
International Journal of Management, Finance and Accounting

AI-Assisted Cultural and Creative Product Design Framework and Case Study

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Abstract

This paper presents an AI-assisted design framework for the development of cultural and creative products, using the Ya Chou Yue, a renowned artifact from the Shandong Museum, as a prototype for designing a cultural creative doll. The framework is structured around key steps: clarifying design objectives, creating a design plan, generating AI images, and revising the design plan. The final design outcome illustrates the practical application of AI in cultural product development. This study highlights both the advantages and limitations of AI technology in the design process, offering new approaches and methodologies for the cultural and creative industries. Furthermore, it contributes to the ongoing efforts to promote cultural heritage and innovation through AI technologies.

Keywords: AI-Assisted Design; Cultural and Creative Products; Ya Chou Yue; Design Framework; Museum Cultural Products

Received on 18 September 2024; Accepted on 18 November 2024; Published on 28 February 2025.

1.0 Introduction

The rapid advancement of artificial intelligence (AI) has extended its influence across a wide range of industries, including the cultural and creative sectors. As an industry that merges cultural heritage with creative innovation, the cultural and creative industry is increasingly exploring how emerging technologies can enhance product development processes (Chen, 2021; Jaw et al., 2012; Sedita, 2012). The application of AI-assisted design tools introduces new possibilities for the creation of cultural and creative products, positioning AI as a critical area of interest within this field (Chen et al., 2024; Furtado et al., 2024; Guo et al., 2023).

Despite the growing interest in integrating AI technologies into the cultural and creative industries, there remains a significant gap in structured methodologies for effectively applying AI in cultural product design (Furtado et al., 2024; Guo et al., 2023). Current approaches often lack a comprehensive framework that addresses both the practical application of AI tools and the preservation of cultural heritage (Chen et al., 2024; Wu & Chang, 2024). This research aims to address this gap by developing a structured AI-assisted design framework tailored to cultural and creative product development.

To demonstrate the practical application of this framework, this paper uses the Ya Chou Yue, a key artifact from the Shandong Museum, as a case study. The artifact serves as the basis for designing a culturally creative doll, illustrating the framework's efficacy in transforming cultural heritage into innovative products. The study aims to provide designers with a new methodology for integrating AI technologies into the design process, thus fostering innovation within the cultural and creative industry.

The research question of this study is: What is the design process for cultural and creative products that integrate AI? The research objective is to establish a design process for cultural and creative products that integrates AI and to validate its effectiveness. On the theoretical level, this research contributes to the development of cultural and creative product design literature by offering a structured approach to integrating AI into the design process. Practically, it provides designers with a viable, step-by-step framework and a concrete case study that highlights the potential of AI to support cultural

preservation and creativity. The findings of this research offer valuable insights into how AI technologies can facilitate the evolution of the cultural and creative industry, ensuring that cultural heritage continues to thrive in the digital age.

2.0 Literature Review

2.1 Doubao AI

The image generation function of AI is a powerful technological innovation. It utilizes artificial intelligence algorithms to quickly generate various styles of images based on input descriptions or specific design requirements (Goodfellow et al., 2020). This function greatly enhances design efficiency and provides designers with a rich source of creative inspiration. By adjusting parameters such as style and color saturation, AI can generate diverse images to meet different design needs (Shamsolmoali et al., 2021).

Doubao, developed by ByteDance, is an AI system with strong capabilities in language understanding and generation. It can answer a wide range of knowledge-based questions and perform text creation tasks, including but not limited to article writing and copywriting. In fields such as cultural and creative product design, Doubao AI plays a significant role, offering creative ideas and generating design images to provide users with professional and innovative solutions.

Doubao AI is a powerful tool, particularly noted for its image generation capabilities. It can accurately comprehend user input and generate high-quality images based on design concepts. In the context of cultural and creative product design, Doubao AI transforms complex design ideas into intuitive images, helping designers refine their plans. Whether in color matching or detailing, Doubao AI excels, offering new possibilities for the design of cultural and creative products.

2.2 AI-Assisted Cultural and Creative Product Design

Cultural and creative products play a crucial role in preserving culture, meeting consumer needs, and enhancing brand image (Chao & Ismail, 2023). During the design process, it is essential to clearly define design objectives, considering factors such as theme, function, and cost. Additionally, the creation of a design plan must account for style positioning, material selection, and color matching to ensure that the products are both aesthetically pleasing and practical. For cultural and creative products based on historical artifacts, it is crucial to explore the cultural connotations and artistic characteristics of the artifacts deeply. This approach imbues the products with rich historical significance and unique charm. Developing products based on museum artifacts not only promotes the transmission and dissemination of museum culture but also attracts visitors and enhances the brand image of museums (Gu et al., 2022).

The design process of traditional cultural creative products often requires a significant amount of labor and time, especially during stages like drawing renderings and manual rendering (Rodgers & Milton, 2011). In this process, designers typically rely on hand-drawn sketches and model-making to accurately convey product concepts and details, which not only increases the workload but also demands high-level skills from the designers (Yang et al., 2005). Additionally, the intricacy of craftsmanship, complexity, and integration of cultural elements often make the traditional design process rather cumbersome (Tschang & Goldstein, 2004). These challenges evidently hinder efficiency improvements, particularly in modern environments that require rapid market response (Gargiulo, 2008).

The application of artificial intelligence in design has garnered significant attention (Deng, 2021). AI image generation technology can quickly transform design concepts into visual representations, providing designers with abundant creative inspiration and improving design efficiency. Experiments show that under generative AI assistance, the quality of furniture design has significantly improved (Chandrasekera et al., 2024). AI technology, when applied to personalized body shape customization, fabric selection, and innovative design, can greatly enhance the efficiency, comfort, and aesthetics of ethnic clothing design (Deng et al., 2023). Generative AI can enhance

innovation in the early stages, especially in exploration, ideation, and digital prototyping (Bilgram & Laarmann, 2023). Generative AI can help quickly transform sketches into detailed renderings, generate real-time 3D models, and predict future trends (Furtado et al., 2024). The AI-assisted development process for intangible cultural heritage digital collections includes design element extraction, AI-driven 3D modeling, manual refinement of 3D models, and NFT creation (Wu & Chang, 2024).

The AI-assisted visual design process includes steps such as content planning, text generation, image generation, and final confirmation; by using conversational AI for information gathering and generative tools for rapid image creation, designers can significantly improve creative efficiency and achieve diverse style options (Chen et al., 2024). Existing literature has discussed the application of AI-assisted design in various fields, such as character and scene design (Chen et al., 2024), fashion design (Guo et al., 2023), 3D modeling of dance imagery (Wu & Chang, 2024), and architectural design (Furtado et al., 2024). However, there is a lack of research on the application of AI-assisted design specifically for cultural and creative products, particularly museum-related cultural products. Whether existing AI-assisted design processes (Chen et al., 2024; Wu & Chang, 2024) can be adapted to cultural creative product design remains uncertain.

2.3 Overview of Ya Chou Yue

The Ya Chou Yue is a highly valuable bronze weapon from the Shang Dynasty. It was unearthed in 1965 from the No. 1 Shang Tomb in Subutun, Qingzhou, Shandong Province, and is currently housed in the Shandong Museum as a national first-class cultural relic (Cook et al., 2024). The total length of the weapon is 32.7 cm, with a blade width of 34.5 cm and a shoulder width of 23.3 cm. It has a rectangular shape with a central square opening, two perforations, ridges on both shoulders and a curved blade. On both sides of the blade's mouth, the inscription "Ya Chou" is symmetrically engraved. The term "Ya" might refer to a military official, and bronze weapons bearing the character "Ya" were considered important artifacts, symbolizing the noble status of their owners.

The Ya Chou Yue has a distinctive appearance, with openwork carvings on both sides depicting human and animal faces. Its facial features are pronounced, with hook-shaped eyebrows, a beast-like nose, ring-shaped eyes, round ears, and a wide-open mouth with upturned corners, exposing sharp teeth that convey a sense of mystery and authority. The “Ya Chou” inscription appears four times on the weapon, with two corresponding sets on each side. The weapon’s purpose might have been as a battle axe, a punitive tool, or a symbol of authority. During the Shang and Zhou periods, bronze yues became symbols of military power and authority, as well as indicators of social status (Sun, 2006). The discovery of the Ya Chou Yue is of great significance for the study of Shang Dynasty history, culture, politics, and art. It is an outstanding representation of Shang Dynasty bronze craftsmanship, reflecting the advanced casting techniques and unique aesthetic concepts of the time. Its inscriptions provide crucial clues for investigating questions related to the ethnic groups and regional powers of the Shang period (Wang, 2018). Figure 1 shows the Ya Chou Yue.



Figure 1: Ya Chou Yue
(Originated from network)

3.0 Methodology

This study first proposes a four-step AI-assisted design framework, which includes clarifying design objectives, creating a design plan, generating AI images, and revising the final design. The development of this framework is based on a comprehensive analysis of existing design theories and previous research to ensure the scientific validity and reliability of the method.

After establishing the framework, systematic data collection was carried out. This involved visiting the Shandong Museum and reviewing relevant literature to gather comprehensive historical and cultural information about the Ya Chou Yue. This literature provided theoretical support for the design and ensured a thorough understanding of the artifact's background.

In the study, Doubao AI developed by ByteDance was used for image generation. Based on the design parameters within the framework, the AI-generated initial images, which were then refined through multiple iterations to meet design objectives and practical needs. The use of AI technology effectively enhanced design efficiency and optimized the design through multiple iterations.

Finally, using the Ya Chou Yue as a case study, the proposed design framework was applied to develop a culturally creative doll. By detailing the design process, this study demonstrates the practical application of AI in cultural and creative product design and highlights its advantages and limitations. This approach not only showcases the potential of AI technology but also provides new ideas and practical pathways for cultural and creative product design.

4.0 Results and Discussion

4.1 AI-Assisted Cultural and Creative Product Design Framework

4.1.1 Clarifying the Design Objectives

Clarifying the design objectives plays a crucial role in cultural and creative product design. It provides direction for the entire design process and serves as the foundation

for subsequent steps. The design objectives should be specific, measurable, and achievable. First, it is important to determine the theme and style of the product, as this will dictate the overall image and target audience. Additionally, the function and purpose of the product must be considered, whether it is meant to be decorative, practical, or commemorative. Different functional goals will influence the formulation of the design plan.

The design objectives should also account for product quality and cost. It is necessary to ensure that the product meets certain quality standards while keeping costs under control, thus maintaining competitiveness in the market. Defining design objectives requires a comprehensive analysis of market demand, cultural value, and technical feasibility. Through in-depth research and analysis, realistic design objectives can be established that align with actual conditions.

4.1.2 Creating the Design Plan

After clarifying the design objectives, creating the design plan becomes a critical step. This stage requires careful consideration of various factors, including but not limited to style positioning, material selection, and color schemes. First, based on the design objectives, the overall style of the product should be determined. Whether it adopts a minimalist modern style, a vintage traditional style, or other distinctive approaches, the style decision will guide the subsequent detailed design process.

Next, material selection should be performed with attention to texture, durability, and cost, ensuring that the chosen materials effectively convey the design concept. Color coordination is another essential element of the design plan. Colors convey emotions and atmosphere, and the right color combinations should be selected based on the product's style and the preferences of the target audience. Additionally, the product's functionality must be taken into account, with a reasonable structural design that ensures the product is both aesthetically pleasing and practical. By thoroughly considering these factors, a detailed and feasible design plan can be formulated, laying a solid foundation for the subsequent design process.

4.1.3 AI Image Generation

AI image generation is a critical component of this design framework. With advanced AI technology, design plans can be quickly transformed into visual images. In this process, designers need to input precise design requirements and key elements to ensure that the AI algorithm accurately interprets the design intentions. By adjusting various parameters such as style, color saturation, and level of detail, initial design images in different styles can be generated.

The AI-generated images provide designers with a wealth of creative inspiration and references. Designers can select the images that best align with the design objectives or combine the strengths of different images to further refine the design plan. Additionally, AI image generation significantly enhances design efficiency, reducing the time and effort required for traditional hand drawing or modeling.

4.1.4 Revising and Finalizing the Design

Revising the design plan is an iterative process of optimization. After evaluating the AI-generated images, designers should make adjustments to the design based on practical considerations. This may involve improving color combinations, modifying details of the shape, or optimizing functional aspects of the design. Throughout this process, designers must maintain a sharp aesthetic sense and stay true to the design objectives to ensure that the revised plan is closer to perfection.

Once the designer is satisfied with the generated images, the design can be finalized. Finalization signifies that the design has undergone refinement and reached the desired outcome. At this point, the design is ready for production, allowing the concept to be realized as an actual cultural and creative product. This transformation provides consumers with a unique cultural experience. Figure 2 illustrates the AI-Assisted Cultural and Creative Product Design Framework.

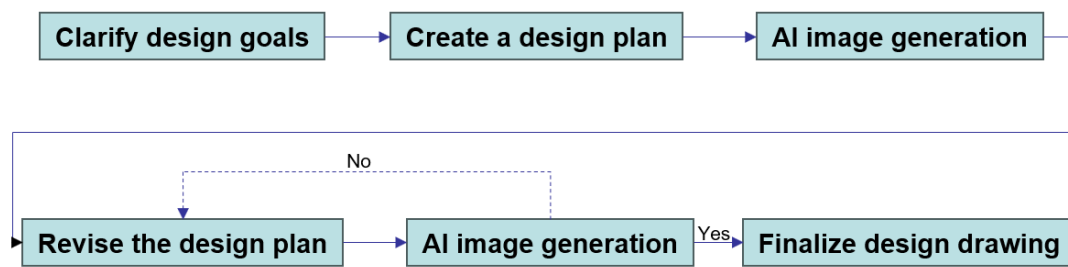


Figure 2: AI-Assisted Cultural and Creative Product Design Framework
(Author's own work)

4.2 Case Study: Designing a Museum Cultural Creative Doll Based on Ya Chou Yue

4.2.1 Design Objectives

The primary objective of designing a cultural creative doll based on the Ya Chou Yue is to vividly and engagingly convey the rich historical and cultural connotations carried by the artifact. By interacting with the doll, people should be able to intuitively appreciate the unique charm of Shang Dynasty artifacts, sparking interest and enthusiasm for history and culture.

Secondly, the goal is to create a product that balances both artistic appeal and practicality. In terms of appearance, the design should strive to faithfully replicate the distinctive shape and intricate patterns of the Ya Chou Yue, while incorporating modern aesthetic concepts to make it more appealing to contemporary audiences. Regarding functionality, the doll can be designed as a decorative item, or it could serve a functional purpose, such as being a keychain or phone accessory.

The ultimate aim of this design is to enhance the cultural dissemination and brand image of the Shandong Museum. Through the creation of this cultural product, more people will learn about the museum's precious artifacts, drawing visitors to the museum and promoting the preservation and development of museum culture.

4.2.2 Design Plan

The design plan begins with the decision to present the Ya Chou Yue doll in a “chibi” style, which retains the artifact’s primary features while adding a sense of cuteness and fun. For the color scheme, bright, historically resonant tones are chosen, such as bronze with warm yellow accents, to emphasize the artifact’s historical depth.

For the material, soft plush fabric is selected to ensure a comfortable feel and to increase the product’s appeal. The intricate face patterns of the Ya Chou Yue will be simplified and exaggerated to create a lively, endearing character. At the same time, attention will be paid to the details, with the Ya Chou inscription embroidered onto the doll to maintain authenticity.

To enhance the practicality of the cultural doll, additional accessories will be included. For example, the doll can be designed as a hanging ornament with an attached string, making it portable and easy to use. Alternatively, a base can be incorporated into the design, allowing the doll to function as a desktop decoration, catering to the varied preferences of consumers.

4.2.3 AI Image Generation

The design plan was input into Doubao AI, and the generated images are shown below (Figure 3).



Figure 3: AI-Generated Image
(Author's own work, generated with Doubao AI)

4.2.4 Revising the Design Plan and Finalizing the Design

Doubao AI performed well in completing the design task, but the color scheme did not adequately highlight the characteristic greenish hue of bronze artifacts. Therefore, the design plan's original "bronze with warm yellow accents" was revised to "greenish bronze," and the images were regenerated. The following are the results of the second round of AI-generated images (Figure 4). The revised images better meet the design objectives and are finalized as the definitive design drawings.



Figure 4: AI-Generated Image After Revising the Design Plan

(Author's own work, generated with Doubao AI)

5.0 Conclusion and Future Research

This paper constructs an AI-assisted design framework for cultural and creative products and demonstrates its application through a case study of designing a cultural creative doll based on the Ya Chou Yue, a national treasure from the Shandong Museum. The design process follows a cycle of clarifying design objectives, creating a design plan, AI image generation, and revising the design plan, ultimately leading to the finalization of the design.

AI technology brings significant advantages to the design of cultural and creative products, as it can quickly generate diverse design options, providing designers with a wealth of creative inspiration and greatly improving design efficiency. Through an in-

depth study of the Ya Chou Yue and innovative design, the ancient artifact was successfully transformed into a modern and appealing cultural product, effectively balancing the preservation of historical culture with the aesthetic and functional needs of contemporary consumers.

However, AI-assisted design is not without its limitations. Designers still need a strong sense of aesthetics and judgment to select and refine AI-generated results. Furthermore, the current AI image generation capabilities do not support detailed refinement of the images, which limits the full potential of this technology. The rapid development of AI also introduces challenges related to copyright and ethical considerations, which require attention and solutions in future research and practice.

In conclusion, the AI-assisted cultural and creative product design framework offers new ideas and methods for the development of the cultural and creative industries. With continuous technological advancement and innovation, AI is poised to play an increasingly important role in this field, assisting designers in creating more outstanding cultural products and contributing to the transmission and development of cultural heritage.

Author Contributions Statement: This study was led by D.H, who was responsible for the overall research design, data collection and analysis, as well as the drafting and revision of the manuscript. S.K.T assisted with the compilation of the literature review, supported data analysis, and contributed to the interpretation and discussion of the research findings. B.C.T provided guidance on research direction and methodology, and reviewed and edited the final manuscript. All authors have read and approved the submitted manuscript and are accountable for the work's results.

Funding Statement: No funding was received to assist with the preparation of this manuscript.

Informed Consent Statement: Informed consent was obtained from all individual participants included in this study.

Data Availability Statement: The data are available from the corresponding author upon request.

Acknowledgement: The authors are grateful for the help from MMU, respondents who participated in this study, and the editors and reviewers of International Journal of Management, Finance and Accounting.

Conflict of Interest Statement: The authors have no competing interests to declare that are relevant to the content of this study.

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