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Evolution of Decorative Elegance: Rediscovering the Honeysuckle Pattern in the Caisson Ceilings of the Mogao Grottoes during the Middle Sui Dynasty

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ABSTRACT

The Mogao Grottoes, situated in Dunhuang City, Gansu Province, holds significant cultural value as an iconic site of Chinese heritage. Among the intricate patterns adorning the caisson ceilings within these grottoes, the honeysuckle pattern stands out as one of the most popular designs. This paper proposes an innovative redesign method the honeysuckle pattern specifically for the caisson in the Mogao Grottoes during the middle Sui Dynasty in order to better inherit the art of Dunhuang and meet contemporary aesthetic requirements. A literature review and case study were used to summarize Lotus pattern types and characteristics. It begins by providing an overview of the original honeysuckle pattern found in the caisson ceilings of the grottoes, followed by an analysis of the different decorative patterns on the borders of caisson ceilings in the early and middle Sui dynasties. Then, paper proposes a novel design model for the honeysuckle pattern, drawing inspiration from historical designs and employing a combination of traditional and modern technology. Through this methodology, the paper concludes that the innovative honeysuckle pattern design for the caisson in the Mogao Grottoes successfully integrates traditional design elements with contemporary design methods. This design method not only reflects the historical context of the Middle Sui Dynasty but also exemplifies the potential of method in contemporary design practice.

Keywords: *Honeysuckle pattern; Caisson ceilings; Mogao Grottoes; Middle Sui Dynasty*

1. INTRODUCTION

The Mogao Grottoes, alternatively referred to as the Thousand Buddha Caves, is a collection of caves situated near Dunhuang, China. The caverns in question have a substantial assemblage of Buddhist art and architecture that may be traced back to the fourth century AD (Yu et al., 2022). The caisson ceilings within the Mogao Grottoes exhibit notable significance among the various items and constructions there. The caisson is an ornamental architectural feature characterized by a centrally recessed panel enclosed by an elevated frame. The frame is commonly adorned with elaborate patterns and decorations.

According to Peng (2021), the honeysuckle pattern is one of the most popular decorative patterns used in the caisson ceilings of the Mogao Grottoes during the middle Sui Dynasty (581-618 AD). This pattern features a continuous scroll of vines and flowers that resemble the shape of a honeysuckle. The pattern is elegant and harmonious and reflects the artistic style of the middle Sui Dynasty (Chen, 2023).

In recent times, there has been a noticeable surge in the inclination towards the use of modern design techniques, such as shape grammar, for the purpose of generating inventive designs that are rooted in conventional patterns. The objective of this study was to make a scholarly contribution to the existing body of knowledge by presenting a novel design approach for the honeysuckle pattern in the caisson of the Mogao Grottoes. This approach incorporates components from historical design practices as well as contemporary design methodologies.

2. METHODOLOGY

2.1 Mixed-methods Approach

The methodology employed in this study encompasses a combination of qualitative and quantitative research methods, complemented by an artwork approach, to provide a comprehensive understanding of the innovative design of the honeysuckle pattern for the caisson in the middle Sui Dynasty within the Mogao Grottoes.

Liu (2022) pointed that the qualitative research method involved an extensive review of literature and documents pertaining to the history, art, and culture of the Sui Dynasty and the Mogao Grottoes. This literature review served as a foundation for identifying the historical and cultural significance of the honeysuckle pattern and its prominent role in the decoration of caisson ceilings during the Sui Dynasty. Through this qualitative approach, a nuanced understanding of the context in which the honeysuckle pattern emerged, and its symbolic meanings was achieved.

In addition to the qualitative research, a quantitative research method was employed to analyze the geometric properties and characteristics of the honeysuckle pattern. This involved a systematic examination of the dimensions, proportions, and spatial relationships within the pattern. By quantitatively assessing these aspects, a more objective and measurable understanding of the pattern's design elements was obtained, contributing to the overall analysis and interpretation (Nguyen & Martínez, 2020).

Furthermore, an artwork practice was incorporated into the methodology, enabling a more hands-on exploration of the honeysuckle pattern. By closely studying and analyzing existing examples of the pattern within the Mogao Grottoes and other relevant artifacts, a deeper appreciation of the craftsmanship, technical skill, and artistic vision involved in creating the pattern was developed. This approach allows for a more holistic understanding of the honeysuckle pattern, considering its visual impact, materiality, and the intricacies of its execution.

3.FINDING

There are over one hundred grottoes in the Mogao Grottoes in Dunhuang, China. These grottoes can be classified into three phases: early, middle, and late stages, based on their form, content, and artistic style (Li et al., 2018). For the sake of convenience, I will only list representative grottoes with patterns here. The patterns of the Sui Dynasty can be primarily found in various structures and models, such as the caisson ceilings, Pingqi (also known as ceilings), niche lintels (decorations on the niche for Buddha), grotto roofs and wall decorations, as well as the costumes and backlighting of statues. The inscribed caisson ceiling pattern refers to a decoration painted at the center of the inverted funnel-shaped grottoes' tops, and they are classified according to different dynasties (see Table 1).

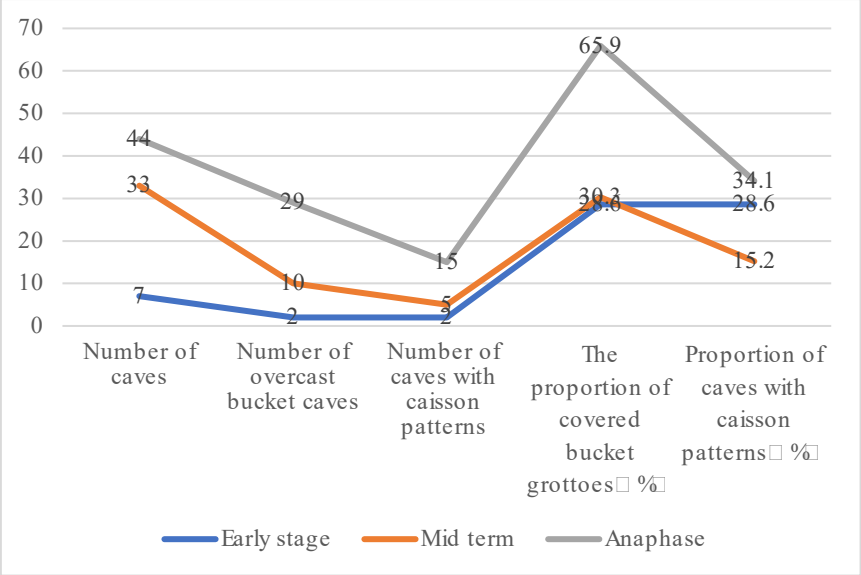


Table 1 Statistical figure of the staging of the grottoes during the Sui Dynasty

Through the statistical analysis of the Sui Dynasty's Inverted funnel grottoes, the following conclusion can be drawn:

(1) With the passage of time, the excavation of additional grottoes has led to a notable increase in both the quantity and proportion of Inverted funnel grottoes.

(2) The proliferation of grottoes featuring inscribed caisson ceiling patterns offers a substantial collection of samples.

3.1 Type analysis of honeysuckle pattern

The decorative patterns on the borders are widely used in inscribed caisson ceiling patterns with a variety of styles (Liu, 2021). With the change of times, the border pattern is also changing in style. This paper will study the development process of the decorative patterns on the inscribed caisson ceiling borders through the classification and comparison.

By counting the Grottoes with inscribed caisson ceiling patterns in the early and middle Sui Dynasty (Figure 1), the main types of border patterns found in the Grottoes of the early and middle Sui Dynasty are the strings of beads, lotus petal, draped tent and rhombus patterns. The majority are the honeysuckle pattern; and this paper focuses on the characteristics of the honeysuckle pattern.

3.2 Honeysuckle Pattern

Honeysuckle pattern is a popular decorative pattern in northern China, having been used for decoration as early as the Han Dynasty (Liu & Yu, 2020). With the introduction of Buddhism, honeysuckle became widely popular, so as to be applied in tombs from Wei and Jin Dynasties, Northern Wei architectural decoration and embroidery. Honeysuckle is also an important pattern in the art of the Dunhuang Grottoes. Honeysuckle flowers resemble trumpets, with four or five lobed petals, and were used from the Northern Liang to the Sui Dynasties. After the Sui Dynasty, the pattern gradually disappeared and was replaced by a variety of scrolling grasses, pomegranate patterns or other patterns from the Tang Dynasty. By the time of the Western Xia Dynasty, the honeysuckle pattern had reappeared, but honeysuckle was no longer as abundant and flourishing (Chen, 2023).

The above enumeration has six distinct classifications of honeysuckle patterns observed throughout the early and middle Sui Dynasty, categorized according to their branching features. The honeysuckle patterns can be categorized into six distinct types: A continuous undulate pattern, B ring-shaped pattern,

C tortoise shell shaped pattern, D calabash shaped pattern, E triangular symmetrical pattern, and F twisted-branches pattern. These patterns can be further classified based on the number of leaves in the branches and vines, the manner in which they undergo changes, and the method by which they are combined.

Type A: Continuous Undulate Honeysuckle Pattern

The continuous undulating honeysuckle pattern is mainly based on a continuous undulating shape, with undulating leaf arrangements or single leaves growing on either side of the undulating branch vine. The following is a classification of the honeysuckle pattern according to the arrangement of the leaves.

Pattern I is characterized by twisted branches that are shaped with a single leaf. The branch vine exhibits an undulating pattern, characterized by the presence of a solitary leaf on each undulation. Furthermore, the vine is rolled back in a consistent manner, displaying a continuous arrangement. Notably, three honeysuckle leaves are positioned on either side of each undulation. The Sui Dynasty, as depicted in Grotto 405 (refer to Figure 1), is being represented.

Pattern II consists of branches that are split and have double leaves. The branches have an undulating pattern and are adorned with pairs of opposite leaves that are rolled back in an outward direction. Additionally, these branches are accompanied by a continuous row of little leaves. The Sui Dynasty is represented by Grotto 305, as depicted in Figure 1.

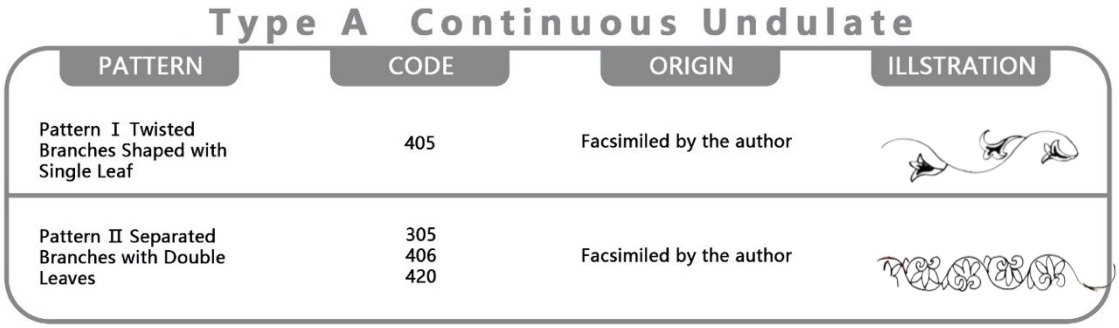


Figure 1 Continuous Undulate Honeysuckle Pattern

Type B: Ring-Shaped Honeysuckle

The branching vine with a ring as the basis and two sets of symmetrical honeysuckle leaves inside the ring define the ring-shaped honeysuckle design. In the pattern IV honeysuckle pattern, the branches and vines are ring-shaped and the four leaves on the left and right are V-shaped. Sui Dynasty Grotto 240 is typical (Figure 2).

Figure 2 Ring-Shaped Honeysuckle

Type C: Tortoise Shell Shaped Honeysuckle Pattern

The main feature of the C tortoise shell shaped honeysuckle pattern is the tortoise-type scrolling grass pattern as the base, with the tortoise-shaped interior configured with scrolling grass and small floral patterns. This pattern is represented by Grotto 407 of the Sui Dynasty (see Figure 3).

Figure 3 Tortoise Shell Shaped Honeysuckle Pattern

Type D: Calabash Shaped Strings of Beads

The calabash-shaped honeysuckle pattern is longitudinally sequenced, with a gourd-shaped vine as the base and inwardly curling leaflets arranged symmetrically above and below from the interior. Grotto 301 of the Sui Dynasty depicts this design (see Figure 4).

Figure 4 Calabash Shaped Strings of Beads

Type E: Triangular Symmetrical Strings of Beads

The two honeysuckle leaves, or the top with a single honeysuckle leaf, are grouped symmetrically to provide the major element of the triangular symmetrical honeysuckle design. Based on the number of leaves, honeysuckles of this type can be classified into one of three distinct patterns: pattern I, with three leaves; pattern II, with five leaves; pattern III, with seven leaves; and pattern I + II, with evolving honeysuckle leaves (see Figure 5).

The main feature of the pattern I three-leaf honeysuckle pattern is a symmetrical group of the two single-leafed honeysuckle leaves and a single honeysuckle leaf at the top. This pattern is represented by the double triangular drapery of Grotto 373 of the Sui Dynasty.

The main feature of the pattern II five-leaf honeysuckle pattern is that the two honeysuckle leaves are grouped together, with the two groups superimposed and a single honeysuckle leaf on the top, which shows a triangular shape. This is represented by the honeysuckle leaves on the drapery of Grottoes 305 and 406 of the Sui Dynasty.

Pattern III Seven-leaf honeysuckle pattern, the same shape as the three- and five-leaf honeysuckle patterns. This is represented by the honeysuckle leaves on the drapery of Grottoes 403 and 407 of the Sui Dynasty.

The three- and five-leaf honeysuckle pattern inspired the designs I + II developing honeysuckle pattern. The original three leaves are flipped 180 degrees into an upside-down symmetrical shape and embellished with an eight-leaf floral motif. The drapery honeysuckle design from Sui dynasty Grotto 407 represents this motif.

Type E Triangular upright Symmetric

PATTERN	CODE	ORIGIN	ILLSTRATION
Pattern Ⅰ Triple Leaves	373	Facsimiled by the author	
Pattern Ⅱ Five Leaves	305 406	Facsimiled by the author	
Pattern Ⅲ Seven Leaves	403 407	Facsimiled by the author	
Pattern Ⅰ + Ⅱ Evolving	407	Facsimiled by the author	

Figure 5 Triangular Symmetrical Strings of Beads

Type F: Twisted-Branches Honeysuckle

The main feature of the twisted-branches honeysuckle pattern is that it is framed by undulating lingonberry leaves or undulating entwined lingonberries, each branch of which is painted with a large lotus flower, or the four corners of the entwined branches are painted with incarnate children or flaming jewels. This pattern is mainly painted in the center of the caisson ceiling, around the large lotus flower and in the structure of the caisson ceiling. The entwined branches are richly shaped with honeysuckle leaves, ranging from three, four and five leaves. This type can be divided into two patterns according to its undulating structure, namely pattern I continuously undulating Honeysuckle and pattern II vine undulating honeysuckle (see Figure 6).

Honeysuckle continued to sway. The earliest honeysuckle leaves have a continuous undulating curve, with other leaves smoothly placed in a pattern. Grotto 405 of the Sui Dynasty depicts this honeysuckle pattern.

Undulating honeysuckle pattern II. The honeysuckle branch vine is wavy like the undulating honeysuckle pattern II style A, and the rotary branch leaves have varying numbers of honeysuckle leaves, demonstrating exaggerated painting qualities.

Type F Twisted-branches honeysuckle pattern

PATTERN	CODE	ORIGIN	ILLSTRATION
Pattern Ⅰ Undulate	403	Sketches of Dunhuang inscribed caisson ceilingFine Pictures from Major Dynasties	
Pattern Ⅱ Vine-shaped	405	Sketches of Dunhuang inscribed caisson ceilingFine Pictures from Major Dynasties	

Figure 6 Twisted-Branches Honeysuckle

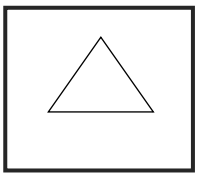
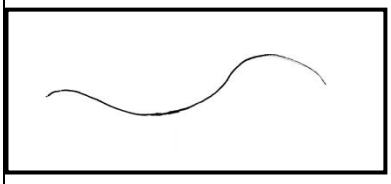
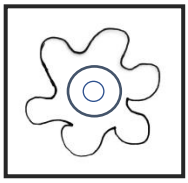
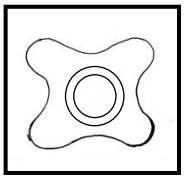
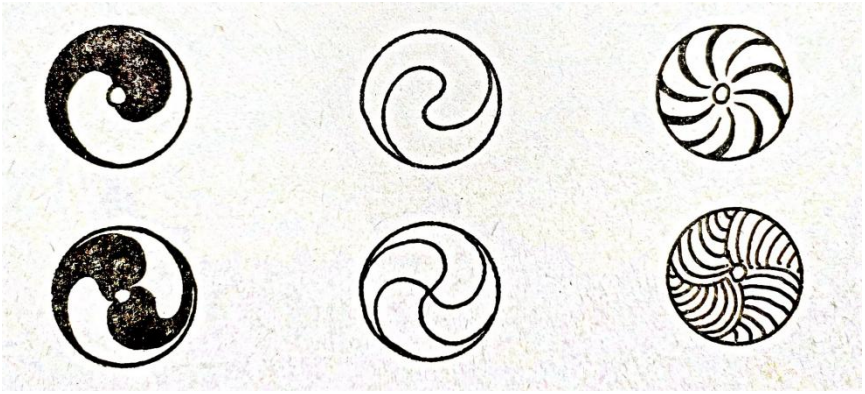
4. ANALYSIS

Upon conducting a comparative analysis of the aforementioned honeysuckle patterns, it becomes evident that the predominant form of the honeysuckle pattern is undulate in nature. This pattern typically

consists of the honeysuckle being divided into three or four symmetrically placed leaves or exhibiting a twisting vine-like structure. The intertwining and overlapping of the stems and vines in the honeysuckle pattern contribute to its vast variation.

Upon examining the patterns from the early and middle Sui Dynasty, it becomes evident that the composition of these patterns consists of an s-shaped structure. These structures are adorned with either single or double leaves on either side, resulting in distinct triangular symmetrical patterns. Additionally, undulating forms and squares are incorporated into the overall design, either in undulating or radiating arrangements. As shown in Figure 2, the s-shaped composition has been recorded in China for a long time, according to the Hubei Jingshan and Tianmen Archaeological Excavation Bulletin, which recorded that the Neolithic painted pottery spinning wheel excavated at Tianmen Shijiahe had an s-shaped composition. The image is divided into two yin and yang poles with an opposing s-shaped line, forming an imaginary illumination, tilting from side to side and full of motion. The undulated honeysuckle pattern is one of the most common compositions of the honeysuckle pattern in the early and middle Sui Dynasties, showing the vitality of its development It can be seen that the inscribed caisson ceiling pattern of the honeysuckle pattern is inherited from the composition used in the Neolithic period (see Table 2).

Table 2 A design process for cultural creative product of Honeysuckle Pattern

			
Type E	Type A	Type F Pattern I	Type F Pattern II
Honeysuckle pattern in Sui Dynasty facsimiled by the author			
			
Neolithic age painted pottery spinning wheel pattern			

The honeysuckle pattern is a popular decorative motif that has been used for centuries in traditional Chinese art. It is characterized by a winding stem with pairs of opposite leaves and pairs of trumpet-shaped flowers that are oriented in opposite directions. This pattern is commonly found in various art forms such as pottery, textiles, and architecture (Xu et al., 2020). The Mogao Grottoes in China's Dunhuang city, which is a UNESCO World Heritage Site, is known for its extensive use of the honeysuckle pattern in the caisson ceiling of the middle Sui Dynasty (Chen et al., 2021).

5. Case study - from honeysuckle pattern to Design model

With the rising demand for cultural creative items, Verganti et al. (2020) suggest creating new designs that blend old motifs into modern products. Traditional patterns like the honeysuckle can be incorporated in modern product design. Cultural creative product design involves using cultural elements and traditions to create unique and innovative products that reflect the values and aesthetics of a particular culture (Tan et al., 2020). The honeysuckle pattern is an excellent example of cultural creative product design that can be used in various products such as clothing, accessories, home decor, and even digital products. This design progress includes five stages:

(1) Research and Analysis

The first stage involved researching and analyzing the existing honeysuckle patterns found in the middle Sui Dynasty caissons at the Mogao Grottoes. This was done by conducting a thorough literature review and examining the caissons in person. The purpose of this stage was to gain an understanding of the design principles and techniques used in the original patterns.

(2) Design Conceptualization

The second stage involved the conceptualization of the honeysuckle pattern design. This was done by combining traditional design principles with modern computer-aided design (CAD) tools. The purpose of this stage was to create a digital prototype of the honeysuckle pattern that could be easily modified and refined.

(3) Pattern Refinement

The third stage involved refining the honeysuckle pattern prototype created in the previous stage. This was done by making adjustments and modifications to the design using the CAD software. The purpose of this stage was to ensure that the design was aesthetically pleasing and met the necessary technical requirements.

(4) Prototype Fabrication

The fourth stage involved fabricating a physical prototype of the honeysuckle pattern using traditional techniques. This was done by carving the pattern into a wooden block and then transferring the pattern onto a piece of fabric using ink. The purpose of this stage was to create a physical representation of the design that could be tested and refined.

(5) Testing and Refinement

The final stage involved testing and refining the physical prototype of the honeysuckle pattern. This was done by examining the pattern in different lighting conditions and making adjustments as necessary. The purpose of this stage was to ensure that the design was suitable for use in the Mogao Grottoes and met all necessary technical requirements.

Gaynor (2002), Trott, and Vogel et al. (2005) argue that the development of a successful new cultural creative product is not a singular event, but rather a process in which a succession of activities are linked, providing a framework for controlling chaos without precisely dictating each step. Despite the fact that You et al.'s (1996) design process is divided into three sequential phases, its framework does not provide sufficient guidance to designers or design teams in order to enhance the operation of design teams.

As stated previously, the three design process models are all practical and effective and can be incorporated into a single framework. Thus, we propose a model of the design process based on You et al.'s image transforming design process, incorporating Cooper's (2000) stage-gate process as critical

decision-making points, and integrating The British Design Council's (2006) double diamond design process as a guideline for divergent and convergent thinking. There are two stages in this design model (see Table3 and Table 4).

(1) Art-making progress

Table 3 Art-making progress

Table 3 Art-making progress	
A. Phase one	Artwork conception
B. Phase two	Idea development
C. Phase three	Making the artwork
D. Phase four	Finishing the artwork and resolution

(2) Studio experience

Table 4 Studio experience

Table 4 Studio experience	
A	Problem finding
B	Problem solving
C	Media exploration
D	Creative process
E	Website
F	Giving form to ideas of personal and social relevant

DISCUSSION

The honeysuckle pattern found on the caisson ceiling of the Mogao Grottoes in the middle Sui Dynasty holds immense significance as a noteworthy milestone in the history of Chinese art and culture (Mogao Caves: Its History And Cave Art, 2020). This pattern stands out for its innovation and distinctiveness, characterized by a skillful combination of curves and lines that create a dynamic sense of depth and movement. It was widely employed in the embellishment of numerous significant structures during the Sui Dynasty.

The analysis of decorative patterns on the borders of caisson ceilings in the early and middle Sui Dynasties offers valuable insights into the evolutionary trajectory of the honeysuckle pattern within the context of the Mogao Grottoes. These patterns serve as reflections of the socio-political and cultural transformations that transpired during this period, and the honeysuckle pattern itself emerges as a unique product shaped by these multifaceted influences.

The innovative design of the honeysuckle pattern within the Mogao Grottoes can be attributed to the artistic vision and technical proficiency exhibited by the skilled craftsmen responsible for its creation (Abe, 1989). By examining the methodology employed in producing this pattern, one gains valuable insights into the materials, techniques, tools, and creative processes employed by these craftsmen, further enriching our understanding of their contributions.

CONCLUSION

Because the cultural and creative sectors are so diverse, there are several aspects that influence the design of cultural and creative items. Due to limited human resources, time, and space, there is still room for improvement in this inquiry. Its beautiful motifs are inspired by Dunhuang caisson patterns, displaying the culture of Dunhuang.

It is important to acknowledge certain limitations within this study. The research primarily relies on historical records, archaeological findings, and artistic analysis, which may present inherent limitations in terms of availability and accuracy. Additionally, the interpretation and understanding of the honeysuckle pattern are subjective to a certain extent, and further scholarly discourse and collaboration are essential for a more comprehensive understanding of its cultural significance.

In the context of the middle Sui Dynasty, future research could delve deeper into the symbolism and cultural significance associated with the honeysuckle motif. In addition, investigating the influence and diffusion of this pattern in other regions and time periods would expand our understanding of its enduring impact. Moreover, the implementation of advanced digital technologies, such as 3D scanning and visualization, can facilitate a more thorough analysis and preservation of the caisson ceilings and intricate designs of the Mogao Grottoes.

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AUTHOR CONTRIBUTIONS

Kang Sujuan contributed to this research in a variety of ways, including data acquisition, analysis, and writing. Nur Hisham Ibrahim gave instructions to conduct this investigation.

CONFLICT OF INTEREST

No conflicts of interest were disclosed by Kang Sujuan in relation to the research, authorship, or publication of this article.

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