Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

The Impact of AI-Generated Reconstructions of Ba-Shu Calligraphy and Painting Visual Features on Cultural Perception: The Chain Mediation Effect of Emotional Resonance and Aesthetic Engagement

Wei Li
Neijiang Normal University
Xuanbo Mao
maoxuanbo@dlu.edu.cn

Dalian University
Shijing Cheng
Jingdezhen University

Article

Keywords: Generated and reconstructed by AI, Bashu calligraphy and painting, Cultural perception, Visual features, Emotional resonance, Aesthetic engagement

Posted Date: April 29th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9277243/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

This study explores the influence of visual features (Texture fidelity, Structural clarity and color consistency) of Bashu calligraphy and painting generated and reconstructed by AI on cultural perception, focusing on analyzing the mechanism of visual features through emotional resonance and Aesthetic engagement, and mainly constructing a chain mediation model to examine how visual features trigger emotional responses, thereby enhancing Aesthetic engagement and deepening cultural understanding. Through the data analysis of 736 participants, the results show that high-quality visual features significantly affect cultural perception, and emotional resonance and Aesthetic engagement play a key mediating role in this process. Specifically, the high degree of restoration of texture, structure and color of AI-generated images can effectively enhance the audience's emotional connection and Aesthetic engagement, thereby promoting a richer cultural experience. This study provides important insights into the interactive design of digital cultural heritage, emphasizing the important role of emotional and aesthetic factors in cultural identity and understanding, and also provides theoretical support for the application of AI technology in cultural heritage dissemination and digital art.

1. Introduction

In recent years, under the joint promotion of digital technology and cultural policies, the digitalization of cultural heritage is gradually moving from the early "digital archiving" to the stage of in-depth presentation with virtual reconstruction, digital twins and immersive experience as the core. High-precision 3D scanning, multi-modal perception and narrative system based on knowledge graph make traditional cultural heritage and works of art no longer just static images or data, but digital objects that can be "re-experienced" in an interactive virtual environment (Pietroni & Ferdani, 2021). On this basis, the concept of digital twins began to be introduced into cultural heritage research, not only focusing on the geometric structure and materials of cultural heritage or works of art, but also emphasizing their visual narrative and semantic hierarchy. For example, taking Leonardo da Vinci's masterpiece "Mona Lisa" as the object, a "digital twin of cultural heritage" model is constructed, which integrates multi-level visual narrative and knowledge expression into a unified framework to serve the dual goals of protection and interpretation(Amelio & Zarri, 2024). The systematic review of digital cultural heritage research also shows that related work is shifting from static recording to dynamic display that emphasizes emotional participation, narrative experience and audience meaning construction (Lian, 2024; Lin, 2025).

In this context, generative artificial intelligence is beginning to emerge as a new paradigm for cultural heritage visualization. The text-to-image and style transfer model can simulate traditional artistic styles, reconstruct historical scenes, and even speculatively "restore" destroyed or defective cultural objects. For example, using generative AI to create images about Tanka culture in three Chinese painting styles not only demonstrates the potential of AI in activating the cultural heritage of ethnic minorities, but also reveals the debate behind style imitation regarding authenticity and cultural depth (Pan & She, 2024). AI-generated "reinterpretations" of historical paintings can be regarded as "digital artists" in a sense. They can not only continue and reinterpret traditional aesthetics, but also dispel subtle cultural details in the

original works(Leong, 2025). In immersive situations, generative AI is also integrated into VR museums as generative visual content and conversational virtual assistants to personalize the explanation of traditional fabrics and craft heritage, thereby enhancing audience participation and interactivity (Ariya et al., 2025). The above research shows that AI-generated content provides a new media path for cultural communication, but there is still a lack of systematic empirical tests on how it affects the audience's cultural perception, authenticity judgment and emotional experience.

In the context of Chinese culture, BaShu region is regarded as one of the important birthplaces of Chinese civilization, and is famous for its unique mountain valley landform, humid climate and multi-layered accumulated historical memory (culture; Wang & Saelee, 2025). The "Bashu Painting School", rooted in this cultural-ecological matrix, has gradually developed into a painting tradition with distinctive regional style. Art history and art criticism literature generally point out that Bashu calligraphy and painting have the characteristics of "moist and rich" ink visually, preferring saturated and warm tones, and often interweaving steep canyons, clouds and misty rivers with dense urban landscapes in the same picture through deep perspective and multi-level spatial organization (Wang & Saelee, 2025). Media and academic comments mostly summarize its style characteristics with vocabulary such as "tactful and delicate, rich and beautiful colors, and slender and elegant lines", emphasizing that its form not only retains the lyricism of literati freehand brushwork, but also incorporates the symbolism of modern composition (Thecover.cn., 2022). With the advancement of national strategies such as Chengdu-Chongqing Twin Cities Economic Circle and "Bashu Cultural Tourism Corridor", Bashu calligraphy and painting and their visual motifs are increasingly used as core visual symbols in urban landscape, public art, cultural tourism brands and digital exhibitions, making "Bashu style" gradually evolve into an important symbol system in contemporary Chinese visual culture.

However, in the digital environment, Bashu calligraphy and painting are often simplified to several keywords or rough style labels (such as "Sichuan landscape", "misty river city", "ink-and-wash with rich colors"), and are directly used to drive the prompt words of the generative model. Compared with physical works, AI-generated "Bashu Style" images can be quickly copied and spread in social media, AR filters and virtual exhibitions, which has a subtle influence on the audience's impression of Bashu culture. At the visual level, when reconstructing Bashu calligraphy and painting, the generative model will not only "learn" the traditional paradigm in spatial composition and brushstroke style, but also show different visual effects in terms of Texture Fidelity (such as the degree of reproduction of paper and silk texture, brushstroke texture and ink color level), Structural Clarity (such as the recognizability of picture structure, object outline and scene depth), and color consistency (such as the overall tone, the relationship between cold and warm and the degree of consistency with traditional Bashu calligraphy and painting). Existing research on AIGC and cultural heritage focuses more on technical processes, design frameworks, or audience acceptance of AI tools (Pan & She, 2024; Ariya et al., 2025; Leong, 2025) (Ariya et al., 2025; Leong, 2025; Pan & She, 2024), while taking fewer dimensions closely related to visual fidelity as independent variables, systematically examines their impact on the construction of cultural meaning for the audience.

The field of digital cultural heritage increasingly emphasizes the central role of emotional and identity-related results in evaluating cultural experiences. Contemporary projects continue to enhance design elements such as multimedia integration, dynamic presentation and emotional narrative. Emotional participation is often closely linked to deeper understanding and stronger heritage identity (Lian, 2024). For example: Taking the case of Azheke Village in Hani Terrace, China, this paper studies how immediate emotional responses in virtual cultural heritage experiences can enhance the heritage identity of young participants, especially when emotional evocation is consistent with the identity dimension based on social values. This enhancement effect is particularly significant(Li et al., 2025). The collective emotional resonance in the digital exhibition of intangible cultural heritage clothing shows that group emotions are closely related to the formation of cultural identity through the mechanism of “collective emotional resonance” (Zhang & Liu, 2025). In the context of cultural heritage tourism, positive emotional experience plays a mediating role between environmental cognition and tourists’ cultural identity and heritage protection behavior willingness (Yang et al., 2023). These studies jointly point that emotional resonance is not a subsidiary variable of cultural experience design, but one of the key psychological mechanisms to promote the construction of cultural meaning and identity.

Aesthetic empirical research further shows that there is a close interaction between emotional response and deeper Aesthetic engagement. Aesthetic appreciation model points out that low-level visual features first enter the stage of perception and early emotional processing, and then affect high-level cognitive processing, evaluation and judgment, and meaning construction (Leder et al., 2004). From the perspective of emotional psychology, it is emphasized that discrete emotions such as “interest”, “awe” and “moving” are triggered by evaluation processes such as novelty and intelligibility, and these emotions will drive continuous attention and reflective participation (Silvia, 2005). In the context of digital art, Aesthetic engagement is often operated into a multi-dimensional construction including attention input, cognitive processing and emotional intensity. The latest evidence shows that in both physical and digital contexts, Aesthetic engagement is highly correlated with the liking degree and self-rated understanding of works (Darda et al., 2025). However, although these theories imply a potential path from visual features—emotional responses—Aesthetic engagement—high-order cultural judgments, there is still a lack of empirical research on AI-generated cultural visual contexts and testing them in a “chain mediation” way.

Based on the above background, this study focuses on Bashu calligraphy and painting images generated and reconstructed by AI, and explores how their visual features affect the audience’s cultural perception, and through what psychological mechanisms this influence occurs. Combining relevant art history documents and digital image quality research, the research defines the operability of key visual features of AI-generated images of Bashu calligraphy and painting into three dimensions: (1) Texture Fidelity: refers to the degree to which the image is close to real Bashu calligraphy and painting in terms of brushstroke texture, paper and silk texture and ink color level; (2) Structural Clarity: refers to whether the overall composition of the picture, the outline of the object and the depth of the scene are clear and distinguishable, and whether the structural relationship is reasonable; (3) Color consistency: refers to the stability of the internal color relationship of the generated image and its consistency with the color

vocabulary of traditional Bashu calligraphy and painting. Based on the aesthetic appreciation model (Leder et al., 2004; Silvia, 2005) and empirical findings about emotional resonance and heritage identity (Li et al., 2025; Yang et al., 2023; Zhang & Liu, 2025), a chain mediation model is proposed. Its core viewpoints include: different configurations of Texture Fidelity, Structural Clarity and color consistency will trigger different degrees of emotional resonance (such as emotional connection to Bashu images, daily experience and regional memory); This emotional resonance further enhances the audience's Aesthetic engagement, which is manifested in attention attraction, interest stimulation and reflective processing; Enhanced Aesthetic engagement ultimately promotes richer cultural perception, including higher perception of cultural value, deeper understanding of cultural connotation and stronger feeling of cultural sustainability. Therefore, this study raises the following research questions:

RQ1: Compared with traditional images, will the visual features (Texture Fidelity, Structural Clarity and color consistency) of Bashu calligraphy and painting generated and reconstructed by AI, significantly enhance the audience's overall perception of Bashu culture?

RQ2: Does emotional resonance play a mediating role between visual features generated and reconstructed by AI and cultural perception? That is, is the audience's resonance with the works the psychological basis for the promotion of their cultural perception?

RQ3: Does Aesthetic engagement play a mediating role in the above relationships? In other words, does the audience's attention input and aesthetic immersion in the works help to transform visual stimulation into a deeper cultural understanding?

RQ4: Do emotional resonance and Aesthetic engagement constitute a chain mediation? That is, does AI generation and reconstruction first stimulate emotional resonance, then promote Aesthetic engagement, and ultimately enhance the audience's overall perception of Bashu culture?

By taking visual features of Bashu calligraphy and painting generated and reconstructed by AI as the research object and empirically testing the above questions, this study intends to make three contributions. This study proposes and verifies a chain mediation mechanism that leads to cultural perception through emotional resonance and Aesthetic engagement from visual features such as Texture Fidelity, Structural Clarity and color consistency. At the same time, it provides practical reference for cultural institutions, urban renewal projects and AIGC platform designers, explaining how to use AI to generate regional artistic styles to enhance "eye-catching" while further strengthening the audience's emotional connection and cultural understanding.

The structure of this paper is divided into seven parts: Firstly, it briefly introduces the concept, related data and theoretical basis of visual features of Bashu calligraphy and painting generated and reconstructed by AI; Secondly, the literature review and the research model and hypothesis are put forward; The third part is the research method; The fourth part shows the results of data analysis; The fifth part verifies the hypothesis and discusses it; The last two parts respectively expound the theoretical

and practical significance of the research, as well as the research limitations and future research directions.

2. Theoretical basis and literature review

2.1 Visual features of Bashu calligraphy and painting generated and reconstructed by AI

As generative AI is widely used in cultural heritage reconstruction, the visual fidelity of images has become a key factor affecting the audience's immersion and authenticity judgment, mainly reflected in dimensions such as geometric structure, texture details and color reproduction. Studies have shown that high-quality image structure and detail reproduction can help to enhance the sense of presence and perceived value in virtual display(Im et al., 2025), while in the context of cultural heritage, color levels and texture details will also directly affect aesthetic evaluation and emotional resonance(Chen et al., 2025). For instance, the Digital Dunhuang Project demonstrated that authentically restored mural colors and textures elicited heightened audience engagement and cultural identification. Comparative studies between photogrammetry and laser scanning highlight that while the latter offers superior structural accuracy, the former excels in texture and color fidelity (Ruiz et al., 2021), showing the multi-dimensional importance of image visual presentation. In terms of generative AI image generation, if it is highly consistent with traditional culture in terms of style, material and color, the audience is more inclined to give it "traditional authenticity", thereby enhancing the sense of identity and willingness to participate (Bui et al., 2024). On the contrary, if the image lacks cultural context embedding and visual logical consistency, it may weaken the immersion experience and trust (Lai et al., 2025). In order to enhance this "AI reality", researchers propose to combine the attention mechanism with the style preservation network for the automatic restoration and generation of images such as murals, calligraphy and paintings, so as to improve the restoration of details while maintaining the consistency of the overall style (Liu et al., 2025). Therefore, this study summarizes the visual features of AI-generated Bashu calligraphy and painting images into three dimensions: First, "Texture Fidelity" means the delicate reproduction of paper texture, ink water marks and brushstroke techniques; Second, "Structural Clarity" emphasizes the spatial order and perspective accuracy of landscape, architecture and character composition; Third, "color consistency" requires that the overall tonality conform to the wet, hazy and highly saturated regional color tradition of Bashu. These dimensions take into account both visual accuracy and cultural context, making the generated images realistic and attractive at both aesthetic and semantic levels.

2.2 Emotional Resonance and Aesthetic Engagement

From the perspective of psychological aesthetics, artistic experience is regarded as a multi-stage process from perceptual analysis, meaning processing to emotional evaluation(Leder et al., 2004). Among them, the formal characteristics of the works guide the audience into aesthetic processing through perceptual organization and meaning reasoning, and then produce preference judgment and

memory impression (Silvia, 2005) .“High-level emotions” such as interest and curiosity are particularly critical in the face of complex or unfamiliar works of art. They not only maintain attention, but also drive deeper search for meaning (Silvia, 2008). This process is embodied in “Aesthetic engagement”, that is, the audience shows the state of continuous attention, emotional involvement and active meaning construction in viewing (Pelowski et al., 2016). This experience not only involves the evaluation of “like/dislike”, but also includes complex psychological components such as emotional evocation, meaning construction and self-reflection (Darda et al., 2025). In the display of digital cultural heritage, “emotional resonance” is used to describe the audience’s emotional substitution of local memory and cultural identity, which can enhance the audience’s identity and participation willingness(Li et al., 2025). In intangible cultural heritage digital exhibitions, emotional resonance can also promote the construction of cultural identity through the path of “empathy-recognition-behavioral willingness” (Meng & Dolah, 2025). Therefore, this study defines emotional resonance as the audience’s emotional empathy and substitution for Bashu’s natural landform, urban space and folk life scenes when viewing AI-generated Bashu calligraphy and painting images; Aesthetic engagement is defined as the continuous attention, immersion imagination and active meaning construction activities in the process of viewing AI-generated Bashu images. Together, they constitute the key psychological bridge from “seeing images” to “entering the world in painting”.

2.3 Cultural Perception

“Cultural perception” transcends the superficial recognition of visual symbols and emphasizes the audience’s comprehensive understanding of cultural value, historical implication and sustainability in multiple dimensions (Sun Lanxin, 2024). In virtual cultural heritage projects such as “Digital Dunhuang”, the audience not only gains aesthetic pleasure through immersive experience, but also forms a deep understanding of religious background, historical context and the importance of cultural heritage protection (Han Bo, 2025). Studies have shown that this multi-level perception process can stimulate cultural identity, enhance emotional connection, and promote actual behavior willingness, such as offline visiting and cultural consumption (Li et al., 2025). The emotional experience triggered by virtual exhibition has become a psychological bridge connecting online aesthetics and offline participation. At the same time, generative AI is reshaping the way cultural images are viewed. The audience’s perception of the authenticity and authority of AI-generated images directly affects their cultural value judgment and willingness to adopt (Hao et al., 2025). Research shows that when AI content is highly semantically and situationally adaptable, audiences are more likely to have “credible” and “meaningful” feelings, thereby enhancing the overall perceived value and transforming it into behavioral motivation(Hao et al., 2025). Therefore, this study defines “cultural perception” as the subjective evaluation and comprehensive cognitive judgment formed by the audience on the regional cultural aesthetics, lifestyle images and cultural persistence displayed by AI-generated Bashu calligraphy and painting images.

2.4 2.4 Chain mechanism of visual features—emotional resonance—Aesthetic engagement—cultural perception

Comprehensive research on psychological aesthetics and digital cultural heritage can construct a chain mechanism of “visual features—emotional resonance—Aesthetic engagement—cultural perception”. First of all, high-fidelity visual features (quality restoration, Structural Clarity, color consistency) can significantly enhance the immersion and realism of virtual images, and establish an “immersive” perceptual foundation for the audience (Hameed & Perkis, 2024). Real image texture and composition structure are more likely to arouse the audience’s emotional substitution of regional landscapes, folk life and other contents, and activate the emotional resonance related to their experience or cultural memory (Chen et al., 2025). Secondly, psychological aesthetic studies show that emotional resonance can enhance curiosity and exploratory motivation, thus deepening attention to concentration and immersive experience, and promoting deeper Aesthetic engagement (Leder et al., 2004; Silvia, 2005).(Leder et al., 2004; Silvia, 2005). Especially in digital context, the combination of image quality and emotional design is critical to maintain user understanding depth and active participation.(Tsita et al., 2023). Continuous attention and meaning construction in the state of Aesthetic engagement help the audience to form a higher level of cultural perception of the cultural symbols and historical context behind the images(Wu et al., 2025). In the end, this emotion-driven aesthetic path is transformed into the audience’s understanding of cultural value, enhancement of cultural identity and cognition of cultural sustainability. Relevant studies have confirmed that in digital cultural heritage and AI-generated art, high-quality images and situational content significantly affect users’ willingness to participate in culture and behavioral tendencies by enhancing their perceived value and emotional involvement(Hao et al., 2025). Therefore, this chain mechanism provides theoretical support for understanding how generative AI images promote audiences’ in-depth perception and dissemination of regional culture.

3 Research Hypotheses

3.1 Visual features and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI

In digital cultural heritage and virtual art display, visual features are the primary factors that affect users’ cultural understanding and meaning processing. First of all, Texture Fidelity has been proved to be the core dimension of whether digital reconstruction can convey cultural realism. When digital images can meticulously reproduce the texture, texture details and material characteristics of paper, it is easier for audiences to regard digital achievements as “credible” cultural objects, resulting in deeper historical association and interpretation activities (Bekele et al., 2018; Malik et al., 2021; Serain, 2018). High-quality three-dimensional reconstruction and surface material reproduction will enhance the “material sense” and “presence sense” of digital cultural heritage and virtual scenes, thus supporting the audience’s understanding of traditional craftsmanship and painting aesthetics (Malik et al., 2021; Meehan, 2022). Secondly, the structural clarity of images (including composition organization, spatial hierarchy and object boundary) is regarded as a key cognitive auxiliary mechanism in virtual cultural experience. A reasonable and clear spatial and narrative structure can reduce cognitive load and improve users’ analysis efficiency of scene semantics, historical background and cultural narrative(Pietroni & Ferdani,

2021). Finally, color consistency is widely regarded as an important medium to carry cultural codes and aesthetic traditions in the study of cultural heritage visualization. Color management and accurate collection can maintain the tone, level and contrast close to the original in digital images, which helps the audience to judge the authenticity, historical context and stylistic characteristics of the works(Berns, 2019; Molada-Tebar et al., 2019). In the context of Bashu calligraphy and painting, green, moist and hazy tones are directly related to regional climate, landscape pattern and aesthetic taste. Therefore, color consistency and overall tone stability are also important visual clues to promote Bashu cultural perception.

To sum up, existing studies have pointed out that highly realistic visual quality, clear structural presentation and stable color logic are the key factors to enhance cultural understanding and perception. Based on this, this study concludes that if Bashu calligraphy and painting generated and reconstructed by AI perform better in the above three dimensions, it will significantly enhance the audience's cognitive depth of the cultural information it carries, and puts forward the following research hypotheses based on this:

Hypothesis

a (H1a): The Texture Fidelity of Bashu calligraphy and painting generated and reconstructed by AI really affects cultural perception.

Hypothesis

b (H1b): The Structural Clarity of Bashu calligraphy and painting generated and reconstructed by AI positively affects cultural perception.

Hypothesis

c (H1c): The color consistency of Bashu calligraphy and painting generated and reconstructed by AI positively affects cultural perception.

3.2 Visual features and emotional resonance of Bashu calligraphy and painting generated and reconstructed by AI

After generative AI was widely used to visualize cultural heritage, visual features began to be regarded as key "inputs" that drive emotional response and emotional resonance. On the one hand, the "AI-authenticity" of AIGC images has been proven to not only affect users' judgment on the credibility and trust of content, but also further affect behavior willingness through emotional evaluation: when AI-generated images are closer to real scenes or original works in terms of material details, structural proportions and overall style, users are more likely to experience positive emotions and proximity, thereby enhancing their favorability and willingness to participate in the destination or cultural scene (Bui et al., 2024). In digital cultural heritage platforms, generative AI's enhancement of semantic relevance,

situational adaptability, and narrative design has been proven to significantly enhance perceived value and pleasant experience, and influence users' adoption willingness and offline cultural participation through emotional evaluation (Gurel, 2025; Hao et al., 2025; Lai et al., 2025). These studies show that "whether AI-generated content looks real and coordinated" is not only a technical issue, but also directly related to whether users are willing to emotionally "walk" into virtual scenes. Taking the interactive device "Known Beauty" based on style transfer and AIGC as an example, by converting audience selfies into images consistent with the style of cultural heritage, it is found that the personalized visual presentation generated by AI can significantly enhance emotional pleasure, intimacy and cultural connection sense, forming a "cultural bond" with emotional resonance as the core (Zhou, 2024). In the AI-driven experience of cultural and creative industries, emotional evocation, emotional involvement and sense of meaning are the core dimensions to measure the quality of experience, and these dimensions are highly dependent on the fit of AI-generated content in visual form and cultural context (Gurel, 2025). Grafting these theories to the Bashu calligraphy and painting scenes generated and reconstructed by AI, it can be inferred that when the image performs better in the three dimensions of Texture Fidelity, Structural Clarity and color consistency, it will not only help to establish the basic judgment of "credibility" and "good-looking", but also arouse the intimacy, nostalgia or yearning of "this is Bashu", and then form emotional empathy for Bashu's natural landform, urban memory and folk life, that is, the emotional resonance defined by this study(Hao et al., 2025; Lai et al., 2025; Wang et al., 2025; Xia et al., 2025).

Based on the above theoretical and empirical evidence, this study believes that the visual features of Bashu calligraphy and painting generated and reconstructed by AI are important prefactors to stimulate emotional resonance. More realistic material and texture reproduction, more layered and discernible spatial structure, and the overall color system consistent with Bashu regional aesthetics will help the audience emotionally "recognize" and "identify" with the Bashu world in the picture. Based on this, the following hypotheses are put forward:

Hypothesis

a (H2a): The Texture Fidelity of Bashu calligraphy and painting generated and reconstructed by AI has a significant positive impact on emotional resonance.

Hypothesis

b (H2b): The Structural Clarity of Bashu calligraphy and painting generated and reconstructed by AI has a significant positive impact on emotional resonance.

Hypothesis

c (H2c): The color consistency of Bashu calligraphy and painting generated and reconstructed by AI has a significant positive effect on emotional resonance.

3.3 Visual features and Aesthetic engagement of Bashu calligraphy and painting generated and reconstructed by AI

“Aesthetic engagement” is usually defined as the audience’s continuous attention, emotional involvement and intensity of meaning processing in artistic experience. The latest research on digital cultural heritage shows that if digital presentation can form a good linkage in multiple dimensions of “things-people-emotions-beauty” (such as the consistency between morphological details, narrative context and emotional clues), it is easier to stimulate the audience’s interest in exploration and immersive gaze, thus deepening the aesthetic participation in cultural heritage and cultural values (Niu et al., 2025). AI-generated images are not only content carriers, but also significantly increase participation by enhancing visual appeal and novelty. Introducing images generated by Stable Diffusion into primary school art classrooms, it was found that compared with traditional images, AI-generated images significantly improved students’ classroom input in the three dimensions of emotion, behavior and cognition, while not increasing cognitive load(Bian et al., 2025). From the perspective of aesthetic evaluation mechanism, the audience’s aesthetic response to AI-generated art is not a single “like/dislike”, but highly relies on the perceptual judgment of the realism, complexity, style consistency and “sense of effort” of the work. These visual and stylistic characteristics mainly affect aesthetic appreciation and input through two paths of pleasure and interest (Bianchi et al., 2025). When AI-generated art is the object, it is found that the generation results with higher computing resources and better subjective quality will significantly improve the aesthetic pleasure and positive emotions of participants, indicating that “subjective quality” and visual fineness are important driving factors to promote emotional input (Grassini, 2024). Experimental research on AI-generated abstract art also shows that the differences in color, shape and composition structure of images will systematically change the way of aesthetic judgment and meaning construction (Hou & Huang, 2025), confirming the basic role of visual structure and color logic in the aesthetic appreciation of AI art.

Accordingly, in the Bashu calligraphy and painting generated and reconstructed by AI, if the material and brushstroke details such as the paper texture, ink water marks, rubbing and flying white of the image are truly presented; The landscape, urban architecture and figures of Xiajiang River are clearly distinguishable in spatial level, perspective relationship and composition order; The overall color tone is consistent with the moist and hazy color tradition in Bashu area, and the internal color relationship of the picture is harmonious and stable. It is easier to attract attention at the first time, stimulate the audience’s interest and curiosity, and prompt them to stay, stare and compare repeatedly in the picture, so as to input more cognitive resources in detailed interpretation and cultural association. In other words, the optimization of visual features is likely to significantly promote the audience’s Aesthetic engagement in AI-generated Bashu calligraphy and painting by enhancing the sense of pleasure, interest and immersion. Based on the above theory, this study puts forward the following hypotheses:

Hypothesis

a (H3a): The Texture Fidelity of Bashu calligraphy and painting generated and reconstructed by AI has a significant positive impact on Aesthetic engagement.

Hypothesis

b (H3b): The Structural Clarity of Bashu calligraphy and painting generated and reconstructed by AI has a significant positive impact on Aesthetic engagement.

Hypothesis

c (H3c): The color consistency of Bashu calligraphy and painting generated and reconstructed by AI has a significant positive impact on Aesthetic engagement.

3.4 Emotional Resonance and Cultural Perception

In the research of cultural heritage digitalization, emotional resonance is generally regarded as the key psychological link between technological presentation and cultural understanding. Research on virtual and digital experiences as the object shows that when audiences produce strong emotional reactions (such as moving, curiosity, awe) during the interaction process, they are not only more willing to participate in sharing and communication behaviors, but also their evaluation of cultural value and historical significance is more positive and in-depth (Yi et al., 2025). Emotional involvement can significantly enhance the audience's understanding of historical situations and cultural narratives. In the EMOTIVE project, different narrative strategies were compared through digital storytelling, and it was found that under the condition of high emotional input, the audience's memory, meaning construction and self-correlation judgment of cultural information were significantly enhanced(Economou et al., 2019). In the context of cultural experience empowered by AI, the linkage relationship between emotional resonance and cultural perception is more prominent. Empirical research on AI-curated exhibitions shows that audiences' emotional themes such as curiosity, amazement or alienation from exhibits generated and screened by AI directly affect their evaluation of the exhibition's "cultural depth", "humanistic temperature" and technical rationality. When emotional connections are insufficient, users are more likely to regard AI curation as a technical gimmick that "lacks cultural charm" (Guo et al., 2025). At the level of space and interaction, by applying emotional computing and artificial intelligence to the optimization of museum exhibition space, it is found that after adjusting lighting, route and information density based on audience emotional feedback, the audience not only improves their subjective participation and pleasure, but also improves the overall cultural value of the exhibition. The scores of value and educational significance also improve significantly, indicating that there is a stable positive correlation between emotional participation and cultural evaluation (Lei, 2025). Regarding AI and digital tools in a broader sense, the ReInHerit project analyzed the practices of multiple venues, and pointed out that computer vision and AI interactive installations can effectively enhance the audience's subjective sense of value and long-term memory of cultural content by stimulating emotional connections, gamifying participation and empathetic experiences (Mazzanti, 2025).

Based on the above research, it can be inferred that in the Bashu calligraphy and painting context generated and reconstructed by AI, if the audience can have a stronger emotional resonance with the landscape pattern, urban life and regional climate images presented in the picture during the viewing process, such as associating with their own memory, identity or imaginary “Bashu life”, it is more likely to form a more positive, holistic and lasting cultural perception of the aesthetic style, lifestyle and historical meaning of Bashu culture. In other words, emotional resonance is not only an emotional response to visual stimuli, but also a key mediation to promote cultural value understanding, identity construction and meaning internalization. Therefore, this study proposes the following hypotheses:

Hypothesis 4

(H4): Emotional resonance has a significant positive effect on cultural perception.

3.5 Aesthetic Engagement and Cultural Perception

In the context of digital cultural heritage and generative AI art, Aesthetic engagement is not only related to the audience’s “how long they watch” and “whether they like it or not”, but also reflected in the continuous attention, emotional involvement and in-depth meaning processing during the viewing process. Higher levels of aesthetic participation (such as focused gaze, being impressed, being inspired, or thinking) are often significantly related to subjective perceptions such as “learning something new” and “better understanding the world represented by the work”, which provides empirical support for the aesthetic epistemology of “aesthetic experience can produce understanding” (Christensen et al., 2023; Darda et al., 2025). When the audience interacts with AI-generated images, they will also have complex aesthetic judgments and cultural reflections. Experiments stimulated by DALL·E 2 works of art found that when participants make preference choices for AI-generated art, they not only think about the relationship between the works and human creation, artistic value, and cultural creativity based on visual pleasure, showing that AI art can trigger high levels of aesthetic and meaning processing (van Hees, 2025). This means that as long as the visual features of the image are sufficient to support continuous attention and emotional involvement, the images generated and reconstructed by AI can also become an important medium for the audience to understand cultural styles, historical contexts and values. Aesthetic encounters starting from senses and emotions often lead the audience into deeper thinking about historical contexts, value systems and cultural differences, thus transforming “aesthetic experience” into learning and reflection on cultural significance (Bell, 2017). From a more macro perspective, a systematic review of art viewing shows that the emotional and cognitive input stimulated by art viewing not only affects emotions and happiness, but also promotes the audience to establish a closer connection with cultural traditions and social contexts through identity construction, self-reflection and meaning seeking (Trupp et al., 2025).

To sum up, existing studies from empirical aesthetics to AI art all point to the same trend: the higher the Aesthetic engagement, the more likely the audience is to form a deep understanding and evaluation of the cultural connotation carried by the works at the emotional and cognitive levels. Based on this, this

study concludes that in the context of Bashu calligraphy and painting images generated and reconstructed by AI, if the audience shows stronger concentration, emotional involvement and active meaning construction during the viewing process, their overall cultural perception of aesthetic tradition, lifestyle images and cultural persistence in Bashu will also be richer and more profound. Therefore, it is proposed that:

Hypothesis 5

(H5): Aesthetic engagement has a significant positive effect on cultural perception.

3.6 Emotional Resonance and Aesthetic Engagement

Emotional resonance is regarded as the key driving force from “seeing the image” to “entering the image”. It activates the audience’s emotional substitution and empathy for the scene, and further promotes the Aesthetic engagement process such as continuous gaze, immersion in imagination and meaning construction. The “aesthetic triad” model in neurasthenics points out that aesthetic experience is the result of the interaction of three systems: sensation-movement, emotion-evaluation and meaning-knowledge, in which emotion-evaluation plays an “amplifier” role in the transition from primary perception to deep participation, that is, strong emotional resonance is often accompanied by longer viewing, higher attention level and more complex understanding processing (Chatterjee & Vartanian, 2014). Specific to the artistic situation, this paper summarizes the role of empathy in aesthetic experience from the perspective of empathy, pointing out that when the audience experiences a higher degree of emotional alignment with the content or subject of the work, it will report a stronger sense of immersion, touch and meaning, thus showing higher Aesthetic engagement(Pizzolante et al., 2022). In the digital cultural experience driven by AI and immersive technology, this emotional input chain is also constantly verified. In the AI-empowered interactive art exhibition, through the “visually enhanced dialogue agent” experiment, it was found that when the AI system stimulates the audience’s emotional input and closeness through language and visual feedback, the audience will stay longer in front of the work, ask more questions and make more associations, and the overall participation is significantly improved (Ho et al., 2025). Together, these studies show that emotional resonance is not a subsidiary result of aesthetic experience, but a prerequisite for driving attention duration, imagination expansion, and meaning construction, whether in physical or digital/AI environments.

Based on this, combining evidence from the fields of neurasthenics, art psychology and digital cultural heritage, this study concludes that in the experience of Bashu calligraphy and painting generated and reconstructed by AI, when the audience has a stronger emotional empathy and substitution (i.e. a higher level of emotional resonance), its immersion, concentration and active interpretation behavior in the image will also be enhanced simultaneously, thus showing higher Aesthetic engagement. Therefore, the following research hypotheses are put forward:

Hypothesis 6

(H6): Emotional resonance has a significant positive effect on Aesthetic engagement.

3.7 The mediating effect of emotional resonance and Aesthetic engagement

Emotional resonance plays an emotional mediating role between visual features and higher-order evaluation. Whether it is personalized recommendations, advertising cues, or interface design features, it often does not directly change user attitudes or decisions, but enhances evaluation and behavior willingness by stimulating positive emotions such as pleasure and interest(Jeong et al., 2022). The so-called aesthetic emotions such as “aesthetic feeling”, “being impressed” and “fascinated” are complete emotional responses generated in the process of aesthetic evaluation of stimuli. They are not only closely related to subjective pleasure or displeasure, but also have significant approaching or avoidance motivation effect: positive aesthetic emotions will prompt individuals to prolong viewing time and repeatedly contact the same work (Menninghaus et al., 2019; Schindler et al., 2017). This means that when AI-generated Bashu calligraphy and painting are closer to the “Bashu picture” in the audience’s mind in terms of Texture Fidelity, Structural Clarity and color consistency, it is more likely to stimulate emotional resonance such as “kindness”, “yearning” and “being moved”, and then transform it into a more positive cultural value judgment and cultural significance understanding through approaching motivation and attention maintenance. Aesthetic engagement can be viewed as a behavioral-cognitive mediator through which visual features influence cultural perception. Research on psychological aesthetics and human-computer interaction shows that Aesthetic engagement not only includes emotional involvement, but also reflects behavioral tendencies such as continuous attention, curiosity-driven exploration and reflective processing, which is the key process from “being attracted” to “willing to take time to understand” (Fayn et al., 2015; Schindler et al., 2017). In the context of interactive games and interface design, high-quality visual design not only improves subjective aesthetic evaluation, but also significantly improves the level of user participation and game input. This improvement does not entirely depend on the improvement of usability, but more from the pleasure and interest brought by the attractiveness of the picture in composition, texture and color (Kokil, 2018).

Emotional resonance and Aesthetic engagement are not independent of each other, but form a continuous chain from emotion to behavior-cognitive processing. The aesthetic emotion model points out that on the one hand, aesthetic emotion is embodied in the subjective feeling of the work, and on the other hand, it has the function of “guiding attention and exploration”: positive and complex emotions (such as awe, fascination, and being impressed) will prompt individuals to “stay longer and think more” in the work, thus promoting deeper meaning construction and self-related processing (Menninghaus et al., 2019; Schindler et al., 2017). From the perspective of philosophy and aesthetics, emotion is not just a subsidiary phenomenon of aesthetic experience, but a cognitive mediation connecting instant experience and value interpretation: emotion will direct the individual’s attention to those “non-aesthetic features” that explain the value of a work, and prompt the individual to reflect on why the work deserves attention, thus realizing the transformation from “feeling good” to “understanding why it is valuable”

(Marín, 2020). It can be inferred that in the context of Bashu calligraphy and painting generated and reconstructed by AI, emotional resonance first “pulls the audience into the world in the painting” by activating the emotional experience related to Bashu images, and this emotional substitution further drives individuals to continue to stare, compare details, and associate regional life with historical context in the picture, thus showing a higher level of Aesthetic engagement.

To sum up, this study believes that the visual features of Bashu calligraphy and painting generated and reconstructed by AI not only have an indirect impact on cultural perception through emotional resonance or Aesthetic engagement respectively, but are more likely to play a chain mediation role through the continuous path of “emotional resonance → Aesthetic engagement”. Specifically, high-level Texture Fidelity, Structural Clarity and color consistency first enhance the aesthetic pleasure and emotional resonance of the works; Emotional resonance immediately pushes the audience to invest more attention and cognitive resources in the picture, which shows stronger Aesthetic engagement; In this process, the audience’s understanding of the natural landform, urban landscape and lifestyle images in Bashu area has been continuously deepened, and finally a higher level of cultural perception and cultural value evaluation has been formed. Based on this, this study puts forward the following hypotheses of mediation and chain mediation:

Hypothesis

a (H7a): Emotional resonance plays a mediating role between the Texture Fidelity and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

b (H7b): Emotional resonance plays a mediating role between the Structural Clarity and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

c (H7c): Emotional resonance plays a mediating role between color consistency and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

d (H7d): Aesthetic engagement plays a mediating role between the Texture Fidelity and cultural perception of Bashu calligraphy and painting reconstructed by AI.

Hypothesis

e (H7e): Aesthetic engagement plays a mediating role between the Structural Clarity and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

f (H7f): Aesthetic engagement plays a mediating role between color consistency and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

g (H7g): Emotional resonance and Aesthetic engagement play a chain mediation role between the Texture Fidelity and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

h (H7h): Emotional resonance and Aesthetic engagement play a chain mediation role between the Structural Clarity and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

Hypothesis

i (H7i): Emotional resonance and Aesthetic engagement play a chain mediation role between the color consistency and cultural perception of Bashu calligraphy and painting generated and reconstructed by AI.

3.8 Research Model

Based on the aforementioned research hypothesis, this paper studies and constructs a model based on the visual features—emotional resonance—Aesthetic engagement—cultural perception of Bashu calligraphy and painting generated and reconstructed by AI, as shown in Fig. 1. Specifically, Texture Fidelity, Structural Clarity and color consistency are regarded as exogenous visual features, which directly affects the audience's overall cultural perception of Bashu cultural value, cultural significance and cultural sustainability, and at the same time produces indirect effects through emotional resonance and Aesthetic engagement.

4. Methodology

4.1 Data Collection

This study first constructed an initial item pool through systematic literature analysis, open-ended questionnaires, and interviews with multiple respondents, forming a preliminary questionnaire draft. To test the questionnaire's comprehensibility and clarity of expression, a pre-test was conducted with 20 art practitioners possessing relevant creative or research experience. The questionnaire was revised and optimized based on the feedback. The formal survey utilized the professional online platform "QuestionStar" (wjx.cn), recruiting participants through random sampling. The target population comprised individuals in mainland China with some familiarity or exposure to Ba-Shu Calligraphy and Painting.

Data collection occurred from June to October 2025, yielding 760 completed questionnaires. Of these, 24 were deemed invalid and excluded due to: abnormal completion times, extensive omissions or duplicate responses, identical selections across all items within the same scale, logically contradictory answers, or suspected random responses. Ultimately, 736 valid questionnaires were obtained. The formal scale used in this study comprises 26 measurement items. Based on Kline's empirical sample size criterion—where the sample size should be at least 10 times the number of measurement items (Kline, 2011)——the minimum required sample size for this study was approximately 260. The actual 736 valid samples obtained significantly exceeded this minimum requirement, fully meeting the statistical demands for subsequent reliability and validity testing, as well as structural relationship analysis.

4.2 Scale Design

The six core latent variables involved in this study—Texture Fidelity, Structural Clarity, Color Consistency, Emotional Resonance, Aesthetic Engagement, and Cultural Perception—were all measured using self-report multi-item scales, as shown in Table 1. Beyond basic demographic information, all options were assessed using a 7-point Likert scale, where 1 indicates “Strongly Disagree” and 7 indicates “Strongly Agree.” Higher scores represent greater perceived or experienced levels of the dimension. To ensure respondents' responses were grounded in a unified visual stimulus, the questionnaire first presented an AI-generated Ba-Shu Calligraphy and Painting artwork before formal scale items. Participants thoroughly viewed this image before completing related items, measuring their immediate reactions and subjective evaluations of this specific visual context.

Table 1
Questionnaire Items and Sources

Variables	Number	Items	Sources
Texture Fidelity	TF1	The brushwork texture of this piece feels remarkably close to authentic hand-painted calligraphy and painting.	(Chen et al., 2025; Im et al., 2025)
	TF2	I find the texture of the paper or canvas in this piece rendered very naturally.	
	TF3	I find the ink's tonal variations (darkness/lightness, dryness/wetness) to be authentically rendered in this piece.	
	TF4	I find the lines and brushstrokes in this piece to have a distinct "handmade calligraphy and painting" charm.	
Structural Clarity	SC1	I find the subject and background of this work clearly distinguished.	(Pietroni & Ferdani, 2021)
	SC2	I find the spatial layers of elements such as landscapes, architecture, and figures in this work easy to discern.	
	SC3	The overall composition of this piece is clear and well-organized, avoiding any sense of clutter.	
	SC4	I can quickly grasp the scene or mood conveyed in this work.	
Color Consistency	CC1	The overall color scheme of this work gives me a sense of harmony and unity.	(Berns, 2019; Molada-Tebar et al., 2019)
	CC2	I find the color transitions between different areas of this work to be natural and seamless.	
	CC3	The use of color in this piece aligns with my impression of traditional Ba-Shu Calligraphy and Painting.	
	CC4	This piece contains no colors that strike me as unnatural or overly "machine-like."	
Emotional Resonance	ER1	This piece resonates with me emotionally.	(Lai et al., 2025)
	ER2	I can feel the emotions expressed in the work and resonate with them.	
	ER3	This piece reminds me of certain experiences or memories of my own.	
	ER4	When appreciating this work, I feel a sense of 'being understood' or 'Emotional Resonance'.	

Variables	Number	Items	Sources
Aesthetic Engagement	AE1	When appreciating this work, I am willing to spend more time lingering.	(Niu et al., 2025)
	AE2	When viewing this piece, my attention is highly focused on the image.	
	AE3	While appreciating this piece, I experience an immersive sensation of being fully present within it.	
	AE4	This piece sparked my interest in continuing to observe the details of the image.	
	AE5	After viewing this piece, I still find myself mentally revisiting or pondering its imagery and meaning.	
Cultural Perception	CP1	This piece allows me to sense the unique cultural atmosphere of the Ba-Shu region.	(Hao et al., 2025)
	CP2	This piece deepens my understanding of the natural landscapes and cultural characteristics of the Ba-Shu region.	
	CP3	This piece has made me develop a fondness for Bashu culture.	
	CP4	This piece has sparked my interest in learning more about or experiencing Bashu culture.	
	CP5	This piece has, to some extent, strengthened my sense of belonging to Ba-Shu culture.	

4.3 Data Analysis

This study employed SPSS 26 and SmartPLS 4 for statistical analysis and structural equation modeling. SmartPLS 4 was selected primarily due to its strong capability in handling complex structural equation models (SEM), facilitating systematic testing of path relationships and effect sizes.

Descriptive statistics were conducted using SPSS 26 to analyze the demographic characteristics of the sample, including basic information such as gender, age, and education level. Background variables were further examined, including respondents' understanding of calligraphy and painting art, frequency of appreciating artworks, and exposure to AIGC, to comprehensively grasp the sample structure and distribution of cultural/technological experiences. SmartPLS 4 was then employed to evaluate the measurement model. Key metrics examined included outer loadings, Cronbach's α coefficients, Composite Reliability (CR), and Average Variance Extracted (AVE) for each observed variable. This assessed whether the scales met conventional criteria for internal consistency reliability, convergent validity, and discriminant validity, thereby ensuring a reliable measurement foundation for subsequent structural model testing.

In the structural model evaluation and hypothesis testing phase, SmartPLS 4's Bootstrap resampling method was employed to estimate path coefficients and test their significance. Key metrics including the coefficient of determination R^2 and predictive correlation Q^2 were reported to comprehensively assess the model's explanatory power and predictive efficacy for endogenous variables such as Emotional Resonance, Aesthetic Engagement, and Cultural Perception. Through this analytical process, the path relationships among visual features, emotional resonance, Aesthetic Engagement, and Cultural Perception, along with the theoretical hypotheses proposed in this study, were systematically examined.

5. Results

5.1. Respondent Demographic Characteristics

This study collected 736 valid questionnaires. Gender distribution was relatively balanced, with females accounting for 50.14%, males for 47.83%, and 2.04% selecting "other or prefer not to disclose." Among respondents, the 19–25 age group constituted the largest proportion (42.53%),followed by those aged 26–35 (30.30%) and 18 and under (10.33%). The 36–45 age group and those aged 46 and above accounted for 11.96% and 4.89%, respectively. The sample predominantly comprised young adults, aligning with the youthful audience characteristic of Bashu cultural dissemination.

Geographically, 55.03% of respondents had lived or studied long-term in the Bashu region, while 44.97% came from other areas, ensuring coverage of both local and non-local groups to facilitate comparisons of cultural exposure differences. Regarding frequency of Bashu cultural exposure, 34.78% reported "moderate exposure," 24.05% "occasional exposure," 11.41% "rare exposure," 19.57% "frequent exposure," and 10.19% "very frequent exposure." This continuous distribution facilitates analysis of how familiarity influences perception.(Table 2.)

Regarding art appreciation habits, 34.65% of respondents view fine art 1–2 times annually, 29.48% quarterly, 25.54% monthly, and 10.33% at least weekly, indicating a generally consistent frequency of artistic engagement among the sample. Regarding exposure to AI-generated or restored art images, 39.00% of respondents "occasionally see them," 33.02% "often see them," 18.48% "have personally used related tools," and 9.51% indicate they "have not noticed or are unsure." This result suggests that most respondents possess some awareness of AI visual generation technology, providing a foundation for studying its impact on Cultural Perception.

Table 2
Demographic Characteristics of Respondents (Sample Size n = 736)

Name	Option	Frequency	Percentage (%)
Gender	Other/Prefer not to disclose	15	2.038
	Female	369	50.136
	Male	352	47.826
Age	18 years old and under	76	10.326
	19–25 years old	313	42.527
	26–35 years old	223	30.299
	36–45 years old	88	11.957
	46 years and older	36	4.891
Long-term residence in Bashu region	No	331	44.973
	Yes	405	55.027
Frequency of exposure to Bashu culture	Moderate	256	34.783
	Occasionally	177	24.049
	Rarely	84	11.413
	Frequently	144	19.565
	Very frequently	75	10.190
Frequency of Appreciating Artworks	Once a week or more	76	10.326
	About once per quarter	217	29.484
	1–2 times per year	255	34.647
	Approximately once per month	188	25.543
Have you seen AI-generated art images?	Occasionally	287	38.995
	Not noticed/unsure	70	9.511
	Frequently seen	243	33.016
	Have personally used related tools	136	18.478
Total		736	100.0

5.2. Reliability and Validity Analysis

In this study, the reliability and validity analysis of the scales (Table 3) indicates that the scales used demonstrate good reliability and construct validity. Specifically, the standardized factor loadings for each item ranged from 0.743 to 0.801, significantly exceeding the conventional standard (0.5) and the ideal threshold of 0.7 (W et al., 2024). This indicates that each item effectively explains its corresponding latent variable, fully supporting the scale's construct validity. The factor loadings for each item demonstrate that every scale item effectively reflects its underlying construct, thereby validating the scale's effectiveness. Furthermore, Cronbach's α coefficients ranged from 0.836 to 0.879, all exceeding the conventional reliability standard of 0.7 (Nunnally & Bernstein), indicating high internal consistency. This result further confirms the scale's stability and reliability under consistent conditions. Moreover, composite reliability (CR) ranged from 0.837 to 0.880, exceeding the reference value of 0.6 (Bagozzi & Yi, 1988), indicating strong internal consistency across the construct. The AVE (Average Variance Extracted) values ranged from 0.561 to 0.633, all exceeding the reference value of 0.5 (Hair et al., 2011). This indicates that the scale possesses high explanatory power and good convergent validity across its latent variables. Overall, the scales used in this survey demonstrated good reliability and validity, laying a solid foundation for subsequent analyses.

Table 3
Reliability and Validity Analysis

Construct	Item	Factor Loadings	Cronbach's Alpha	CR	AVE
Texture Fidelity	TF1	0.767	0.836	0.837	0.561
	TF2	0.758			
	TF3	0.780			
	TF4	0.752			
Structural Clarity	SC1	0.756	0.839	0.840	0.567
	SC2	0.750			
	SC3	0.759			
	SC4	0.783			
Color Consistency	CC1	0.801	0.873	0.874	0.633
	CC2	0.797			
	CC3	0.801			
	CC4	0.781			
Emotional Resonance	ER1	0.773	0.851	0.851	0.588
	ER2	0.780			
	ER3	0.772			
	ER4	0.766			
Aesthetic Engagement	AE1	0.754	0.877	0.879	0.591
	AE2	0.777			
	AE3	0.780			
	AE4	0.752			
	AE5	0.743			
Cultural Perception	CP1	0.777	0.879	0.880	0.593
	CP2	0.770			
	CP3	0.789			
	CP4	0.751			
	CP5	0.788			

5.3. Discrimination Validity Analysis

This study employed two methods to validate the discriminant validity of the model. The first method is the Fornell–Larcker criterion, which requires that the correlation coefficients between latent variables be lower than the square root of their respective AVE values. The second method is the Heterogeneity-Trait-Monotonicity (HTMT) ratio, which stipulates that the HTMT value should be less than 0.85. Through these two methods, the discriminant validity of the model was effectively validated. Specific results are presented in Tables 4 and 5.

Table 4
Fornell-Larcker

Variable	1	2	3	4	5	6
Aesthetic Engagement	0.768					
Color Consistency	0.460	0.796				
Cultural Perception	0.461	0.420	0.770			
Emotional Resonance	0.495	0.481	0.433	0.767		
Structural Clarity	0.522	0.487	0.442	0.473	0.753	
Texture Fidelity	0.482	0.447	0.472	0.478	0.449	0.749

Table 5
HTMT

Variable	1	2	3	4	5	6
Aesthetic Engagement						
Color Consistency	0.457					
Cultural Perception	0.466	0.416				
Emotional Resonance	0.493	0.479	0.428			
Structural Clarity	0.522	0.485	0.441	0.472		
Texture Fidelity	0.480	0.445	0.469	0.476	0.449	

5.4. Multicollinearity Analysis

To ensure the stability of subsequent regression analysis or structural equation modeling estimates, this study conducted multicollinearity tests on all observed variables. The results of the variance inflation factor (VIF) analysis (Table 6) indicate that the VIF values for all items were below 10, well below the commonly used warning threshold of 5(Hair et al., 2011) and not approaching the stricter threshold of 3. These findings suggest that no severe multicollinearity issues exist among the variables, allowing each variable to contribute its explanatory power independently within the model.

Table 6
Collinearity Diagnostics

Item	VIF Value	Tolerance
TF	1.431	0.699
SC	1.469	0.681
CC	1.432	0.698
ER	1.457	0.686
AE	1.528	0.654
CP	1.398	0.715

5.5. Path Analysis

Path coefficients of the structural model were assessed using SmartPLS4. When the t-value of a path coefficient exceeded 1.96(Bagozzi & Yi, 1988), it indicated that the coefficient passed the significance test at the 5% level ( ) and was statistically significant. The analysis results are presented in Table 7 and Fig. 2. Specifically:

TF (β = 0.216, T = 4.438, p = 0.000),SC (β = 0.142, T = 3.110, p = 0.002), and CC (β = 0.117, T = 2.535, p = 0.000) exerted significant positive effects on CP, thus supporting hypotheses H1a, H1b, and H1c.

TF (β = 0.261, T = 5.718, p = 0.000),SC (β = 0.234, T = 4.717, p = 0.000), and CC (β = 0.250, T = 5.885, p = 0.000) exerted significant positive effects on ER, thus supporting hypotheses H2a, H2b, and H2c.

TF (β = 0.201, T = 4.049, p = 0.000),SC (β = 0.265, T = 6.046, p = 0.000), and CC (β = 0.141, T = 2.898, p = 0.005) exerted significant positive effects on AE, thus supporting hypotheses H3a, H3b, and H3c.

ER (β = 0.206, T = 4.153, p = 0.000) had a significant positive effect on CP, thus supporting H4.

AE (β = 0.168, T = 3.141, p = 0.000) had a significant positive effect on CP, thus supporting H5.

ER (β = 0.206, T = 4.153, p = 0.000) had a significant positive effect on AE, thus supporting H6.

Additionally, ER mediated the relationships between TF and CP (β = 0.032, T = 2.276, p = 0.023), SC and CP (β = 0.029, T = 2.410, p = 0.016),, and CC and CP (β = 0.031, T = 2.276, p = 0.021), supporting hypotheses H7a, H7b, and H7c.

AE mediated the relationships between TE and CP (β = 0.034, T = 2.563, p = 0.011), SC and CP (β = 0.044, T = 2.597, p = 0.010),, and CC and CP (β = 0.024, T = 2.051, p = 0.041), assuming H7d, H7e, and H7f hold.

ER and AE mediated the relationships between TF and CP (β = 0.009, T = 2.203, p = 0.003), SC and CP (β = 0.008, T = 2.197, p = 0.002),and CC with CP (β = 0.009, T = 2.390, p = 0.003), assuming H7g, H7h, and H7i hold.

Table 7
Path Analysis

Path	β	STDEV	T	P	Decision		
					2.5%	97.5%	Decision
H1a: Texture Fidelity -> Cultural Perception TF->CP	0.216	0.049	4.438	0.000	0.128	0.315	Supported
H1b: Structural Clarity -> Cultural Perception SC->CP	0.142	0.046	3.110	0.002	0.054	0.226	Supported
H1c: Color Consistency -> Cultural Perception CC->CP	0.117	0.046	2.535	0.000	0.024	0.192	Supported
H2a: Texture Fidelity → Emotional Resonance TF→ER	0.261	0.046	5.718	0.000	0.169	0.346	Supported
H2b: Structural Clarity -> Emotional Resonance SC->ER	0.234	0.050	4.717	0.000	0.137	0.331	Supported
H2c: Color Consistency -> Emotional Resonance CC->ER	0.250	0.042	5.885	0.000	0.170	0.333	Supported
H3a: Texture Fidelity -> Aesthetic Engagement TF->AE	0.201	0.050	4.049	0.000	0.098	0.290	Supported
H3b: Structural Clarity -> Aesthetic Engagement SC->AE	0.265	0.044	6.046	0.000	0.183	0.357	Supported
H3c: Color Consistency -> Aesthetic Engagement CC->AE	0.141	0.049	2.898	0.005	0.043	0.236	Supported
H4: Emotional Resonance → Aesthetic Engagement ER→CP	0.206	0.050	4.153	0.000	0.114	0.311	Supported
H5: Aesthetic Engagement -> Cultural Perception AE->CP	0.168	0.053	3.141	0.000	0.064	0.267	Supported
H6: Emotional Resonance → Aesthetic Engagement ER→AE	0.206	0.050	4.153	0.000	0.114	0.311	Supported
H7a: Texture Fidelity -> Emotional Resonance -> Cultural Perception TF->ER->CP	0.032	0.014	2.276	0.023	0.028	0.098	Supported
H7b: Structural Clarity -> Emotional Resonance -> Cultural Perception SC->ER->CP	0.029	0.012	2.410	0.016	0.006	0.055	0.029

Path	β	STDEV	T	P	Decision		
					2.5%	97.5%	Decision
H7c: Color Consistency -> Emotional Resonance -> Cultural Perception CC->ER->CP	0.031	0.013	2.322	0.021	0.006	0.056	Supported
H7d: Texture Fidelity -> Aesthetic Engagement -> Cultural Perception TF->AE->CP	0.034	0.013	2.563	0.011	0.011	0.062	Supported
H7e: Structural Clarity -> Aesthetic Engagement -> Cultural Perception SC->AE->CP	0.044	0.017	2.597	0.010	0.016	0.083	Supported
H7f: Color Consistency -> Aesthetic Engagement -> Cultural Perception CC->AE->CP	0.024	0.012	2.051	0.041	0.005	0.049	Supported
H7g: Texture Fidelity -> Emotional Resonance -> Aesthetic Engagement -> Cultural Perception TF->ER->AE->CP	0.009	0.004	2.203	0.028	0.003	0.018	0.009
H7h: Structural Clarity -> Emotional Resonance -> Aesthetic Engagement -> Cultural Perception SC->ER->AE->CP	0.008	0.004	2.197	0.028	0.002	0.016	Supported
H7i: Color Consistency -> Emotional Resonance -> Aesthetic Engagement -> Cultural Perception CC->ER->AE->CP	0.009	0.004	2.390	0.017	0.003	0.017	Supported

5.6. Explanatory Power and Predictive Capability of the Model

The explanatory power and predictive capability of the model were evaluated using the R^2 and Q^2 metrics. Results indicate that the structural model constructed in this study exhibits good explanatory power and robust predictive performance across all three key latent variables. ((Table 8))An R^2 value exceeding 0.25 signifies strong explanatory power for endogenous variables. Regarding predictive capability, Q^2 values were significantly greater than 0 (ranging from 0.243 to 0.293), indicating the model possesses strong out-of-sample predictive power. Furthermore, the RMSE and MAE for all three latent variables remained at low levels, further confirming the model's minimal prediction errors and stable fitting performance. Overall, these results demonstrate that the proposed model not only possesses

strong explanatory power in its theoretical structure but also exhibits reliable predictive accuracy. It serves as an effective analytical framework for exploring how AI-reconstructed Visual Features of paintings and calligraphy influence Cultural Perception.

Table 8
Model Explanatory Power and Predictive Capability

Aesthetic Engagement	Q^2predict	RMSE	MAE	R^2 Variance
	0.293	**0.844**	**0.663**	**0.403**
Cultural Perception	0.243	0.872	0.711	0.345
Emotional Resonance	0.27	0.857	0.684	0.355

6. Discussion and enlightenment

6.1 Discussion

This study aims to explore how the visual features of Bashu calligraphy and painting generated and reconstructed by AI affect the audience's cultural perception, and conduct chain mediation analysis through emotional resonance and Aesthetic engagement mechanisms. Through data analysis, the important role of visual features (Texture Fidelity, Structural Clarity, color consistency) among emotional resonance, Aesthetic engagement and cultural perception is verified.

First, the results show that the visual features of AI-generated Bashu calligraphy and painting images significantly affect the audience's cultural perception. Specifically, Texture Fidelity, Structural Clarity and color consistency all have a significant positive impact on cultural perception. This shows that the high degree of image restoration in detail reproduction, spatial structure and color presentation can effectively enhance the audience's cognition and understanding of Bashu culture. In particular, the visual fidelity of images, such as brushstroke texture and ink color level, can stimulate the audience's emotional resonance, further promote Aesthetic engagement, and ultimately enhance cultural perception. This finding echoes existing studies that show that high-fidelity images can enhance the audience's immersion and authenticity judgment, thus deepening the understanding of cultural identity and historical contexts.

Secondly, emotional resonance plays a mediating role between visual features and cultural perception. AI-generated images enhance Aesthetic engagement and deep understanding of culture by triggering the audience's emotional substitution of Bashu's natural landscape and cultural memory. This process shows that emotional resonance is not a simple emotional response, but it plays a bridge role in the construction of cultural meaning and promotes the audience's transformation from emotional experience to cultural identity. Therefore, enhancing the emotional connection of images can not only enhance their aesthetic value, but also strengthen the effect of cultural communication and heritage protection.

In addition, Aesthetic engagement also plays an important role between visual features and cultural perception. The audience's Aesthetic engagement is the key to perceiving cultural depth. It promotes the interpretation of cultural symbols behind images through continuous attention and deep meaning construction. This mechanism is particularly important in the interactive experience of AI-generated art, indicating that participants tend to have richer cultural thinking and self-reflection when faced with high-quality visual content.

6.2 Enlightenment

At the theoretical level, visual features (such as Texture Fidelity, Structural Clarity and color consistency) have a significant impact on the audience's cultural perception, which provides a new theoretical perspective for the field of digital art and cultural heritage. Research shows that AI-generated art is not only a display of technical means, but also an effective carrier of cultural communication and art appreciation. As an mediating mechanism connecting visual features and cultural perception, emotional resonance and Aesthetic engagement provide a new path for future academic research, especially in exploring the psychological mechanism of cultural inheritance and artistic acceptance. Secondly, the dual roles played by emotional resonance and Aesthetic engagement in this process show that the emotional design of cultural heritage plays a key role in enhancing the audience's cultural perception. Theoretically, this finding supports the core position of emotional resonance and aesthetic participation in cultural experience, and provides a new theoretical framework for future cultural heritage research, especially at the mechanism level of the interaction between emotion and cognitive processing.

At the practical level, this study provides practical guiding significance for the display of digital cultural heritage and the interactive design of AI art. First of all, the visual presentation of digital cultural content should pay attention to the authenticity of details and the consistency of cultural context, especially in the reproduction of texture, structure and color. By improving the visual fidelity and cultural adaptability of images, it can more effectively attract the audience's attention, stimulate emotional resonance, and then promote deeper Aesthetic engagement and cultural understanding. This means that cultural institutions and museums should pay attention to the accurate reproduction and emotional design of their cultural backgrounds when designing AI-generated cultural content to enhance the audience's sense of participation and experience quality. Secondly, the dual mechanism of emotional resonance and Aesthetic engagement provides a practical basis for the emotional display of cultural heritage. Cultural institutions and museums can enhance the emotional connection of the audience through AI technology, so that the audience can not only visually feel the aesthetic charm of the works, but also emotionally resonate with the cultural heritage, thus enhancing the educational significance of the cultural experience. By designing emotional interactive content, cultural institutions can enhance audience participation, strengthen their recognition and understanding of cultural heritage, and promote the goals of cultural education and heritage protection.

7. Conclusions, Limitations, and Future Research

7.1 Conclusion

This study explores how the visual features (Texture Fidelity, Structural Clarity and color consistency) of Bashu calligraphy and painting generated and reconstructed by AI affect the audience's cultural perception through the dual mechanisms of emotional resonance and Aesthetic engagement. Through empirical analysis, the study found that the visual features of AI-generated images have a significant impact on cultural perception, especially under the mediation of emotional resonance and Aesthetic engagement, the audience's overall perception of Bashu culture has been effectively improved. Specifically, high-quality visual features are able to stimulate emotional resonance and further promote Aesthetic engagement, ultimately enhancing understanding of cultural values, historical contexts, and cultural sustainability. The research results provide theoretical support for the interactive design of digital cultural heritage and AI art, and provide new ideas and methods for the dissemination and protection of cultural heritage.

7.2 Limitations

Although this study provides strong empirical support for the application of AI in the field of cultural heritage, there are still some limitations. First of all, the research samples mainly come from mainland China and are concentrated in the cultural background of Bashu area. Therefore, the external validity of the research results may be limited by geography and cannot fully represent the audience perception of other regions or cultures. Secondly, this study adopted the self-reporting questionnaire survey method, which may be influenced by the subjective bias of the respondents, and failed to completely eliminate the social expectation bias or other cognitive biases. Furthermore, although the research explores the role of emotional resonance and Aesthetic engagement, the specific influence paths of these psychological mechanisms and their relationships still need more in-depth research and verification. In addition, the technology of AI-generated images continues to develop. The image generation technology used in this study may not represent the latest AI progress and can be tested in combination with more advanced generation models in the future.

7.3 Future Research

Future research can further explore the impact of AI-generated images on cultural perception from multiple perspectives. First, cross-cultural comparative research can be extended to audiences with different regions and cultural backgrounds to compare how cultural differences affect the perceptual effect of AI-generated images. Secondly, future research should deeply explore the psychological mechanisms of emotional resonance and Aesthetic engagement, and further verify the role of these mechanisms in audience perception by combining physiological and behavioral measurements, such as eye tracking and physiological feedback. At the same time, with the continuous advancement of AI technology, in the future, it can be combined with more advanced generative models (such as GANs, Transformer in deep learning, etc.) to explore its application in the digitalization and re-creation of cultural heritage, and evaluate its impact on cultural identity and education. In addition, the evaluation of long-term effects is also an important direction for future research. By tracking the audience's cultural

identity and behavioral changes after long-term exposure to AI-generated works of art, it can provide more empirical data and theoretical basis for the continuous impact of AI in the dissemination of cultural heritage.

Declarations

Consent to Participate Declaration

Informed consent was obtained from all individual participants included in the study. Participants were fully informed about the study's purpose, procedures, and the voluntary nature of their participation.

Ethical approval statement

All procedures conducted in research involving human participants have followed the ethical standards of institutions and/or national research committees, as well as the 1964 Helsinki Declaration and its subsequent amendments or similar ethical standards. This study has been approved by the ethics committee of the author's institution (Neijiang Normal University).

Human Ethics and Consent to Participate Declarations

The research protocol was reviewed and approved by the Neijiang Normal University Institutional Review Board (IRB), and informed consent was obtained from all participants.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

W.L. and SJ.C. wrote the main manuscript text and XB.M. prepared figures 1-2. All authors reviewed the manuscript.

Funding

This research received no external funding.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. To protect participant privacy and comply with ethical requirements, only fully

anonymized data and related study materials will be shared. The questionnaire, measurement items, and supporting documentation can also be made available to editors and reviewers for the purpose of manuscript evaluation.

References

1. Amelio A, Zarri GP (2024) Cultural heritage digital twin: Modeling and representing the visual narrative in Leonardo da Vinci's Mona Lisa. Neural Comput Appl 36. https://doi.org/10.1007/s00521-024-10010-x
2. Ariya P, Khanchai S, Intawong K, Puritat K (2025) Enhancing textile heritage engagement through generative AI-based virtual assistants in virtual reality museums. *Computers & Education: X Reality*, *7*. https://doi.org/10.1016/j.cexr.2025.100112
3. Bagozzi RP, Yi Y (1988) On the evaluation of structural equation models. J Acad Mark Sci 16(1):74–94. https://doi.org/10.1007/BF02723327
4. Bekele MK, Pierdicca R, Frontoni E, Malinverni ES, Gain J (2018) A survey of augmented, virtual, and mixed reality for cultural heritage. J Comput Cult Herit (JOCCH 11(2):1–36
5. Bell DR (2017) Aesthetic encounters and learning in the museum. Educational Philos Theory 49(8):776–787. https://doi.org/10.1080/00131857.2016.1214899
6. Berns RS (2019) Digital color reconstructions of cultural heritage using color-managed imaging and small-aperture spectrophotometry. Color Res Appl 44(4):531–546. https://doi.org/10.1002/col.22371
7. Bian C, Wang X, Huang Y, Zhou S, Lu W (2025) Effects of AI-generated images in visual art education on students' classroom engagement, self-efficacy and cognitive load. *Humanities and Social Sciences Communications*, *12*, 1548. https://www.nature.com/articles/s41599-025-05860-2
8. Bianchi I, Branchini E, Uricchio T, Bongelli R (2025) Creativity and aesthetic evaluation of AI-generated artworks: Bridging problems and methods from psychology to AI. Front Psychol 16:1648480. https://doi.org/10.3389/fpsyg.2025.1648480
9. Bui HT, Filimonau V, Sezerel H (2024) AI-thenticity: Exploring the effect of perceived authenticity of AI-generated visual content on tourist patronage intentions. J Destination Mark Manage 34:100956
10. Chatterjee A, Vartanian O (2014) Neuroaesthetics. Trends Cogn Sci 18(7):370–375. https://doi.org/10.1016/j.tics.2014.03.003
11. Chen Y, Peng Y, Tan Y, Luo G, Wang M (2025) Achieving cultural heritage sustainability through digital technology: Public aesthetic perception of digital Dunhuang murals. Sustainability 17(17):7887. https://doi.org/10.3390/su17177887
12. Christensen AP, Cardillo ER, Chatterjee A (2023) Can art promote understanding? A review of the psychology and neuroscience of aesthetic cognitivism. Psychol Aesthet Creativity Arts 19(1):1–13. https://doi.org/10.1037/aca0000541
13. culture B S. Wikipedia. In

14. Darda KM, Estrada Gonzalez V, Christensen AP, Bobrow I, Krimm A, Nasim Z, Cardillo ER, Perthes W, Chatterjee A (2025) A comparison of art engagement in museums and through digital media. Sci Rep, *15*, 8972-41598-41025–93630–41590.
15. Economou M, Young H, Sosnowska E (2019) Evaluating emotional engagement in digital stories for interpreting the past: The case of the Hunterian Museum's Antonine Wall EMOTIVE experiences. In *2018 3rd Digital Heritage International Congress (DigitalHERITAGE* (pp. 1–8). IEEE. https://doi.org/10.1109/DigitalHeritage.2018.8810043
16. Fayn K, Silvia PJ, Dejonckheere E, Kuppens P (2015) Aesthetic emotions and aesthetic people: Openness predicts sensitivity to novelty in the experiences of interest and pleasure. Front Psychol 6:1877. https://doi.org/10.3389/fpsyg.2015.01877
17. Grassini S (2024) Computational power and subjective quality of AI-generated outputs: The case of aesthetic judgement and positive emotions in AI-generated art. Int J Human–Computer Interact 40(14):9056–9065. https://doi.org/10.1080/10447318.2024.2422755
18. Guo Q, Meng Q, Li H, Li R, Zhang P, Shi M, Lee K (2025) Exploring user reactions to AI-curated exhibits: Emotional engagement and social interaction in digital cultural spaces. In A. Coman & S. Vasilache (Eds.), *Social Computing and Social Media. HCII 2025 (Lecture Notes in Computer Science* (Vol. 15787, pp. 48–61). Springer. https://doi.org/10.1007/978-3-031-93536-7_4
19. Gurel E (2025) AI-driven experiences in cultural and creative industries: A review of literature and development of a multifaceted framework. *The Service Industries Journal. Advance online publication*
20. Hair JF, Ringle CM, Sarstedt M (2011) PLS-SEM: Indeed a Silver Bullet. J Mark Theory Pract 19(2):139–152. https://doi.org/10.2753/MTP1069-6679190202
21. Hameed A, Perkis A (2024) Authenticity and presence: Defining perceived quality in VR experiences. Front Psychol 15:1291650. https://doi.org/10.3389/fpsyg.2024.1291650
22. Han Bo LJ (2025) Youth's Identification with Traditional Culture Based on Digital Museum Engagement. J Journalism Communication Stud 78:46–65
23. Hao X, Xu J, Wang Y (2025) How generative AI shapes user perceived value and adoption intention in digital museum experiences. npj Herit Sci 13(1):608
24. Ho HP, Ramesh V, Žaloudek I, Rikhtehgar J, D., Wang S (2025) 2025). Enhancing visitor engagement in interactive art exhibitions with visual-enhanced conversational agents
25. Hou W, Huang R (2025) 2025). Exploring the aesthetic judgments of AI-generated digital abstract arts
26. Im JB, Hong RL, Joo M, Zhang E, Kim JH (2025) Visual fidelity effects on occupants' performance, mental states, and emotions in mixed reality environments. Architectural Sci Rev, 1–21
27. Jeong J, Kim D, Li X, Li Q, Choi I, Kim J (2022) An Empirical Investigation of Personalized Recommendation and Reward Effect on Customer Behavior: A Stimulus–Organism–Response (SOR) Model Perspective. Sustainability 14(22):15369. https://doi.org/10.3390/su142215369
28. Kline RB (2011) *Principles and Practice of Structural Equation Modeling* (3rd ed., Vol. 14,pp). New York, NY, USA

29. Kokil U (2018) 2018). The Impact of Visual Aesthetic Quality on User Engagement during Gameplay
30. Lai S, Tian Y, Zhang Q (2025) The impact of AI-generated technologies-driven digital cultural heritage platforms on users' offline cultural participation intentions. npj Herit Sci 13(1):574
31. Leder H, Belke B, Oeberst A, Augustin D (2004) A model of aesthetic appreciation and aesthetic judgments. Br J Psychol 95(4). https://doi.org/10.1348/0007126042369811
32. Lei L (2025) The artificial intelligence technology for immersion experience and space design in museum exhibition Scientific Reports. In
33. Leong WY (2025) AI-generated artwork as a modern interpretation of historical paintings. Int J Social Sci Artistic Innovations, *5*(1)
34. Li Y, Qiu R, He Z, Wu X, Han T, Tong X, Zhao Y, Li M (2025) Enhancing young generation's heritage identity through emotional responses to virtual cultural heritage experience. Int J Human–Computer Interact Adv online. https://doi.org/10.1080/10447318.2025.2505159
35. Lian Y (2024) The evolution of digital cultural heritage research. Sustainability, *16*(16). https://doi.org/7125.https://www.mdpi.com/2071-1050/16/16/7125
36. Lin C (2025) A review of emotional design in extended reality for the conservation and exhibition of cultural heritage. Herit Sci. https://doi.org/10.1038/s40494-025-01625-x
37. Liu Z, Liu S, Fan S (2025) Research on the virtual restoration of faded Dunhuang murals with a global attention mechanism. npj Herit Sci 13(1):35
38. Malik US, Tissen L, Vermeeren APOS (2021) 3D reproductions of cultural heritage artifacts: Evaluation of significance and experience. Stud Digit Herit 5(1):1–29. https://doi.org/10.14434/sdh.v5i1.32323
39. Marín IM (2020) Non-standard emotions and aesthetic understanding. Estetika: Eur J Aesthet 57(2):135–149. https://doi.org/10.33134/eeja.211
40. Mazzanti P, Ferracani A, Bertini M, Principi F (2025) Reshaping museum experiences with AI: The ReInHerit Toolkit. Heritage 8(7):277. https://doi.org/https://doi.org/10.3390/heritage8070277
41. Meehan N (2022) Digital museum objects and memory: Postdigital materiality, aura and value. Curator: Museum J 65(2):417–434. https://doi.org/10.1111/cura.12361
42. Meng W, Dolah J (2025) From virtual museum experience quality to offline visit intention: A cultural identity mediation model. Sustainability 17(23):10664. https://doi.org/10.3390/su172310664
43. Menninghaus W, Wagner V, Wassiliwizky E, Jacobsen T, Koelsch S (2019) What are aesthetic emotions? Psychol Rev 126(2):171–195. https://doi.org/10.1037/rev0000135
44. Molada-Tebar A, Marqués-Mateu Á, Lerma JL (2019) Correct use of color for cultural heritage documentation. ISPRS Annals Photogrammetry Remote Sens Spat Inform Sci 2(W6):107–113. https://doi.org/10.5194/isprs-annals-IV-2-W6-107-2019
45. Niu X, Ye J, Yu S, Chen L (2025) Thing–Human–Emotion–Beauty model for multi-dimensional perception of cultural relics' values from the design perspective. Sci Rep 15:41910. https://doi.org/10.1038/s41598-025-25843-2

46. Nunnally JC, Bernstein IH (1994) Elements of Statistical Description and Estimation. Psychometric Theory, 3rd edn. McGraw Hill
47. Pan S, She J (2024) 2024). Tanka heritage revived: AI-generated artworks in three Chinese art styles
48. Pelowski M, Markey PS, Lauring JO, Leder H (2016) Visualizing the impact of art: An update and comparison of current psychological models of art experience. Front Hum Neurosci 10:160
49. Pietroni E, Ferdani D (2021) Virtual restoration and virtual reconstruction in cultural heritage: Terminology, methodologies, visual representation techniques and cognitive models. *Information*, *12*(4). https://doi.org/167.https://www.mdpi.com/2078-2489/12/4/167
50. Pizzolante M, Chirico A, Gaggioli A, Riva G (2022) Why and How Empathy Matters in Aesthetic Experiences. Cyberpsychology Behav Social Netw 25(11):762–764. https://doi.org/10.1089/cyber.2022.29260.ceu
51. Ruiz RM, Torres MTM, Allegue PS (2021) Comparative analysis between the main 3d scanning techniques: Photogrammetry, terrestrial laser scanner, and structured light scanner in religious imagery: The case of the holy christ of the blood. ACM J Comput Cult Herit (JOCCH 15(1):1–23
52. Schindler I, Hosoya G, Menninghaus W, Beermann U, Wagner V, Eid M, Scherer KR (2017) Measuring aesthetic emotions: A review of the literature and a new assessment tool. PLoS ONE 12(6):0178899
53. Serain C (2018) The sensitive perception of cultural heritage's materiality through digital technologies. Stud Digit Herit 2(1):95–105. https://doi.org/10.14434/sdh.v2i1.24606
54. Silvia PJ (2005) Emotional responses to art: From collation and arousal to cognition and emotion. Rev Gen Psychol 9(4):342–357
55. Silvia PJ (2008) Interest—The curious emotion. Curr Dir Psychol Sci 17(1):57–60
56. Sun Lanxin WQ (2024) Factors and Influence Pathways Affecting Consumer Decisions on Intangible Cultural Heritage-Inspired Cultural and Creative Products: An FSQCA-Based Study. Oper Res Fuzzy Sci 14:157–169
57. Thecover.cn (2022) *A scholarly monograph The History and Theory of the Bashu Painting School is published.*. The Cover. https://m.thecover.cn/news_details.html?id=9996151
58. Trupp MD, Howlin C, Fekete A, Kutsche J, Fingerhut J, Pelowski M (2025) The impact of viewing art on well-being—a systematic review of the evidence base and suggested mechanisms. J Posit Psychol Adv online publication. https://doi.org/10.1080/17439760.2025.2481041
59. Tsita C, Satratzemi M, Pedefoudas A, Georgiadis C (2023) A virtual reality museum to reinforce the interpretation of contemporary art and increase the educational value of user experience. Heritage 6(5):4134–4172. https://doi.org/10.3390/heritage6050218
60. van Hees J, Grootswagers T, Quek GL, Varlet M (2025) Human perception of art in the age of artificial intelligence. Front Psychol 15. https://doi.org/https://doi.org/10.3389/fpsyg.2024.1497469
61. W G, Cooper-Thomas HD, Lau RS, Wang LC (2024) Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. Asia Pac J Manage 41(2):745–783. https://doi.org/10.1007/s10490-023-09871-y

62. Wang S, Peng KL, Huang Z, Ma L (2025) AI-Generated Videos: Influencing Trustworthiness, Awe, and Behavioral Intention in Space Tourism E-Commerce. J Theoretical Appl Electron Commer Res 20(4):307. https://doi.org/10.3390/jtaer20040307
63. Wang Y, Saelee S (2025) Bashu painting school art aesthetics and application. Pakistan J Life Social Sci, *23*(1). https://doi.org/1131–1142.https://www.pjlss.edu.pk/pdf_files/2025_1/1131-1142.pdf
64. Wu R, Gao L, Li J, Xie A, Zhang X (2025) Exploring key factors influencing the processual experience of visitors in metaverse museum exhibitions: An approach based on the Experience Economy and the SOR model. Electronics 14(15):3045. https://doi.org/10.3390/electronics14153045
65. Xia T, Wu Y, Qiu A, Liu Z, Fan M (2025) The impact of AI guide language strategies on museum visitor experience: The mediating role of psychological distance in the arousal–topic fit effect. Behav Sci 15(11):1569
66. Yang Y, Wang Z, Shen H, Jiang N (2023) The impact of emotional experience on tourists' cultural identity and behavior in the cultural heritage tourism context: An empirical study on Dunhuang Mogao Grottoes. *Sustainability*, *15*(11). https://doi.org/8823.https://www.mdpi.com/2071-1050/15/11/8823
67. Yi C, Zhang H, Lin Y (2025) Enhancing intangible cultural heritage dissemination through digital experience: An Affective Events Theory approach. *npj Heritage Science*, *11*. https://doi.org/10.1038/s40494-025-02017-x
68. Zhang Y, Liu L (2025) Generation mechanism of collective emotional resonance: A study on group emotions and cultural identity in digital exhibitions of intangible cultural heritage costumes. Int J Human–Computer Interact Adv online. https://doi.org/10.1080/10447318.2025.2520920
69. Zhou L (2024) Cultural bonding through AI-mediated emotional engagement with selfie. In *Design for Intercultural Innovation: Cumulus Regional Seminar China 2024* (pp. 0–4). https://scholar.xjtlu.edu.cn/en/publications/cultural-bonding-through-ai-mediated-emotional-engagement-with-se

Figures

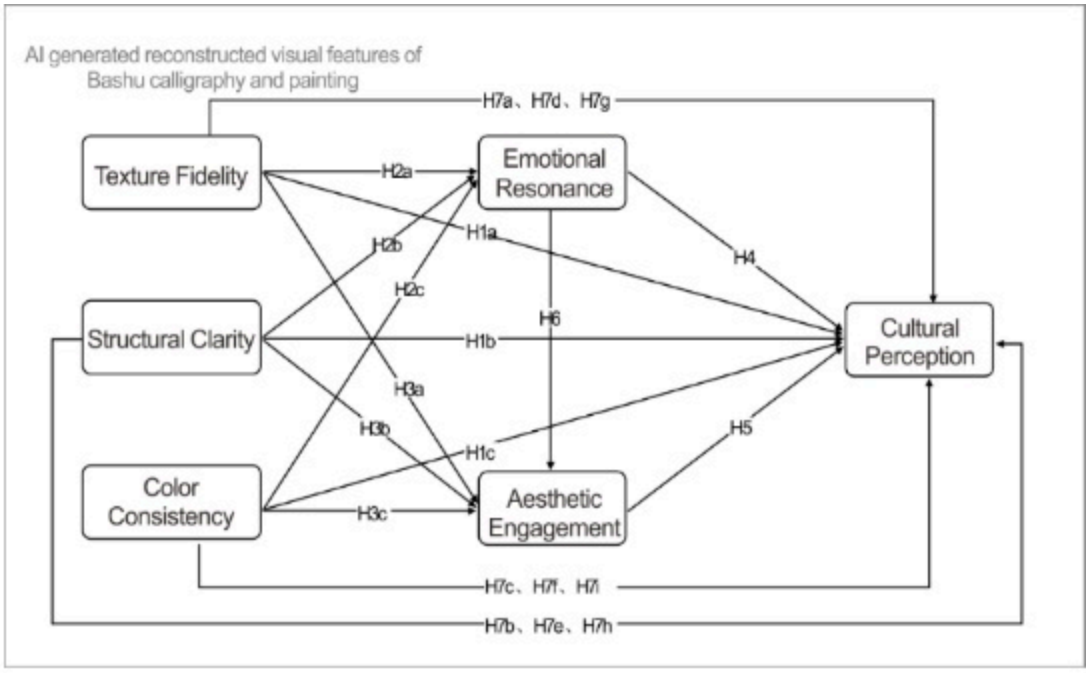


Figure 1

A Model of the Influence of AI-Generated Reconstructed Visual Features of Ba-Shu Calligraphy and Painting on Cultural

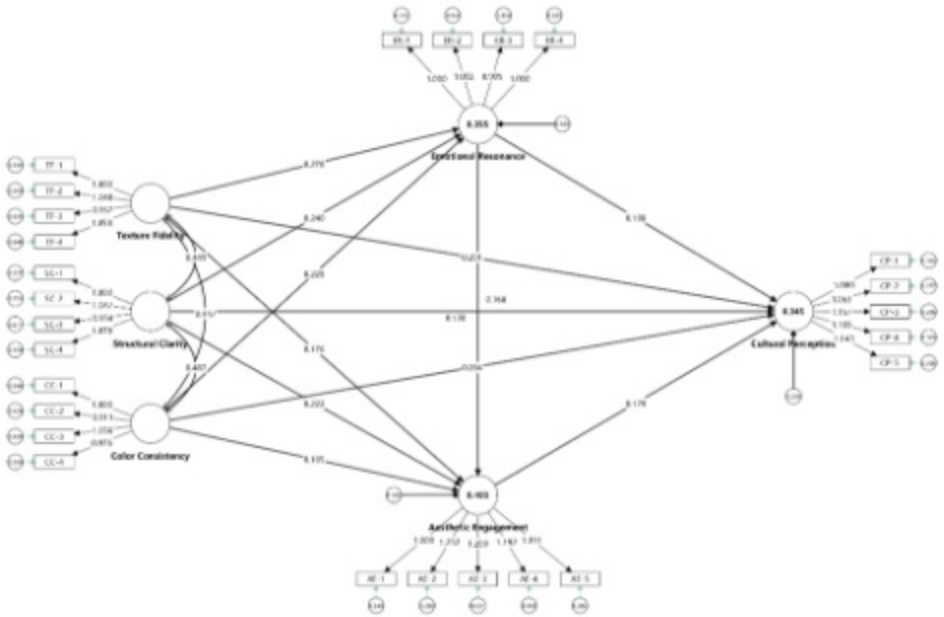


Figure 2. Model Analysis Results

Figure 2

See image above for figure legend