



A STUDY ON THE SPATIAL COMPOSITION OF FIVE GROTTOS IN TANYAO



Huiwen Xia

School of Art and Archaeology, Zhejiang University, Zhejiang, 310013 - China.

 <https://orcid.org/0000-0003-4043-0585> |  xiacsdfewtf@email.cn

Changyu Diao

School of Art and Archaeology, Zhejiang University, Zhejiang, 310013 - China.

 <https://orcid.org/0000-0001-7744-0889> |  dchangy0802@hotmail.com

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Abstract: The Yungang Grottoes are one of China's four major grotto sites and a UNESCO World Heritage Site. This study examines how to incorporate social rights and religious traditions into the grotto space via architecture. Focuses on three main areas: 1. An examination of the historical context surrounding the creation of the Tanyao Five Caves. 2. An exploration of the internal structure of the Tanyao Five Caves through the analysis of spatial elements, such as points, lines and surfaces. 3. At the micro level, this study incorporates human vision and perception within the cave environment, it identifies three parallel dimensions that influence spatial perception: physical, psychological and perceptual spaces. This blend contributes to the establishment of a religious ideal within the grottoes, where architecture seamlessly intertwines the divine and the human, resulting in a rich spatial experience defined by uniqueness, diversity and unity.

Keywords: Yungang Grottoes. Spatial composition. Worship space. The Northern Wei Dynasty. Politics. Religion.

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Resumo: As Grutas de Yungang constituem um dos quatro principais locais de grutas da China e um Patrimônio Mundial da UNESCO. Este estudo examina como incorporar direitos sociais e tradições religiosas no espaço da gruta, por meio da arquitetura. O foco está em três áreas principais: 1. Um exame do contexto histórico que envolve a criação das Tanyao Five Caves. 2. Uma exploração da estrutura interna das Tanyao Five Caves, através da análise de elementos espaciais, como pontos, linhas e superfícies. 3. Em nível micro, este trabalho incorpora a visão e a percepção humanas no ambiente da caverna, identificando três dimensões paralelas que influenciam a percepção espacial: espaços físicos, psicológicos e perceptuais. Essa combinação contribui para o estabelecimento de um ideal religioso dentro das grutas, onde a arquitetura entrelaça perfeitamente o divino e o humano, resultando em uma rica experiência espacial definida pela singularidade, diversidade e unidade.

Palavras-chave: Grutas de Yungang. Composição espacial. Espaço de adoração. Dinastia Wei do Norte. Política. Religião.

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INTRODUCTION

Du (2009, p. 1) said, in *Hexi Buddhist History*: “During the dissemination of Buddhism to China, numerous grottoes and temples were excavated along the Silk Road”. The Yungang Grottoes are some of the most important Buddhist relics on the Silk Road. The “Tanyao Five Grottoes” were excavated from 460-465 AD and were the first phase of the Yungang Grottoes project. Su (1996), in *Chinese Grottoes Temples*, said that “[...] the Tanyao Five Grottoes are now known as the Yungang 16-20 Grottoes”. The study object of

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² School of Art and Archaeology, Zhejiang University, Zhejiang, 310013 - China. ORCID: <https://orcid.org/0000-0003-4043-0585>. Email: xiacsdfewtf@email.cn.

³ School of Art and Archaeology, Zhejiang University, Zhejiang, 310013 - China. ORCID: <https://orcid.org/0000-0001-7744-0889>. Email: dchangy0802@hotmail.com.

this paper, Tan Yao five Grottoes, refers to the Yungang 16-20 Grottoes. The content of the statue is mostly based on Buddha's three generations and the thousand Buddhas. This article takes the existing ruins of the Tanyao Five Caves as the practical basis for research, and from this, the following three specific aspects are carried out.

On the one hand, from a macro perspective, we have considered the historical background of the formation of the Tanyao Five Caves. The Tanyao Five Caves are a product of the combination of politics and religion during the Northern Wei Dynasty, and a reflection of the integration of multiple ethnic groups and cultures. The feudal rulers used religion to numb the people, consolidate their acquired power and achieve the purpose of ruling. Studying this period of history is beneficial for us to clarify the important factors that affect the formation of the Tanyao Five Caves from a cultural perspective.

The second is to focus on the internal space of the Tanyao Five Caves, dissect the spatial factors, such as points, lines and planes within the space, from surface to body, to form the spatial form of the Tanyao Five Caves and, then, unpack their spatial form, sum up their spatial types and combine aesthetic principles to derive the formal beauty of the spatial composition of the Tanyao Five Caves. Thirdly, at the micro level, human vision and perception are introduced into the cave space. By researching the spatial composition within the cave space, three parallel spaces that affect the formation of spatial sense are identified: physical space, psychological space and perceptual one. Finally, it is also a summary section that summarizes the characteristics of the spatial composition of the Tanyao Five Grottoes – a comprehensive space that integrates different regional cultures, but is unified in the spirit of Buddhism and creates a religious ideal world in the grottoes, where architecture is integrated with gods and humans, and is unique, diverse and integrated.

1 THE PHYSICAL SPACE OF GROTTOS

Francis (2005, p. 1), in *Architecture Form, Space, and Order*, said: "A simple exterior package competes with complex internal shapes and spatial organization". The author agrees with this statement: a Buddhist space is often composed of various opposing relationships, such as worshippers and worshipped, this shore and the other one, the builders' will, and so on. Studying the essence of space composition is actually a means to clarify the relationship among various elements in space. From the perspective of research procedure, the "study on the spatial composition of the Tanyao Five Grottoes" is based on the analysis and interpretation of the relationship among individual caves (including the architectural space of the grottoes and the spatial relationship among the sculptures in the grottoes) and the space among the grottoes.

It takes the grotto space of the Five Grottoes as the research object, by fieldwork, cultural and historical data, image analysis as the information support source, from the historical and cultural background, and the spatial composition of the grottoes. It starts

from three aspects of the spatial sense and characteristics of the grottoes and, based on the exploration and analysis of the three parts, the characteristics of the spatial composition of the Tanyao Five Grottoes are summarized. From the perspective of research materials, this paper makes use of different types of historical evidence and data for the “Tanyao Five Grottoes”, and collects the field survey data, pictures and basic relevant documents and materials about the Yungang, as well as various documents and anthropological survey reports related to the grotto space as complements. This paper utilizes the existing ruins of the Tanyao Five Grottoes as the practical foundation for the study. It then addresses three key aspects. First, it examines the historical background of the formation of the Tanyao Five Grottoes space from a macro perspective.

As Wu (2022) said, in *Spatial Dunhuang Approaching the Mogao Caves*: “The reconstruction of spatial experience is a method and means of exploring the past, and its ultimate goal is still to construct and narrate the history of grottoes”. The Tanyao Five Grottoes are the embodiment of multiethnic and multicultural integration. The study of this period of history will help us to clarify the important factors that affect the formation of Tanyao Five Grottoes from the perspective of culture. Secondly, it focuses on the internal space of the Tanyao Five Grottoes, analyzes the spatial factors, such as points, lines and planes in the space, from surface to body to form the spatial form of the Tanyao Five Grottoes, and, then, analyzes their spatial form, summarizes the spatial their types and draws the formal beauty of their spatial composition by combining aesthetic principles. Thirdly, at the micro level, human vision and feeling are introduced into the grotto space. Through analyzing the spatial composition in the grotto space, three parallel spaces that affect the formation of spatial sense are obtained: physical space, psychological space and perceptual one. Finally, at the same time, it is also the summary part, which concludes the characteristics of the spatial composition of the Tanyao Five Grottoes - the integration of different regional cultures, but unified in the spirit of Buddhism, the religious ideal world’s creation in the grottoes, the integration of architecture and deities, and the uniqueness, the diversity and the integration of the comprehensive space.

From the perspective of interpretation, the research method of this paper emphasizes the importance of “spatial composition” and “spatial perception”. Space construction refers to the organization, combination and shaping of space. Spatial perception means the process of perceiving the world around you through various senses. At the same time, in order to facilitate the interpretation, this paper has carried out the research method of “image” in words, trying to, based on the combination of image and text, systematically and comprehensively reveal the “spatial relationship” and “spatial composition” of the Tanyao Five Grottoes, hoping to have a more complete understanding of Yungang Studies and the Yungang Grottoes’ spatial form.

Zhang (2011, p. 3) said, in *Space Composition*: “Space refers to the real or suggestive range enclosed by the ground plane, vertical plane and top plane alone or jointly”. The space

of Tanyao Five Grottoes includes the space range, enclosed by the statue, the facade of the open window and the top of the cave. In this enclosed grotto space, it divides the boundary, based on the material one, and the audience or believers' view is constrained within a certain range. With Buddha's three-dimensional images and different specifications, it creates a quiet and solemn sense of space. Therefore, space is not only physical, but also a restricted and closed space. Space is also what human vision can reach, and it is the whole range that human vision can cover at a certain position. Of course, space is also a kind of "perception", which is the "spiritual discipline" of space to people's various feelings.

Early Indian Buddhist monks dig grottoes to pursue the spiritual needs of faith and comfort. That is, the "existence space", which is what *Research on Spatial Narrative*, Long (2014, p. 28) said: "[...] a relatively stable perceptual schema system that settles deep in consciousness, which has cognitive functions". 'Existence space' is a space that we are very familiar with and invest in emotions. Grottoes are the space where Buddhist pursue their faith and realize the true meaning of life. Religion and conscious culture coexist in the "spiritual space". Therefore, the construction site selection of the grottoes should be adapted to the internal requirements of the main spirit and the norms of religious space. The construction direction of the cave space, the size of the cave, the pattern of it, and the means and treatment of some construction technologies are all restricted by religious norms and space. With the continuous development of this ideology and the rapid popularization of religious beliefs, Indian grottoes have gradually become stylized and standardized, forming a cave model that is not only constrained by the environment, but also integrated with religious consciousness. This model serves as both a carrier of material space and a carrier of spiritual space of consciousness.

In ancient India, the Buddhist grottoes were generally transformed into a rectangular cave space from the cliff grottoes. The entrance of each cave was equipped with arches and open windows. First, it was convenient for monks to enter and leave. Second, it was convenient for air circulation. Third, it was convenient for cave lighting. There is a relatively spacious and flat central space inside the cave in this pattern, which is used for Buddhist monks to gather and recite, and for larger group religious activities, such as chanting sutras and worshipping. On both sides of the cave, there are small caves that can accommodate only one monk to sleep and cultivate. This material and spiritual, religious and practical multifunctional space body has gradually formed into "worship caves" and "Zen caves".

In many Buddhist texts, the "Worship Grottoes" or "Sutra Hall Style Grottoes" are written as "Zhi Di", which means "accumulation", implying the gathering of Buddha's inestimable blessings. In the *Nanhai Yigui Nei Fa Chuan*, it is written, "After Nirvana, a person sets fire to a large joss stick, i.e., the ground of collected wisdom for the accumulation of righteousness" (Yi, 1995). It can be concluded that the cave is a rectangular vault with a square pagoda in the center of the hall. The basic shape of this cave is round inside and

square outside, that is, “Horseshoe Shape”, which is a square with four right rounded angles. The space of the caves presents a “Vault Roof”, which is a reflection of the common Indian thatched structure in the caves. The grotto is equipped with a pagoda, with a square or round flat base. Around the pagoda, a clockwise path is set for worshippers to pay homage to the “Buddha Treasure” and practice the mysterious and solemn etiquette in their religion.

Another type of cave is called “Zen Cave”, transliterated as “Vihara”, which, in Chinese, means “residence”, “Residence of Buddhist monk”. Yi (1995) says, in the *Dainichi Sutra*, Volume 3, “Monk House has the name of Brahma Vihara, which is translated as scripture, i.e. Changfu Residence”.⁴ He built a house so that those, who hold the precepts, can protect themselves from the wind, the cold, the heat and the dampness of all sorts of disasters, cultivating Buddhism with peace of mind. In the center of the cave, there is a rectangular hall, called “Guangtang”. Behind the hall, there is a shrine for Buddhist monks to visit. This cave is a square structure, which cuts out a number of small niches about three-square meters, in the front and under the two sides of the cave walls, for monks to live in.

In terms of function, the former is mainly used for Buddhist activities focusing on “commemorative gatherings”, while the latter is mainly used for individual monks’ residence and meditation. These two types of grotto patterns, with religious characteristics and spiritual connotations, have become a spatial pattern of cave formation in Buddhist culture and have a profound impact on Buddhist grotto art. As the birthplace of Buddhist grotto art, ancient India has gradually developed, from using natural caves at first to manually digging caves, to meet the monks’ religious spiritual needs. The cultural development of grotto art has evolved from the primitive, natural and non-human cave culture to the grotto culture that has been repaired, carefully selected and planned. In the process of promoting the grotto culture, the needs of the main spirit are greater than the needs of material existence. Peng (2017, p. 255) said:

On both sides of the river valley that this road passes through, there are mostly mountainous hills with crisscrossing gullies. Only in the Wuzhou Mountain area in the middle reaches of the river, the mountaintop terrain is flat and suitable for military garrisons and large-scale construction.

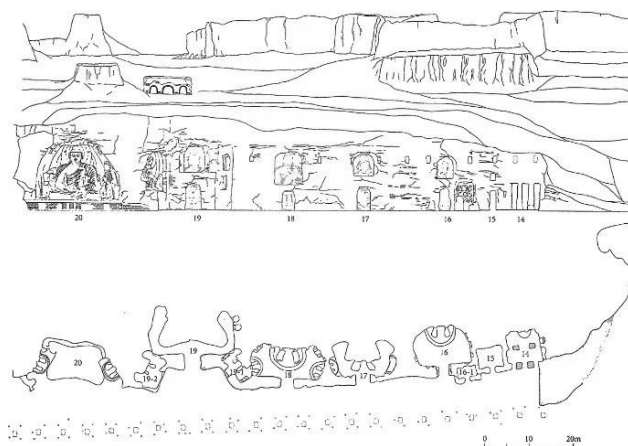
Therefore, it is not only an important fortress, but also a holy mountain for the royal family to visit and worship the two capitals. At the southern foot of the Wuzhou Mountain, due to the erosion and accumulation of river water, two levels of terraces were formed. The first level of terraces was developed and utilized early on. In order to connect the river roads between the two capitals, the width of the roads was expanded during the Northern Wei Dynasty, and the rear edge of the terraces was trimmed to a certain extent. The second level terrace is relatively high from the ground and has a large slope at the back edge, forming a natural cliff.

⁴ *The Commentary on the Great Sun Sutra* is an annotated book of the “Great Sun Sutra”. There are different names, such as “Ben Shu”, “Da Shu”, “Wu Wei Shu”, etc. The circulation volume is 20 volumes. There are multiple versions with varying volumes.

Carving a huge mountain is not just a depiction of the Buddha's image, but involves the design of various aspects, such as natural environment selection, strategic deployment and transportation roads. Prof Peng's analysis supports this idea. The unique terrain of the Wuzhou Mountain, where the Yungang Grottoes are located, as Xin (2005, p. 587), in *Yungang Grottoes and Qidujue Mountain*, said: "The Wuzhou Mountain, located to the west of Pingcheng, is a remarkable mountain that closely resembles the characteristics and stone coloration of India's Sacred Mountain". The Tanyao Five Grottoes were dug on the same extended surface of the same stone view and at the same level. There was a pedestrian walkway in front of the cave. The five units are arranged in series from east to west, with a span of about 100 meters. The height of each cave is equal, and it is more than 15 meters from the high ground.

The north wall outside the cave was once full of thousands of Buddha, but most of them were weathered. The cave owners' Buddha statues are tall, and they are the greatest and most influential Buddhist grotto statues in the 5th century AD. According to the main image and the spatial layout of the grottoes, the five caves in Xian Yao can be divided into three groups: the 18th, 19th and 20th ones, which are mainly composed of three statues or three Buddha ones (Buddhas of the Past, Present and Future). The outer wall of Cave 19 is inclined and concaved, and the left and right Buddha statues are located in the east and west ear holes respectively, which is the central cave of this combination. Grottoes 16 and 17 are a group. The main Buddha of the former is the standing statue of Sakyamuni, while the main Buddha of the latter is Maitreya. The first group of three caves features complete design ideas and the earliest excavation time. The second cave, in the rear group, was constructed later, with noticeable supplementary carvings. The spatial distribution of the five caves in Tanyao is shown in Figure 1.

Figure 1 – Elevation and plane mapping of the Tanyao Grottoes



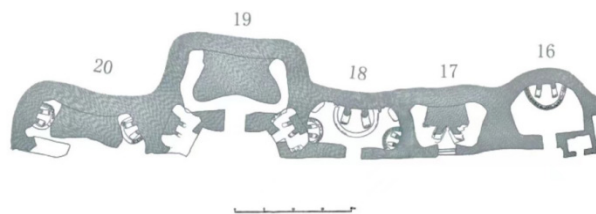
Source: Zhang *et al.* (2019)

From a broader perspective, the sites of China's primary cave temples are determined by specific criteria rather than being arbitrarily chosen. The site selection of the Yungang Grottoes is mainly characterized by the following features: excellent environment, facing the mountains and water, and a treasure land with wind and water. The vast majority of the existing grottoes in China are located in the treasure land of geomantic omen, and the site is located in the best position of facing mountains and backwater. Take the Longmen Grottoes as an example, built on the stonewall of the Longmen Mountain, facing the Yi River. Similarly, the site selection of the Mogao Grottoes of Dunhuang is also very exquisite. It was built on the cliffs in the east of the Mingsha Mountain, close to the Daquan River.

2 HORSESHOE-SHAPED PLANE

The early concept of human understanding of space was not abstracted from the direct experience of space, but rather a spatial experience formed, based on the specific positioning of a certain object (Zhan, 2011). First of all, from the perspective of the cave plan (Figure 2), the plane of the Tanyao Five Grottoes presents a horseshoe shape. The horseshoe shaped plane may have originated from an imitation of nomadic tents. From the perspective of the nature and function of the traditional grottoes, the large image grottoes, in other regions, are designed with passages to facilitate surrounding worship. The most primitive function of the grottoes is to provide a channel for believers to worship. Although large Buddha statues were dug in the Tanyao Five Grottoes, no worship channel was found in the caves.

Figure 2 – Plan of the Tanyao Grottoes



Source: Yungang Grottoes Institute for Research in Humanities, Kyoto University⁵

There are three reasons why the flat horses, in the Tanyao Five Grottoes, are hoof-shaped, and there is no worship channel: 1. The cave safety and rock formation quality are considered: the Yungang Grottoes are dug against the mountain, and the rock formation quality belongs to Jurassic sandstone, which is relatively soft and easy to be carved, but the mudstone zone area is prone to weathering and not easy to be preserved. It can be seen that, although the rock quality in this area is easy to be carved, it is not suitable for the preservation

⁵ Yungang Grottoes - Archaeological Investigation Report on Buddhist Grottoes and Temples in Northern China in the 5th Century AD.

of the grotto space statues, as shown in Figure 3. Considering the special rock mass and the space design of the whole cave, no worship channel has been dug inside the cave. 2. Considering the special statue form of the Tanyao Five Grottoes and the political implication of “the image of the ruler and the Buddha is unified”, the five main statues of the Tanyao Five Grottoes are all tall and magnificent, which is quite imperial.

Since the imperial power is supreme and should not be offended, it should be considered, for the inviolability of the imperial power, that there is no worship channel in the Tanyao Five Grottoes. 3. According to the plan of the horseshoe-shaped cave, there is no more space in the cave outside the main statue. It is more suitable for worship under the giant statue. The limitation of space makes it impossible for people to stay here for a long time, and the space of the cave cannot accommodate more people, thus achieving the goal of making the audience not stay for a long time for worship.

Figure 3 – Severe weathering of mudstone



Source: By the author

3 CLOSED SPACE FORM

The organization of points, lines and surfaces in space is not simply the addition of points, lines and surfaces themselves. Instead, through careful combination, deformation and other processing techniques, various forms become higher visual quality form variants in design (You, 2020, p. 30). The Tanyao Five Grottoes exhibit a contained environment, characterized by three-dimensional worship spaces, formed by points, lines and planes. However, the somewhat enclosed and segregated experience of these grottoes does not align with the spiritual space sought in Buddhist practice. But the research process from the point, the line, the surface to the body is the main part highlighted in the grotto space.

The definition of a point, in the space structure, is that the intersection of two lines is called a point geometrically. The point in the space represents a position. It is the most concise modeling element, and it is the smallest unit in the design language. When a point

is designed in space, it must have the characteristics of size, volume and shape, and, at the same time, it must have a clear direction guidance feature to meet the point in the sense of space design.

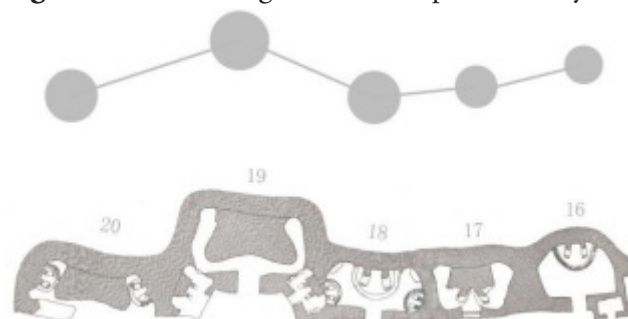
4 POINTS, LINES AND FACES IN SPACE

4.1 FIVE GROTTOS DISTRIBUTED IN DOTS

The unit grottoes are arranged in the form of points as shown in Figure 4. The five caves are basically horizontal. The position of Cave 19 is concave upward and inward. There are two possible reasons for the concave. One is that the cliff wall on the upper part of the mountain, where Cave 19 is located, is flush with the western area. Through special design, Cave 19 deliberately chisels the cliff surface to form a trapped cave surface; another possibility is that some of the cliffs on the mountain, where Cave 19 is located, are naturally sunken, and the excavation works only use this natural condition to repair, before forming the current cave surface form. When we consider the unit grottoes as reference points, it becomes evident that, in a vast spatial environment, the arrangement of these points exerts a significant attraction, resulting in spatial tension that creates a sense of visual tension.

As visitors navigate through these five grottoes, the consecutive sequence of the cave structures contributes to this visual tension. The points can freely form different spatial forms. From the distribution characteristics of the five grottoes, they create a dynamic sense of space. Five consecutive points can create invisible lines in space. This invisible line establishes the unique rhythmic space and temporal one of the Tanyao Five Grottoes. When a point deviates from the center, such as the largest cave in the 19th Grotto, the outer wall of the cave is inclined and concave, and the plane is trapezoidal. The space it creates has a certain sense of movement, highlighting and becoming the role of the visual center.

Figure 4 – The unit grottoes are represented by dots

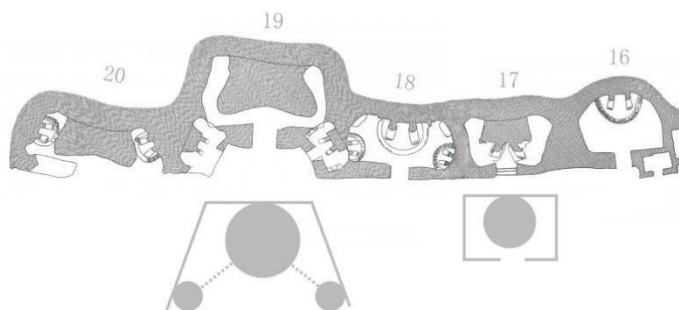


Source: By the author

4.2 GROTTOS CENTERED ON THE BUDDHA

The 19th and 17th grottoes of the Tanyao Five Grottoes are taken as examples. The distribution of the main statue, in the interior space of the grottoes, is shown in Figure 5 below. The main statue of the cave and the grottoes on both sides form a relatively symmetrical spatial layout, and become the largest and the most special grotto in the county Yao Five Grottoes. In the current grotto number, the grotto is the 19th one, and the east and west ear caves are numbered as the 19-1 grotto and the 19-2 one respectively. If we use dots to represent the Buddha statues in the three grottoes, could be discovered that they are very dynamic and have the primary and secondary visual effects. Compared to the simplicity and statics of Cave 17, the main grotto master of Cave 19 deviated from the east-west horizontal axis of the grottoes and became the role of the absolute control center of vision. Therefore, whether it is visual perception or spatial perception, the central Buddha in Cave 19 is the focus of vision. Cave 19 is the center of the Tanyao Five Grottoes. Considering the reasons for the collapse of Cave 20, the originally designed cave in the west of Cave 20 may have to be moved to the current position of 16 and 17.

Figure 5 – The main statue in Cave 19 and Cave 17 is shown in dots



Source: By the author

4.3 DOT DISTRIBUTION OF SMALL STATUES

If the unit Buddha is regarded as points of different sizes according to size and shape, then the cave wall is composed of thousands of Buddhas, and the cave wall body presents a surface composed of points arranged with dense dots. Taking a unit on the west side of the south wall of Cave 17 as an example, the white dot represents the unit Buddha (as shown in Figure 6). It can be seen from the above figure that the distribution of points is regular and organized, forming a strong rhythm, which can obviously strengthen the spatial language potential, map the infinite “Buddhist doctrine” with the limited “Buddha image” and guide the viewers to sublimate their emotions, thus achieving the purpose of understanding life and spreading enlightenment in the Tanyao Five Grottoes.

The thousands of Buddha sculptures, in the Tanyao Five Grottoes, resonate with the thematic representation of Trikalea Buddha, reflecting a profound Buddhist significance. At the same time, this arrangement of countless small seated Buddha statues forms a strong contrast with the size of the large Buddha statues, which increases and strengthens the visual impact, so that people can clearly see the grandeur of the large Buddha statues, as well as the exquisite and dense of the thousand-buddha statues, resulting in endless reverie and incomparable devotion to religion. This kind of artistic creation, displayed by making full use of visual power, is an excellent expression method, both in the promotion of Buddhist ideas and in the design and decoration.

Figure 6 – A unit statue on the west side of the south wall of Cave 17 is illustrated by dots



Source: By the author

The statues in the Tanyao Five Grottoes are not only simple single statues, but also exist as an important display part of the composition of the grotto space. The statues become a part of the grotto space. The composition and carving forms of the statues are designed for the composition of the grotto space. From the perspective of visual culture, the grotto space composed of Buddha sculptures is much more complex and advanced than the single structure. The Yungang Grottoes combine the image with the space to achieve the audience's visual and psychological understanding of faith.

Spatial form composition is an artificially created material form that explores the visual characteristics of various material forms in space, based on the theory of form composition in the spatial environment. The space shape of the Tanyao Five Grottoes plays an important role in the creation of the space atmosphere of the grottoes, and the space shape of the grottoes plays a decisive role in the space shape. In traditional grottoes, regular geometric spaces, such as cuboids and squares, are often seen. Different shapes and spaces have different

sculptural shapes, which will give people different spatial feelings. Using the Mogao Grottoes of Dunhuang as an example, these grottoes primarily feature rectangular spaces that exhibit a clear sense of order and orientation. The spatial form of the Tanyao Five Grottoes is a circular arch space, with the trend of centripetal and cohesion, with a strong sense of closure and oppression, giving people a solemn and rigorous static space. The similarity of the spatial form of the Five Grottoes shows that the designers have a clear and persistent pursuit of the spatial form of the grottoes from beginning to end (Wang *et al.*, 2021).

5 THE FORMATION OF CENTRIPETAL SPACE

Citing the concept of space centripetal in *Towards Architectural Phenomenology*, “[...] the role of centripetal force increases with the increase of the number of enclosing edges of internal space” (Norberg-Schulz, 2010, p. 15). The analysis of the centripetal nature’s spatial expression of the unit grottoes is summarized in the following three points.

5.1 DIVISION OF INTERNAL AND EXTERNAL SPACE: THE FORMATION BASIS OF “CENTRIPETAL”

The division of internal and external space determines the formation of the “centripetal” space. The basic level of the cave body and ground level footpath of the Tanyao Five Grottoes are slightly higher or lower than the surrounding environment. Except for the 17 Grottoes, the rest of the cave rooms have a small degree of uplift or subsidence, but they are divided into two distinct spaces with the road outside the cave. The elevated space inside the cave is independent, indicating that it is different from the surrounding environment in terms of use functions, but has a strong common attribute with the surrounding environment and a certain spatial connection. Taking Cave 17 as an example, according to the profile, it can be seen that the difference between the road outside the cave and the inside of the cave is about 100 cm, forming a sunken space form (as shown in Figure 7). The difference between the height and the outside gives the viewer a sense of protection and enclosure to some extent, and has an obvious effect of isolation from the outside. The division of the internal and external space symbolizes that the cave space is relatively independent from the outside in material and spirit.

Figure 7 – The sinking place of the cave door



Source: Yungang Digital Studio⁶

5.2 SPHERICAL DOME TOP: HIGHLIGHT THE CENTER OF THE SPACE

The spherical dome top of the Tanyao Five Grottoes emphasizes the center of space. The top of the Tanyao Five Grottoes provides a shelter for the space below the top, delimits the invisible ground shape inside the grottoes, and provides material and psychological protection for the objects covered by it. People's feelings about space first depend on the height of the top. Typically, the elevated height can create a sensation of grandeur and remoteness in individuals, while the low ceiling will make people feel warm and close. However, the vertical height of the Tanyao Five Grottoes is more than 15 meters, the top of the cave is domed and turned upward, and the junction between the wall and the top of the cave turns naturally, without obvious boundary, forming a "spherical" round arch.

With the upward development of the cave space, the space is in the process of decreasing and changing. The dome roof brings the directionality of the space in the cave, gives people the sense of infinite rise about the space and simulates the infinity of the universe space. At the same time, it highlights the center of space and realizes the deductive transformation of the cave top from two-dimensional to three-dimensional space. It can be seen from the above that the vertically elongated space strengthens the vertical depth of the grotto space. Under the effect of the vertical depth, the believers can experience the Buddhist cultural connotation of "people and heaven meet each other".

⁶ The Yungang Grottoes are located at the southern foot of Wuzhou (Zhou) Mountain, about 16 kilometers west of Datong City in Shanxi Province, China, on the north bank of Wuzhou River. The grottoes are carved along the mountain, with a grand scale and majestic momentum, stretching about 1 kilometer from east to west. The cave area is divided into three areas from east to west, based on the natural mountain terrain: east, middle and west.

Figure 8 – Vault of Cave 17



Source: Yungang Grottoes Institute for Research in Humanities, Kyoto University⁷

5.3 INCLUSION OF SPACE: CLEAR RELATIONSHIP BETWEEN PRINCIPAL AND SUBORDINATE

In the interior of the grotto space, a number of sub-spaces (the main Buddha occupies most of the space inside the grotto) are completely set in a whole space. Its back is connected with the mountain body, and they are consciously designed to overlap. In terms of space form, the large grotto space contains internal sub-spaces, which exist in the same space in different forms. The large grotto space contains a sub-space (the main statue), and the two spaces of the main statue and the grotto body can produce visual continuity. However, the mutual combination of subspaces is the basic guarantee to handle the whole space well. The spatial combination of the main cave body in the Tanyao Five Grottoes reflects the ancient people's wisdom in the Northern Wei Dynasty. The shape of the main statue protrudes from the wall, and is connected with the inclined wall rocks and with the dome. The towering Buddha statue leans forward on the wall. In the inclusive space of the grottoes, there is no obvious difference in size between the large space (grotto body space) and the small one (main statue space), and the small space is in the same direction as the large space. Therefore, the sense of spatial inclusion of the Tanyao Five Grottoes is weak.

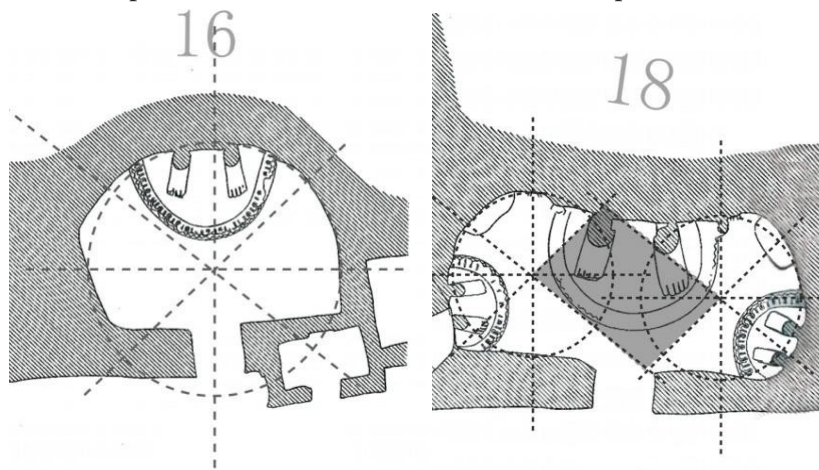
5.4 CURVE IN SPACE - THE FORMATION OF “CENTRIPETAL” SPACE FORM

From an imaging perspective, it would appear, from their placement of the caves in the pass to the west from Datong and from the interest in the foreign monks as soothsayers, that they had something even more immediate in mind: the protection of the Wei state -

⁷ Yungang Grottoes - Archaeological Investigation Report on Buddhist Grottoes and Temples in Northern China in the 5th Century AD.

literally, their own bit of paradise right here on earth (Huntington, 1986, p. 142). From a spatial perspective, the curve of space plane shape - the formation of “centripetal” space shape, the centripetal nature of the space, enclosed by different degrees of curves, is different. The centripetal space, formed by the curve enclosure, depends on the direction of the central master of the grotto. In the space of the grottoes, the purpose of creating a centripetal space is to make people feel pious and whole-hearted towards the Buddha in the space with centripetal nature.

Figure 9 – The centripetal sketch of the curve formed in the plan of Cave 18 and Cave 16



Source: By the author

CONCLUSION

According to Li (2005, p. 6), in his discussion on the *Yungang Grottoes and the Northern Wei Period*: “The Yungang style stone carving art is deeply influenced by Indian art and is a fusion of Chinese and Indian art”. At the same time, India’s plastic arts are more influenced by Greek art, which means that ‘yungang style’ is an artistic crystallization that combines Chinese art, Indian art and Greek one organically. i The Tuoba clan served as the ruling dynasty of the Northern Wei, a people’s branch of the Inner Asian Xianbei active in the steppe land. Grassland culture, royal politics and Buddhist culture are all reflected in the cave space. ii The spatial composition of Yungang Buddhist grottoes shows the extreme beauty of form and art in the form of statues, structural layout, spatial form of caves, etc. It will combine the formal factors, such as orderly arranged points, smooth and powerful lines, structured faces, true and exaggerated proportions, and the rhythm that forms the unique characteristics of each cave, with the profound Buddhist doctrines expressed by Buddhist statues. iii The integration of historical and cultural connotations, pointed by religious images, constitutes the spatial complex of the Yungang Tanyao Five Grottoes, which shows the blending and combination of various forms of factors, applies “spatial force” to people and, finally, perfectly

interprets the religious, political and cultural significance of space. The spatial design of the caves of Tanyao is not just an expression of architectural art, but a profound reflection of philosophical issues, such as religious belief, social power and human experience.

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