

AIGC Empowering the Cultural and Creative Design of Cultural Heritage: A Case Study of Southern Dynasties stone carvings

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ABSTRACT

With the rapid development of AIGC technology, the integration of cultural heritage and digital technology has become an important issue in the current field of cultural and creative design. This article takes the stone carvings of the Southern Dynasties in China as the research object, exploring how to use AIGC technology to promote the creative transformation and innovative dissemination of cultural heritage. Through literature review, technical analysis and case studies, this paper systematically analyzes the artistic characteristics and cultural connotations of Southern Dynasties stone carvings, explores their design potential in graphic language, structural design and cultural narrative, and constructs a design method framework based on AIGC. Research has found that AIGC has significant advantages in rapid content generation, style transfer and cross modal interaction, but also faces challenges such as copyright, ethics, and cultural authenticity. Finally, it is pointed out that the AIGC cultural and creative design model based on the Southern Dynasties stone carvings has strong portability and can provide reference templates and practical strategies for the digital expression and cultural and creative development of other cultural heritage.

1. INTRODUCTION

In the past few years, artificial intelligence generated content (AIGC) technology has rapidly advanced beyond imagination, driving unprecedented development in the field of digital cultural creativity. Users can issue simple commands through AIGC tools driven by large models, such as ChatGPT, Midjourney, Adobe Firefly, Stable Diffusion, etc. The system can quickly perform deep operations and output various forms of content such as text, images, audio and video that meet user needs. This not only shortens working hours exponentially, but also significantly improves work quality. The breakthrough development of AIGC technology has opened up novel ideas and strategies for the digital protection of cultural heritage and the innovative development of cultural and creative design (Li, 2025; Cetinic & She, 2022).

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Cultural heritage is a key symbol of national and ethnic historical and cultural achievements, and has immeasurable value in showcasing the diversity of cultures around the world. In recent years, countries around the world have been increasing their protection measures for cultural heritage, and the demand for cultural and creative products from ordinary people has shown various development trends. The cultural and creative industry is facing severe challenges of transitioning from simple replication to deep innovation (Feng et al., 2024; Cui, 2025). Therefore, how to use advanced digital technologies to facilitate the revitalized dissemination of cultural heritage has become a core issue in the fields of culture and design today. AIGC technology demonstrates efficient generativity and creativity, providing novel means for deconstructing, reconstructing, and recreating cultural heritage content.

The stone carvings of the Southern Dynasties have a history of more than 1500 years and are a key component of ancient Chinese mausoleum art. The stone carvings of the Southern Dynasties are mainly distributed in Nanjing and Zhenjiang areas of Jiangsu Province. Their contents include stone beasts, stone pillars and stone tablets, which are neatly arranged on both sides of the Shinto Road in the mausoleums of Southern emperors and nobles. The stone carvings of the Southern Dynasties not only reflect the aesthetic preferences of the aristocratic class during that period, but also witness the contradictions and conflicts in the political background, the integration of religious culture, and the prosperity of the commercial economy at that time. The stone carvings of the Southern Dynasties are also praised as the highest example of stone carving art in southern China due to their long history, exquisite craftsmanship and profound cultural depth, possessing extremely high artistic value and symbolic significance (Fei, 2020).



Fig.1. Stone Carvings of Emperor Chen Wen, Chen Qian, and Yongning Mausoleum
Source: Photo by author, 2021

However, due to a series of factors such as geographical distribution and dissemination methods, it is difficult for ordinary people to fully understand the artistic and cultural value of the stone carvings in the Southern Dynasties (Yang, 2023). Therefore, how to use cutting-edge digital technology to stimulate the intrinsic vitality of the stone carvings in the Southern Dynasties has become an urgent problem that needs to be addressed in the fields of culture and design. This article aims to provide a set of theoretical guidance and practical examples for the cultural and creative design of cultural heritage around the world through the AIGC technology, which can be used as a reference and conducive to promotion and dissemination.

2. LITERATURE REVIEW

2.1 The current application status of AIGC in the protection and dissemination of cultural heritage

AIGC technology uses large-scale text and images to train models and automatically generate content such as text, images, audio and video, changing the traditional form of cultural heritage dissemination and promoting its transformation towards intelligence, immersion and multimodality (Zhu et al., 2024).

From the perspective of cultural heritage protection, experts around the world often combine AI with technologies such as 3D scanning and digital modeling to achieve precise restoration and digital storage of heritage such as ancient buildings, murals, sculptures, etc. The renowned British Factum Arte team utilized high-precision scanning and AI texture reconstruction techniques to digitally restore the mausoleum of Tutankhamun in Egypt, effectively avoiding potential irreversible risks during the restoration process. The Italian National Research Council has utilized AIGC technology to construct a structural model of Pompeii, which has played a positive role in environmental monitoring and heritage restoration. The "Digital Dunhuang Open Material Library" jointly launched by Dunhuang Academy and Tencent utilizes AIGC technology to achieve high-definition restoration and element splitting of mural images, promoting the application and dissemination of cultural relics resources in various scenarios (Xue & Li, 2024).

From the perspective of cultural heritage dissemination, AIGC promotes visual re-creation and secondary dissemination of cultural heritage images. AIGC image generation tools such as DALL · E, Stable Diffusion, Midjourney, etc. have been applied in various fields such as cultural scene restoration, museum cultural and creative product development, and Chinese style character image design. The Google Arts and Culture project has developed multiple interactive exhibitions and AI guided tours using AIGC technology, allowing users to deeply experience world cultural heritage through image recognition and virtual interaction. In addition, institutions such as CyArk and The British Museum have also begun to use AI assisted image generation and automatic explanation systems to create a new form of "visualized" and "interactive" cultural heritage information, in order to meet the multi-level needs of user experience in the new media era.

2.2 Research progress on the application of AIGC technology in cultural and creative design

Advanced AI technologies, especially AIGC systems focused on deep learning and generative models, have sparked a new round of transformation in the cultural and creative fields in recent years. The traditional design process is gradually shifting from being "human-led" to a "human-AI collaboration" stage. AIGC has not only become a good helper for assisting designers, but also plays an important role as a content generator and decision supporter in some links, triggering multiple changes in design concepts, creative processes and output forms (Hao, 2022).

At present, the application of AI in cultural and creative design mainly focuses on three aspects: inspiration generation, image design and user interaction experience. In terms of inspiration production, AI image models such as DALL · E and Midjourney can generate a large number of visually creative sketches and elements based on keywords, providing designers with a wealth of visual materials and creative inspiration (Vayadande et al., 2024). In the field of image design, AIGC technology has been widely used in museum cultural and creative product development, digital wallpaper production, art peripheral customization and other scenarios. For example, the Firefly AI tool launched by Adobe can generate various styles of patterns and text in real-time in Photoshop, allowing traditional symbols to be recreated with modern aesthetics, greatly improving the efficiency and quality of designers' work.

AIGC technology has also demonstrated critical value in interactive experience design. Many cultural exhibition halls and theme parks have introduced AI driven voice interactive guidance, personalized recommendation systems, and virtual character settings to create a more immersive and personalized cultural experience for users. For example, the AI cultural relic navigation system developed by Sanxingdui Museum can automatically push relevant historical stories and image explanations based on the duration and interest preferences of the audience, enhancing the user's immersive experience.

2.3 Research Status and Value Re-evaluation of Stone Carving Art in the Southern Dynasties

As a major component of Chinese mausoleum stone carving art, Southern Dynasties stone carvings have received attention from multiple disciplines such as archaeology, art history, art studies and religious history since the early 20th century. Research has mostly focused on the classification of forms, artistic styles, subject matter evolution, inscriptions on stone tablets and Buddhist influence.

In recent years, some researchers and designers have begun to explore the potential of the visual features of Southern Dynasties stone carvings in cultural and creative development as well as visual redesign (Yang & Zhang, 2020; Diao, 2022; Wang, 2021). However, overall, most of the existing literature focuses on historical background and image analysis, lacking analysis of the adaptability of its visual language in modern communication and design systems. Especially, it has not fully considered how to use AIGC technology to transform the cultural imagery of Southern Dynasties stone carvings into representative forms. There is no systematic research to explore how to use AIGC technology to reproduce the facial expressions, structural beauty and religious symbols of Southern Dynasties stone beasts, and then develop cultural and creative products that conform to contemporary public visual aesthetics.

This study aims to bridge the gap between cultural heritage research and contemporary design. From the perspective of empowering cultural and creative design with AIGC technology, it explores AI regeneration pathways and cross media communication models for the visual image of Southern Dynasties stone carvings, filling the gap in AIGC and cultural heritage creative design. This not only promotes the revitalized dissemination of Southern Dynasties stone carvings in today's world, but also provides practical examples for the deep application of AIGC in the field of cultural heritage.

3. METHODOLOGY

This study adopts a design-oriented qualitative approach, integrating cultural analysis with a generative design framework to explore the mechanisms and application pathways of AIGC in cultural and creative design of cultural heritage. The core objective of the research is to examine how AIGC intervenes in cultural and creative design process of cultural heritage and reconstructs the logical structure of translating cultural elements to design expressions.

At the methodological level, this paper regards AIGC as a generative design medium, emphasizing its mediating role in the design process. By analyzing the relationships among cultural characteristics, generative mechanisms, and design outputs, the study attempts to construct a practical design methodology framework to illustrate the application modes and potential impacts of AIGC in cultural and creative design of cultural heritage (Figure 2).

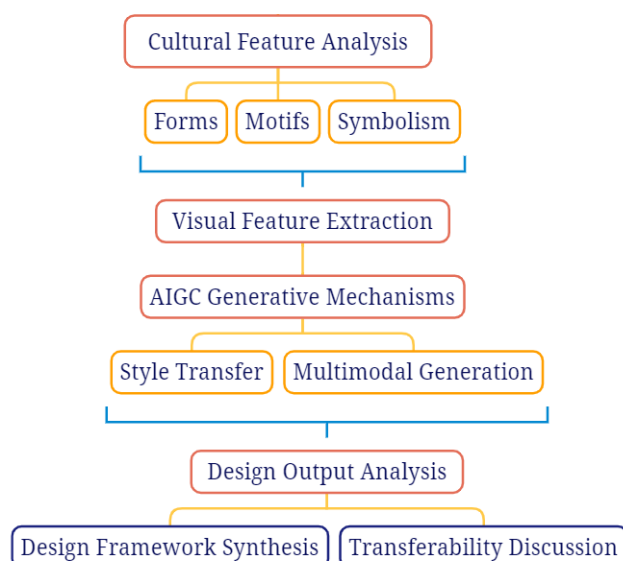


Fig.2. Methodological Framework of the Study
Source: Diagram by author, 2025

4. ANALYSIS

4.1 Analysis of Cultural Characteristics And Design Potential Of Southern Dynasties Stone Carvings

4.1.1 Overview of the artistic characteristics of Southern Dynasties stone carvings

As an important representative of medieval Chinese sculpture art, Southern Dynasties stone carvings are mainly distributed on the sacred sites of Southern Dynasties emperors and nobles' mausoleums in Nanjing, Zhenjiang and other areas, presenting a regular layout and highly unified decorative style, reflecting the deep integration of religion, politics and aesthetics in the Southern Dynasties (Zhu et al., 2025).

From the appearance style, the stone carvings of the Southern Dynasties are neatly arranged on both sides of the divine path of the mausoleums of emperors and nobles, with stone beasts, stone pillars and stone tablets in order. The stone beasts are strong in size and have a concise structure, revealing the structural rules of real animals. They also add a lot of mythological imagery, demonstrating the aesthetic beauty of idealized and symbolic shapes (Xu, 2009). The stone pillars of Southern Dynasties stone carvings are often decorated with patterns such as lotus flowers, auspicious clouds and exotic beasts, expressing a strong religious and cultural connotation. The stone tablet is divided into a stele head, a stele body and a tortoise-shaped pedestal. Dragon patterns are embossed on both sides of the stele head, and the calligraphy style of the inscription reflects a high level of calligraphy. The tortoise-shaped pedestal bears on the stele body, presenting a negative stele state, and the head of the tortoise-shaped pedestal is raised upwards, with a majestic and atmospheric overall line.

In terms of modeling language, the Southern Dynasties stone carvings exhibit a style characterized by simplicity, subtlety and introversion. The strong and powerful line processing is particularly reflected in the shape of the stone beast, which uses local reinforcement of muscles, bones and organs to express a sense of majesty. But the overall treatment aims to reflect a calm and solemn spirit. Compared to the rough and unrestrained carving of the Northern Dynasties period, the stone carvings of the Southern Dynasties emphasized more on spiritual restraint and the unity of form and spirit.

The stone carvings of the Southern Dynasties are not only a combination of practicality and symbolism, but also an important symbol of the artistic style of the Southern Dynasties, presenting the characteristics of the integration of traditional Central Plains culture and religious art.

4.1.2 Exploring the Cultural Connotation of Southern Dynasties Stone Carvings

The stone carvings of the Southern Dynasties, as a material manifestation of imperial rituals and religious culture during a specific historical period, are not merely works of art, but also highly condensed cultural symbols. The constituent elements and symbolic meanings of Southern Dynasties stone carvings are closely integrated, carrying multiple connotations such as political power, religious beliefs and aesthetic orientation.

From the perspective of power symbols, the construction of a strict Shinto ritual system in Southern Dynasties stone carvings is an effective way to visualize the order of imperial power. Stone beasts not only serve to guard mausoleums and suppress evil spirits, but also symbolize the majesty of kings. The emperors of the Southern Dynasties displayed stone beasts on both sides of the Shintoism, creating a political space with orderly hierarchy and solemn tranquility, reflecting the legitimate status of their rule and their sense of destiny. Steles usually have inscriptions praising virtue, which match the solemn stone structure, forming a commemoration and reverence for royal power, and reinforcing the patriarchal concept and ethical color of loyalty and filial piety in the political ideology of the Southern Dynasties (Zhu et al., 2025).

From a religious and cultural perspective, during the Southern Dynasties period, Buddhism was widely spread and received strong official support. It also changed people's religious belief system and greatly influenced funeral culture and sculpture art. The decorative patterns on the stone pillars, the postures of stone beasts, and the decorative shapes on the stone tablets all demonstrate a good integration of Buddhist elements and Han dynasty mausoleum rituals. For example, the lotus flower pattern on the stone pillar symbolizes the purity and undefiled nature of Buddhist teachings. In addition, the image of the stone beast carries religious significance as a protector of the underworld, reflecting the Buddhist concept of "six realms of reincarnation". The cultural integration has made Southern Dynasties stone carvings an important visual carrier for cultural interaction between Chinese and foreign countries.

From the perspective of form, Southern Dynasties stone carvings do not deliberately pursue realistic complexity, but rather emphasize the unity of form and spirit, with a vivid and expressive aura. The stone beast has a deep gaze, a slightly open mouth and a heavy posture, reflecting the aesthetic pursuit of "motion within stillness" and "spiritual presence within movement". Stone pillars and steles emphasize maintaining a symmetrical layout and visual center of gravity, presenting an overall restrained, implicit, and quiet visual orientation, in line with the elegant and ethereal spiritual characteristics popular during the Wei, Jin, Southern and Northern Dynasties period. The stone carvings of the Southern Dynasties are not only a materialized representation of the political system, but also a concrete expression of the aesthetic taste of the aristocracy during the Southern Dynasties period.

4.1.3 The cultural and creative design potential of Southern Dynasties stone carvings

As an outstanding representative of ancient Chinese sculpture art, the stone carvings of the Southern Dynasties not only have high historical and cultural connotations, but also contain rich cultural and creative design potential. In recent years, young people's enthusiasm for traditional culture has continued to rise, and traditional art is gradually becoming a source of inspiration for modern design. The Southern Dynasties' stone carvings exhibit unique graphic symbols, formal styles, and cultural narrative characteristics, expanding vast space for innovation in contemporary cultural and creative product development and visual design (Table 1).

Table 1. Cultural Features and Design Potentials of Southern Dynasties Stone Carvings

Cultural Feature	Description	Design-Convertible Elements	Potential Creative Applications
Formal Structure	Symmetrical layout and stable proportions along the spirit road	Structural order, rhythm, balance	Product form design, visual identity systems
Stone Beasts Imagery	Stylized mythical creatures with abstracted animal forms	Iconic silhouettes, symbolic figures	IP character design, digital avatars, toys
Decorative Motifs	Lotus patterns, cloud motifs, dragons and mythical animals	Modular patterns, ornamental graphics	Packaging design, textiles, graphic design
Cultural Symbolism	Representation of power, guardianship, and religious beliefs	Narrative themes, symbolic storytelling	Interactive exhibitions, digital storytelling, cultural media

The graphic elements in the Southern Dynasties stone carvings reflect a high degree of recognition and transformation. The image of stone beasts has become a classic symbol in the Chinese divine beast system, with symbolic meanings such as auspiciousness, protection and authority. It can be widely used in clothing patterns, jewelry patterns, toy shapes, digital characters and other fields. The lotus flowers, exotic beasts, double dragons and other patterns on the stone pillars are highly decorative and suitable for transformation into border and lace designs in pattern design. They can be applied to stationery, home furnishings, packaging and other products.

The style features presented in the Southern Dynasties stone carvings have high aesthetic translation value. This shape emphasizes symmetry and rhythm, with smooth and highly tense lines, stable structure and profound charm. It is very suitable for transforming into modern flat and 3D design elements. With the help of AIGC technology, the stone carving structure can be style transferred, redrawn, or reassembled to produce works that combine traditional charm and modern

aesthetics. Especially in the fields of China-Chic style design, urban visual image system, digital art installation and so on, the stone carving art of the Southern Dynasties has given abundant creative inspiration.

The historical stories and cultural connotations behind the stone carvings of the Southern Dynasties add storytelling depth and emotional resonance to cultural and creative products. Each stone beast has its origin and meaning, and each inscription is related to the rise and fall of the dynasties, embodying sentiments of loyalty and righteousness as well as ceremonial traditions. If these contents are integrated with digital interactive technology, such as exhibition activities in AR museums, mobile applications for virtual tours, interactive storybook presentations and game scene settings, more immersive cultural experience projects can be created, allowing users to learn new knowledge in entertainment and enhancing their cultural identity with their own nation.

The stone carvings of the Southern Dynasties also have obvious advantages in international communication. Compared with the symbolic Chinese cultural images such as the Mogao Grottoes of Dunhuang and the Terra Cotta Warriors of the First Emperor of Qin Dynasty, the stone carvings of the Southern Dynasties have not yet fully entered the field of vision of international cultural communication, and have great development potential. By relying on AIGC technology, a digital visual asset library belonging to Southern Dynasties stone carvings can be created, providing favorable support for global designers and content creators to redesign and recreate, thereby promoting Southern Dynasties stone carvings to become a globally renowned fashion and cultural IP.

4.2 Principles of Aigc Technology And Its Advantages In Cultural And Creative Design

4.2.1 AIGC basic framework and representative model

AIGC is a cutting-edge achievement in the development of AI technology in recent years, relying on techniques such as large-scale language models, generative adversarial networks, diffusion models and multimodal learning. It can automatically output various styles of content such as text, images, audio and video based on instructions (Hei et al., 2024).

In the field of image content generation, the mainstream representative models currently include OpenAI's DALL · E, Stability AI's Stable Diffusion, Google's Imagen, Adobe's Firefly, etc. These models are generally based on deep neural networks and use massive images and text to train data, with functions such as image generation, style replacement, image restoration and image text transformation. Taking DALL · E as an example, it utilizes the CLIP model to achieve high-quality conversion from text to image. Users only need to input a descriptive copy to produce semantically corresponding image content.

In terms of text creation, ChatGPT, Bard, Claude and others use Transformer architecture language models to perform tasks such as copywriting, story arrangement and script generation. They also demonstrate human-like expression abilities in terms of context understanding and smooth logical connections. In the field of audio and video, platforms such as Synthesia, Runway, ElevenLabs, etc. have achieved automated generation effects from speech synthesis to virtual hosting.

The outstanding advantage of AIGC lies in its strong self-learning and adaptability, which enables it to not only achieve imitative creation, but also aggregate and generate cross modal content. The achievement of this ability relies on the breadth of training data, the depth of algorithm models, and the optimization of reasoning ability, becoming the foundation of current AI cultural and creative design tools.

4.2.2 AIGC technology empowers design in the following ways

The empowering role of AIGC technology in cultural and creative design mainly includes four aspects: rapid generation, style transfer, personalized creation and cross modal interaction. These abilities greatly broaden the boundaries of design practice and change the creative approach of designers (Liu et al., 2024).

Quick generation is the most intuitive advantage of AIGC. Designers can quickly obtain high-quality image sketches, scene layouts, or text content by simply entering keywords or short explanations. This creative approach greatly compresses the time from conceptual conception to initial implementation, which is conducive to conducting multiple attempts at design work in a short period of time and improving the efficiency of design work. Especially in the early stage of conceptual expansion, AIGC can quickly provide diverse visual solutions to help stimulate design inspiration (Huang et al., 2024).

AIGC has the ability to transfer styles, which can transfer image features of a certain style to another target object. Introducing the carving textures and image features of Southern Dynasties stone carvings into modern furniture, clothing, or packaging design allows traditional cultural elements to be reproduced in a modern way. This style transfer not only achieves the integration of formal categories, but also endows traditional images with new design contexts.

AIGC supports personalized creation by implementing customized designs based on user preferences, usage contexts, aesthetic preferences and other parameters. Through multiple rounds of dialogue or image feedback, users' design needs can be learned, achieving dynamic changes and creative upgrades (Wang et al., 2024). This interactive creative mode is particularly suitable for customized development of cultural and creative products, such as personalized souvenirs, digital collections, themed visual images, etc.

AIGC also has the advantage of cross modal interaction, which can carry out content conversion and integration between various media forms such as text, images, sound and video. It can transform a textual story about the Southern Dynasty stone beast myth into digital illustrations, animated short films, or virtual navigation audio scripts. This composite creative ability makes the multidimensional dissemination of cultural heritage a reality, which is conducive to creating immersive and interactive digital experience environments.

4.2.3 Comparison between AIGC empowered cultural and creative design and traditional cultural and creative design processes

Compared with the traditional cultural and creative design process, the generative design paradigm led by AIGC highlights significant advantages in multiple key aspects, including enhancing design efficiency, stimulating creativity and improving user interaction experience. At the same time, it also poses new challenges to the role of designers and the design process (Table 2).

Table 2. Comparison Between Traditional Cultural Creative Design and AIGC-Empowered Design

Dimension	Traditional Cultural Creative Design	AIGC-Empowered Creative Design
Creative Agency	Designer-led creation	Human-AI collaborative creation
Idea Generation	Experience-driven	Generative exploration through models
Design Efficiency	Relatively low to medium	High, with rapid iteration
Style Control	Manual adjustment	Model-based style learning and transfer
User Participation	Limited or indirect	Enhanced through interactive generation
Creative Diversity	Constrained by time and resources	Expanded through large-scale generation

From the perspective of design efficiency, traditional processes generally go through stages such as data collection, sketching and multiple revisions. AIGC, with the help of a large model generation mechanism, can complete the initial generation and output of concept maps, graphic schemes, or copywriting content in seconds to minutes, greatly saving the labor time in the initial design stage. Designers can focus more on content selection and creative deepening, enhancing the overall efficiency of project progress (Gill et al., 2005; Cross, 2023).

In the realm of creative inspiration, AIGC not only provides support in tools, but also brings a continuous stream of inspiration. The results generated by AIGC often exhibit unpredictability, which can break free from the limitations of human design inertia and generate unexpected visual expressions and creative combinations, driving designers to constantly broaden their creative boundaries during the dialogue between artificial and intelligent collaboration. For example, by using the AIGC tool to input "Combining Southern Dynasties stone carvings with fashionable clothing", multiple styles of mixed image schemes can be immediately generated for designers to refer to and make adjustments.

In the field of user interaction and experience design, AIGC has inherent advantages. Traditional design values linear creative processes, while AIGC can achieve real-time interaction, dynamic control and iterative generation, providing technical support for user participatory design and immersive experiences. Combined with platforms such as AR or VR, users can directly produce visual content through voice, action, or text commands, achieving a deep experience of co creation with technology. From the perspective of cultural heritage dissemination, this interactive mode is particularly suitable for the aesthetic and usage habits of young people.

Compared to traditional design, AIGC also faces challenges. For example, issues related to originality and copyright definition of works, key points for controlling content authenticity and cultural accuracy, etc. However, in terms of overall trend, the paradigm shift caused by AIGC technology is driving cultural and creative design towards the direction of "human-machine collaboration, multidimensional integration, and real-time generation". In the field of cultural heritage, AIGC can not only optimize the entire creative process, but also enable traditional cultural elements to enter contemporary visual contexts in a more vibrant way, increasing their dissemination effect and public influence.

5. DISCUSSION

5.1 Opportunities and challenges for AIGC to empower cultural heritage

AIGC provides unprecedented opportunities for the protection, dissemination and recreation of cultural heritage. By relying on the generation capability of large models, cultural heritage can be more efficiently digitally presented and disseminated through multimodal channels, presenting traditional culture to the public in a more intuitive, immersive and interactive way (Chen, 2024). In addition, AIGC allows non-design professionals to participate in cultural heritage and creative design, greatly expanding the boundaries and breadth of cultural participation (Table 3).

Table 3. Opportunities, Challenges, and Design Responses of AIGC in Heritage Creative Design

Dimension	Opportunities	Challenges	Design Responses
Generative Capability	Rapid content production and variation	Risk of cultural misinterpretation	Human review and cultural validation
Style Transfer	Innovative visual expression	Blurring of cultural authenticity	Expert involvement and contextual guidance
Dissemination mode	Cross-media storytelling and dissemination	Increased copyright uncertainty	Clear authorship attribution and governance mechanisms
Public Engagement	Broader participation and accessibility	Over-simplification of heritage meanings	Layered interpretation and narrative control

In terms of Southern Dynasties stone carvings, AIGC can assist in identifying and extracting visual elements inherent in stone carvings, and then output diverse design solutions that can be applied to cultural and creative products, digital exhibitions, virtual tours and other scenarios. AIGC can also adopt measures such as simulating style transfer and semantic restoration to achieve the re-creation of Southern Dynasties stone carving art, promoting the organic integration of traditional art and contemporary visual aesthetics.

However, the process of empowering cultural heritage with AIGC faces many challenges. Firstly, it is difficult to control the quality and cultural accuracy of the generated content, and some of the results may have defects such as "symbol misreading" or "cultural flattening". Secondly, there is a cultural bias in the model training data, which can lead to the weakening or even misinterpretation of non mainstream cultural elements. Once again, the reliance on technology may weaken the enthusiasm and depth of humanistic research. Interpreting cultural heritage cannot rely solely on technological algorithms, but also requires deep academic support and cultural analysis.

AIGC empowers cultural heritage, where opportunities and challenges coexist. In the application of cultural heritage, AIGC needs to pay attention to the synergy between humanities and technology, balance creativity and standardization, and establish a sustainable and reliable mechanism for cultural regeneration.

5.2 Copyright, ethics and cultural authenticity of AIGC generated content

With the widespread application of AIGC generated content, copyright, ethical and cultural authenticity issues have become key topics that cannot be ignored (Xu & Lin, 2024). Cultural and creative design itself involves visual expression, symbol borrowing and cultural reinterpretation. When the source of generated content is unclear, it is easy to trigger a series of conflicts and disputes over intellectual property and cultural ownership.

At the level of copyright, there is currently no global consensus on whether the images, text, or multimedia content produced by AIGC have independent copyright (Zhao et al., 2024). If copyrighted cultural images or materials are used during model training, there is still uncertainty as to whether the generated results infringe upon the rights of the original work. If cultural and creative products use AIGC output as their main component content and encounter copyright ownership and revenue distribution issues in the commercialization process, it is urgent to delineate the rights boundaries between creators (human users), platforms (AIGC providers) and primitive culture.

AIGC design may encounter cultural misunderstandings, incorrect symbol combinations, or the reproduction of stereotypes (Monteith et al., 2024; Polypotis & Pahos, 2024; Sun et al., 2024). Especially when dealing with content such as religious symbols, historical figures and traditional totems, it is more likely to provoke ethical controversies and public backlash. For example, transforming the Southern Dynasties stone beasts into anthropomorphic and commercialized forms, does this violate their sacredness and original context. Therefore, how to grasp the boundaries of cultural re-creation is a question that designers and developers should seriously reflect on at present.

In terms of cultural authenticity, although AIGC has the function of imitating traditional styles, it is difficult to truly understand the philosophy, aesthetics and institutional logic behind culture. Without in-depth research and cultural background support, generating content may only remain at the visual surface stage. Therefore, when using AIGC for cultural heritage design, it is necessary to involve historians, archaeologists and cultural researchers to ensure that the content meets both academic and ethical standards.

5.3 The collaborative relationship between AIGC and designers

The popularity of AIGC does not mean replacing the position of designers, but rather guiding the role transformation of designers. Designers have transformed from creators in traditional concepts to planners or guides, reshaping the development direction of contemporary designers (Liu, 2020).

In the AIGC creative process, designers play an important role as thought input providers, using AIGC tools to input precise prompt instructions and generate works that satisfy users. In addition, when faced with the various output results provided by the model, designers should also utilize their professional discernment ability to screen, improve and further creatively expand from them, ensuring the aesthetic and cultural value of the generated content (Jiang et al., 2025).

The innovative ability and cultural comprehension ability of designers are the irreplaceable core advantages of AIGC at present. Especially in the field of cultural heritage, design is not only a form of innovation, but also a reconstruction of cultural expression. Taking the Southern Dynasties stone carvings as an example, designers must understand their religious culture, political background and aesthetic style in order to design cultural and creative products rich in cultural heritage, rather than simply piecing together images and imitating styles.

The relationship between designers and AIGC can also be a mutual learning and reference. By relying on unexpected results obtained from models, designers can gain inspiration and break free from the shackles of thinking (Wu, 2020). The feedback and revision suggestions provided by designers can also assist in optimizing the operational logic and user experience of AIGC models, promoting the development of AI systems towards a direction that is more in line with human aesthetics and cultural cognition.

AIGC is not meant to serve as a tool to replace designers, but rather to expand their means of expression and accelerate their creative completion efficiency (Brüns & Meißner, 2024). In the future, the cultural and creative design of cultural heritage will usher in a new era of co-creation by humans and machines.

5.4 The transferability of AIGC-empowered design approaches based on Southern Dynasties stone carvings

Starting from the stone carvings of the Southern Dynasties, explore the methods of AIGC's involvement in cultural heritage design. It is not only the value of a single case, but also has a certain universality, which is suitable for promoting this model to other cultural heritage objects.

The Southern Dynasties stone carvings present significant visual language, religious elements, and historical backgrounds, making them suitable as objects for AIGC training and testing. They can verify AI's ability to recognize and express form norms, style symbols, and historical semantics. This highly visual and unified cultural heritage style provides an ideal training case for creating AIGC design models.

Using this as a template, it can be extended to other cultural heritages with rich images and profound cultural heritage, such as Tang Dynasty murals, Qing Dynasty palace architecture, ancient statues, etc. Each cultural heritage can draw on the practical experience of Southern Dynasties stone carving in the process of "Digital feature extraction–AIGC generation–Design output", and create standardized data collection procedures, instruction writing styles and cultural review systems. However, there are significant differences between different cultural heritages and local adjustments need to be made based on their cultural attributes.

The AIGC-driven cultural and creative design model initiated by the Southern Dynasties stone carvings can serve as a transferable prototype. However, when promoting this model, it is necessary to follow the strategy of "Feature Extraction–Commonality Modeling–Local Adaptation" to achieve intelligent re-creation and modern expression of diverse cultural resources, contributing to the development of an AIGC-powered cultural and creative system rich in cultural depth and breadth.

6. CONCLUSION

This study systematically elucidates the mechanism and practical value of AIGC technology in the cultural and creative design of Southern Dynasties stone carvings. From multiple dimensions such as technological empowerment, design process optimization and cultural visual re-creation, it demonstrates the role of AIGC in promoting the revitalized dissemination of cultural heritage. By constructing a transferable design process model, this article not only provides an innovative path for contemporary expression of Southern Dynasties stone carvings, but also provides theoretical support and empirical cases for the in-depth application of AIGC in the field of cultural heritage.

With the continuous iteration and cross disciplinary integration of AIGC technology, its application in cultural heritage and creative design will present a more diverse and intelligent development trend. Future research can further explore the precise control capabilities of AIGC in semantic understanding, style recognition, and cultural context adaptation, and construct a more refined and personalized design generation mechanism. At the same time, the deep integration of AIGC with technologies such as AR or VR, virtual humans and immersive exhibitions will also expand the experiential dimensions of cultural heritage dissemination. In addition, the institutional construction around copyright ownership, ethical norms and cultural authenticity will also become a key issue in AIGC's process of empowering cultural heritage, which is worthy of continuous exploration and improvement at the policy, technical and cultural levels.

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CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Zhenya Zhu: Substantial contribution to the conception and design of the work; and the collection, analysis, and interpretation of data.

Shanshan Zhang: Conceptualization, methodology, and overall project supervision. Responsible for communication with the journal and ensuring the integrity of the final manuscript.

Fauzi Naeim: Provided systematic guidance on the overall research direction and academic framework of this paper.

DECLARATION OF GENERATIVE AI IN THE WRITING PROCESS

During the preparation of this work, the author(s) used ChatGPT to improve the accuracy of the language. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

ETHICS STATEMENT

The authors declare that this research did not involve human or animal subjects.

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