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Comparative Study of Dougong and Flying Buttress from the Perspective of Religious Culture

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Abstract

This is a comparative study of the dougong system in Buddhist architecture and the flying buttress in Christian architecture from the structural, historical, and cultural points of view. Despite their similar structural load-bearing and ornamental functions in religious buildings, these two systems actually embodied the fundamentally different philosophical and religious principles: Chinese dougong has Taoist harmony and multi-layered spatial development, and Gothic flying buttresses are emphasizing verticality and divine transcendence. Through comparative studies, this paper illustrates that dugong and flying buttresses both originated only as stabilizing architectural elements, but their cultural meanings evolved under different social contexts. Flying buttresses more directly reflect Christian culture because they developed in a mono-religious society, whereas dougong, emerging in a multi-religious context, carries more complex cultural associations beyond a single faith. The paper emphasizes the importance of the significance of cross-cultural exchanges between the East and the West, as well as the interplay between architectural structures and cultural connotations.

Keywords: Dougong, flying buttress, religious architecture, cultural symbolism, structural comparison

1. Introduction

This paper aims to compare the dougong structure in Buddhist architecture with the flying buttress structure in Christian architecture. Both are exposed structural support elements with decorative functions, sharing similar roles in supporting roofs and walls in religious architecture of the East and the West. However, they embody and reflect different religious cultures. As a form of cultural expression, architecture's unique structures convey distinct cultural messages. Traditional Chinese architecture influenced by Taoist thought emphasizes the progressive layering and harmonious unity of space, (Peng Yoke Ho & F. Peter Lisowski, 1993) whereas Christianity architecture highlights the transparency and vertical extension of space. (Camilo Rosales, 2022) Although previous studies have explored the individual characteristics of these two structures and how they express their respective cultural features, few studies interrogate how their forms articulate religious cosmology. By comparing dougong and flying buttress, this paper seeks to enhance cross-cultural

understanding through architecture and raise awareness of its role in cultural continuity — the preservation of unique traditions through physical forms that transcend centuries. For architects, this comparison serves as a reminder that social and cultural values must never be overlooked in the design process. Similarly, scholars of religious and cultural studies must recognize the vital importance of preserving and promoting religious architecture for the continuation and evolution of cultural heritage. This paper employs a tripartite methodology: (1) graphic statics-based structural analysis, (2) historical contextualization of their origins in 12th-century Europe and Asia, and (3) semiotic reading of their cultural narratives. By the intersection of architectural technology and cultural studies, this paper emphasizes how architecture continues traditions over millennia — a lesson of direct application in today's heritage conservation.

2. Literature Review

2.1 The Appearance and Significance of Dougong

Figure 1. Dougong

Source: https://www.sohu.com/a/788814458_120727706

The origin of dougong can be traced back to the Western Zhou Dynasty, but its use as a structural element in architecture began around the 1st century BC during the Han Dynasty. (Han, Baode, 2014) The culture of the Han Dynasty was characterized by its diversity and inclusiveness, with Taoism emerging as one of the important religious ideologies. Buddhism was also introduced during this period. Taoism emphasizes that humans should follow the laws of nature and stresses harmony and mutual complementarity among all things. (Lu, Guolong, 2007) Lao Zi, the founder of the Daoist school and a philosopher from the Spring and Autumn period in China, advocated the principle of "governing by non-interference," which emphasizes allowing things to take their natural course and eliminating unnecessary actions. He applied this attitude to various aspects of life, philosophy, and politics. For instance, he suggested that rulers should govern the country by non-interference. He also took a position against war and in favor of light taxes. (Zhu Kangyou, 2021) The interlocking dougong system, with its emphasis on wooden flexibility, aligns with the Taoist principle of "yielding to overcome rigidity." (Needham, J., 1956)

The term "dougong" is composed of two Chinese characters — 斗拱. The horizontal structural elements placed on top of columns or beams are called "gong" (拱), while the square wooden blocks between adjacent arches, which transfer loads in the vertical direction + and provide stability in the horizontal direction, are called "dou" (斗). The structural significance of dougong lies in its ability to support the heavy roof and extended eaves, transferring the vertical loads from the roof to the columns. It serves both structural and decorative functions.

Based on the relatively independent cultural connotations, material applications, structural characteristics, and developmental systems of traditional Chinese wooden architecture, only a few East Asian countries, such as Japan and South Korea, have similar architectural forms to dougong. Dougong structure is very common in ancient Chinese architecture, and its complexity and decorative role made it gradually become a symbol of architectural grade in the Ming and Qing dynasties. (Ruyuan Yang, Seithati Mapesela, Haitao Li & Rodolfo Lorenzo, 2023) Although the interlocking of wooden components in dougong, with their concave and convex features, can well reflect the religious ideas of "following the laws of nature" and "harmony and mutual complementarity" of Taoism and even farming culture, (Wang Yilin & Huang Youxi, 2008) and represents a unique culture in some Asian regions, we can barely find direct evidence to prove that the original design intention of dougong was to reflect religious ideas. There is little research in this area. Its emergence in architecture was more based on structural needs, but over time, it gradually incorporated the concepts of traditional Chinese philosophy.

2.2 The Appearance and Significance of Flying Buttress

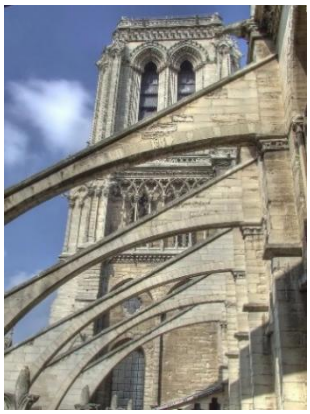

Figure 2. Flying Buttress

Source: https://baike.baidu.com/item/飞扶壁/10247170

In the 4th century AD, early characteristics of the flying buttress had already appeared in ancient Greek architecture. However, this structural element was fully developed and widely applied in Gothic architecture during the period from the 12th to the 16th century, particularly in large Gothic cathedrals. (*Chinese Encyclopedia*, 2021) Gothic architecture is an important manifestation of medieval Christian culture. In Christianity, God is the core of faith, the all-knowing, and the creator of heaven. (King James Bible, Genesis 1:1) Christianity teaches people to establish a personal relationship with God. (Team Kaarwan, 2024) The structural features of Gothic architecture are a testament to humanity's desire to connect with the divine. (The AI Prompt Shop, 2025) The flying buttress's vertical thrust embodies the Christian aspiration toward divine transcendence, as noted by Panofsky in his analogy between Gothic structures and scholastic theology. (Panofsky, E., 1951)

The flying buttress, as a unique structural element in Gothic architecture, primarily serves to redistribute the weight of the roof and upper walls, transferring the forces outward and downward to the ground. This innovation enabled the construction of taller and more slender walls, which in turn facilitated the incorporation of larger windows. (Design Horizons Team, 2024) While the flying buttress emerged primarily as a structural solution, (Fitchen, John, 1961) its eventual association with Christian theology (Otto Georg von Simson, 1956) exemplifies how functional forms acquire religious symbolism. Even though, as a key component of Gothic architecture deeply influenced by Christianity, the upward and soaring form of the flying buttress symbolizes the path to heaven. (*Chinese Encyclopedia*, 2021) Unlike thickening walls, this lightweight and dynamic support structure allows more light to enter the interior, which aligns with the Christian concept of "to the true light, where Christ is the true door." (Hillary Smith, 2020)

After separately discussing the cognition of dougong and flying buttress, we need to further discuss the insufficiency of current comparative studies on the two.

2.3 The Current Status of Comparative Research

At present, comparative studies on the cultural expression and structural function of flying buttress and dougong are scarce. Recent literature on dougong and flying buttresses remains largely confined to mono-cultural critiques, with minimal cross-cultural discussion. This is in spite of the growing recognition in architectural theory that structural systems are not technical fixes but cultural artifacts—a position at the center of Frampton's Critical Regionalism, (Kenneth Frampton, 1983) which argues that regional construction techniques inevitably hold cultural values. Since they belong to different architectural systems in China and the West, most of the studies focus on architectural components under their respective cultural backgrounds, and there are few cross-cultural comparative studies. Therefore, this paper aims to conduct a comparative study of the dougong structure influenced by Taoist philosophy and the flying buttress widely used in Christian architecture. By examining the similarities and differences in how these unique structural features express their respective cultures, this paper helps promote the exchange between Eastern and Western cultures.

By systemic comparison of these two systems, this study not only addresses an academic void but also demonstrates how structural forms can serve as channels for cross-cultural comprehension—a necessity in today's heritage conservation, when technocentric approaches often overlook cultural histories. Foguang temple and Notre-Dame de Paris have been chosen because the former is the largest existing Tang Dynasty timber structure in China and the second-oldest wooden building in the country. It was constructed during the Tang Dynasty, a period when Buddhism and Taoism were

flourishing, so its massive dougong can serve as a representative example. The latter is a representative of Gothic architecture, with the flying buttress being an important and iconic component.

3. Case Study

Figure 3. Foguang Temple

Source:
https://www.douyin.com/hashtag/1670078717258765,
https://www.sohu.com/a/761007921_121124385

3.1 Foguang Temple: Structural Taoism in Dougong

The Foguang Temple features huge dougong with a cross-sectional dimension of 210×300 centimeters—ten times larger than those of the late Qing Dynasty. (Lv, Zhou, 2011) The dougong, consisting of seven layers with double cantilevers and double brackets, (Zhang Rong, Li Yumin, Wang Shuai, Wang Yizhen, Chen Zhuyin & Wang Qi, 2021) is intricately designed and securely connected through mortise-and-tenon joints. The exterior eaves' dougong extends far out, reaching four meters, (Lv, Zhou, 2011) effectively transferring the weight of the roof to the vertical columns and stabilizing the structure. The interior dougong is rich in layers and serves a strong decorative purpose.

As a Buddhist temple, the temple is a symbol of Buddhist culture. By this time, Buddhism had spread to China and integrated with other Chinese traditional cultures, including Taoism. Although the dougong of Foguang Temple was not originally intended to display Buddhist culture, influenced by the era and its architectural purpose, Scholars like Zhang Xia and Zhang FangTao interpret its layered brackets as a materialization of Buddhist-Taoist concepts such as "order," "harmony," and "protection." (Zhang, X., & Zhang, F. T., 2007)

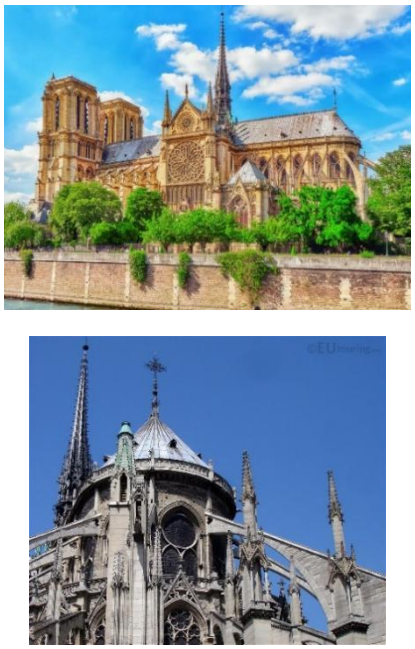

Figure 4. Notre-Dame de Paris

Source:
https://www.holidaywolf.de/notre-dame-de-paris/,
https://www.eutouring.com/images_notre_dame.html

3.2 Notre-Dame de Paris: Verticality as Christian Transcendence

Notre-Dame de Paris was constructed in the 12th century and was completed 180 years later. (France Archives, 2024) The iconic flying buttresses are an important part of it. The structural design of the flying buttresses is exquisite and their function is powerful. The unique semi-arch structure spans the lower auxiliary space and connects to the starting part of the ribbed vault at the top of the high wall. This design not only effectively counteracts the

lateral thrust of the vault on the wall but also allows the building to reach an unprecedented height, providing space for the large stained-glass windows inside the building, therefore making the interior of the church brighter. Notre-Dame's flying buttresses, while structurally innovative, extend beyond functionality by their sculptural spires—a duality indicative of Gothic theology's synthesis of physical and divine worlds. (Panofsky, E., 1951) The stone spires at the top of the flying buttresses add to the building's grandeur. As a religious building, the design of the flying buttresses of Notre-Dame de Paris makes the building as a whole lighter and more transparent, creating a religious atmosphere that approaches God and heaven. Although the main function of the flying buttresses is to support the structure, their design was also influenced by the religious ideas of the time, which reflect the pursuit of sacred space in religious culture.

While Foguang Temple's dougong embodies horizontal harmony, Notre-Dame's flying buttresses express vertical aspiration.

4. Findings

	Dougong	Flying Buttress
Purpose of Construction	To solve the structural and saptial problems of the achitecture, not to show the culture	
Historical Background	Prosperity of Taoism. Buddhism was also introduced into China and integrated with traditional Chinese culture	Gothic period (Mid-12th century to 16th century)
Applied Range	In lots of ancient Chinese architectures, not only religious architectures	Mainly in Christian architectures
Structural Function	Support the heavy roof and overhanging eaves, and transfer the vertical load of the roof to the columns	The lateral thrust caused by the vault to the wall is transferred to the ground, reducing the load on the wall and promoting the use of more windows
Decoritive Function	Complex, with numerous components, maintains an overall harmony, and often adorned with exquisite carvings	Exhibits a tendency to extend outward and upward, appearing light, and often adorned with exquisite carvings
Cultural Connotation	Shows the Taoist and Buddhist culture of "harmony", "nature" and "law" and other ideas	Reflects the Christian cultural aspiration for heaven

Through comparison, this paper found that the emergence and application of dougong and the flying buttress structure in architecture were primarily aimed at making buildings more stable and addressing specific support issues, rather than showcasing the cultures they represent. Both dougong and flying buttresses are exposed support structures, and their functions share certain similarities. However, due to their different architectural systems, there are also differences. The main purpose of dougong is to transfer the weight of the massive eaves to the load-bearing columns, while the flying buttress transfers the lateral thrust from the vault to the ground.

Nevertheless, even though their emergence and usage were driven by structural purposes, they still effectively represent their respective religious cultures, which is closely related to the historical context in which they appeared and were widely used. For dougong, its application in architecture dates back to the Han Dynasty, an era when Taoist culture was flourishing. The society was stable and harmonious, and Taoist concepts such as "harmony" and "following nature" were widely disseminated among the people. Thus, culture influenced architectural structures, and architectural structures, in turn, reflected the culture of the time, complementing each other. This is why, when people see the dougong structure, which is entirely made of natural wood interlocked in a harmonious and stable manner to support the eaves, they associate it with Taoist ideas such as "pursuing harmony" and "following nature."

The flying buttress displays a parallel culturally encoded structural design trend. As a feature of Gothic architecture (c. 12th – 16th centuries), its development followed parallel with the theological drift towards lux divina (divine

light) in Christian theology. (Panofsky, E., 1951) They emerged during the Gothic period and were influenced by Christian culture, which they also came to represent. Although architects did not prioritize showcasing Christian concepts such as "aspiring to heaven" and "being closer to God" when designing, the structures they created inevitably reflected these ideas due to the influence of the historical context. Therefore, the extended lines, upward trends, and lightweight framework of flying buttresses evoke a sense of sanctity and convey the relevant ideas of Christian culture to people today.

However, the ways in which dougong and flying buttresses represent religious culture are not entirely the same. Dougong was widely used in classical architecture in China and some other parts of Asia, and many of these architectures did not have a religious character. (Ye Meme Art, 2020) This is because the cultures of China and neighboring regions have long been in a state of continuous exchange and integration, leading to the overlap of many similar ideas across different religions, such as the fusion of Buddhism and Taoism. As a result, dougong no longer represents a single typical religious ideology but embodies traditional Chinese culture's thought and even more. It's also hard to find studies that directly point to dougong as representing a particular culture. In contrast, the flying buttress emerged and was used in a more concentrated time and place, making it a typical Gothic architectural structure that directly represents Christian culture.

5. Discussion

This paper compares the dougong (a traditional Chinese architectural element) and the flying buttress (a Gothic architectural feature) to explore how each represents its respective culture. This paper finds that neither the dougong nor the flying buttress was initially designed to showcase culture; rather, their primary purpose was to enhance the structural stability of buildings. The reason why these elements are now seen as cultural symbols lies in the influence of the historical context in which they developed. This finding helps correct the misconception that dougong and flying buttresses were intended to convey religious ideas from the moment they were created. It also suggests that architectural design can, in turn, promote the formation of cultural identities.

In terms of detailed comparison, this paper summarizes the structural characteristics of both elements and the cultural connotations they have acquired over time, presenting them in a more direct and clear comparison table. Direct comparisons between a Western religious architectural structure and an Eastern one are currently lacking, especially when these structures share similarities in function but exhibit entirely different cultural meanings in their respective contexts. Therefore, such comparative research is highly meaningful since it is conducive to promoting cultural exchanges and mutual learning between the East and the West.

However, this study also has its limitations. First, since this paper involves how architectural structures reflect cultural connotations, there was a lack of authoritative interpretations in the literature. Instead, it relies more on commonly accepted understandings, which might cause collecting potentially erroneous information and introducing subjective biases during the research process. Additionally, given that dougong and flying buttresses belong to different architectural systems, finding commonalities could only be done at a general level to provide readers with a broad concept. Otherwise, focusing on too many details would highlight numerous differences, potentially weakening the significance of connecting Eastern and Western architecture and culture.

6. Future Research

Based on the existing research, this paper suggests that future studies could be developed in the following directions. For architects, future research could explore how to integrate traditional structural elements (such as dougong or flying buttresses) into contemporary architectural design, so as to reflect cultural heritage while meeting modern functional needs, instead of merely pursuing technological innovation. For scholars of culture and regional studies, future research could explore the relationship between architectural structures and cultural contexts, analyzing how specific architectural elements were influenced by the prevailing cultural concepts of their time, thereby gaining a more comprehensive understanding of a culture. For the general public, future efforts could focus on how to enhance public awareness of the cultural value of architecture through education and publicity, guiding people to understand the cultural

significance conveyed by architectural details and strengthening the consciousness of protecting architectural heritage.

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