to revitalize intangible cultural heritage through symbolic transformation and algorithmic design. The findings revealed that fractal logic—notably self-similarity, scaling, and iteration—can serve as both a visual grammar and a cultural strategy for adapting ancient scripts to contemporary design formats such as product packaging and cultural souvenirs.

Through design experimentation and symbolic reinterpretation, this research demonstrated how algorithmic processes can preserve and even enhance the formal integrity and cultural resonance of historical scripts. The Bird-Worm Seal Script, known for its mythological references and ornate visual style, was successfully translated into complex design motifs, allowing it to re-emerge as a meaningful semiotic system within today's visual and commercial landscape. The collaborative methodology, which combined algorithmic processing with human aesthetic judgment, proved crucial in balancing innovation with cultural authenticity.

Ultimately, the study offers a conceptual and operational framework for transforming traditional symbolic systems into flexible, multi-layered design assets. This not only expands the creative vocabulary of cultural product design but also provides a viable model for the digital regeneration of intangible heritage in the age of AIGC.

Recommendation

1. General Recommendations

This research encourages future cultural product designers, digital artists, and computational researchers to explore traditional scripts not merely as static artifacts but as dynamic visual systems capable of semantic evolution. Fractal geometry and algorithmic design principles should be considered valuable tools for reinterpreting symbolic heritage, especially when paired with careful cultural analysis and human-centered design thinking. Furthermore, design education should incorporate both computational methods and cultural semiotics to train a new generation of designers fluent in tradition and innovation.

2. Recommendations for Further Research

Future studies could investigate the applicability of this model across other forms of cultural texts and symbols, such as oracle bone script, bronze inscriptions, or minority writing systems. Researchers are also encouraged to explore the impact of interactive or immersive technologies (e.g., AR/VR or motion graphics) in enhancing audience engagement with symbol-based designs. Moreover, a deeper exploration into audience perception and reception, especially among younger demographics, could offer insights into how cultural memory is negotiated through digitally transformed artifacts.

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