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# Abstract

With the influence of globalization, an increasing number of modern buildings have a general problem of homoplasy (Universalism), which is contrary to the proposition of regionalism. As far as we concerned, architecture is an important medium to understand history and culture in a certain region. Then, the representation of regional culture and history through architectures are brings into question the cultural identification and the perception of affiliation. Meanwhile, the development of digital information technology is promoting a new architectural design mode in twenty-first century. The Computer Aided Architectural Design (CAAD), especially supported by computational strategies, establishes a strong interplay between architecture and information technology, then we are convinced that the use of parametric architectural modelling can support the development of new integrated strategies for facing at the same time contemporary and historical architectural problems.

Therefore, we will attempt to use parametric methods to find the appropriate methodology for linking vernacular manifestation on

contemporary buildings in this research, with special reference to some relevant ancient and modern Chinese architectures and settlements. And in the end, as a test and a practical exercise, we will apply some computational methods to selected cases from the emerging trends of the contemporary Chinese cities, taking into due account the vernacular manifestations of the Chinese tradition.

Keywords:

Vernacular Architecture,  
Computer Aided Architectural Design,  
Parametric Method,  
Computational Design,  
Contemporary and Historical Architecture

# Preamble

## Research motivation

With the globalization around the world, modernism have spread to every corner, especially the metropolitan, resulting in the problem of universalism. The similarity between modern cities arouses our attention to have introspection on our own identities. Additionally, the situation among Chinese cities is obvious, because there more people are chasing the modern than considering the traditional aspect. As a matter of fact that architecture is an important medium to propagate the culture and history, it is appropriate to take advantage from this solid volume to get immaterial value by learning and understanding its origin and development then the mature form. Moreover, the great culture of China interested us a lot that we would like to inherit in a good sense.

In fact, we understand the modern and the tradition are not the contrary on each side, which means they can be well cooperate with each other in some sense. Under the certain requirement for living in modern time, to satisfy the material demand, our purpose is to discover the methods to make them integrated well with each other.

# Preamble

## Research status

Vernacular architecture is getting more popular now than before, some architects are also doing the practical experiment by using the Chinese traditional architecture elements. For example the architect Wangshu who is famous of using local construction materials and transformed the manifestation of traditional roof. The renovation of a Chinese traditional street is also famous. Besides, other architects such as Li Xinggang, Zhang Lei and Zhang Ke etc, these young architect care about the essence of tradition and show the creative face in their way, more concentrate on presenting the space not just the symbolic appearance, in order to discover the connection between architecture and human, being closer to both mental and physical world of people. That should be inspiration a lot for us. As the aspect of parametric study on traditional vernacular architecture, it is a field need more people to experiences, which make us believe our process is worth.

# Preamble

## Research method

After the inspiration from critical regionalism theory from Alexander Tzonis, we consider it is an innovated way to use western thought and logic to dissect the regional and vernacular elements of Chinese traditional architecture. First of all, it is no doubt that we should have a completed knowledge of Chinese traditional architecture, for which we start to sort out the material thought out the whole history of China, from ancient to modern in order to better discover its discipline behind. Then we abstract the key elements after logical analysis based on all the relevant research material by comparing, selecting and sorting all the architectural elements in different scale which includes city scale, street scale and architecture scale. After the cumulative progression way for exploration, we conducted experiments in a parallel manner. Using the advanced computer-aided method to parametrical simulate all the possibilities. All the parameters are defined based on the pervious study which is the significant element for each typology. Finally, by combining all the results while considering the reality demand, we achieve our goal to introduce the possibilities of Chinese vernacular architectures and provide the inspiration to people which can make modern architecture more characteristic.





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Introduction



1  
Ruminating on  
the Vernacular  
Manifestation from  
the Perspective of  
Critical Regionalism

At the beginning, we would like to interpret the definitions of two terms, 'regionalism' and 'critical regionalism' in architectural field. According to the relevant materials that we found, the term of 'regionalism'<sup>1</sup> generally refers to the context and customs of making buildings in a particular region. These buildings had to be very performative, relying on specific knowledge of the climate, geology, geography, and topography. Different societies used what they had available and invented ingenious ways to build their accommodations. What they built had to keep them warm in the cold, cool in the heat, and dry in the rain. Meanwhile, regionalism in architecture often has a cultural aspect built in, and you can see political structures, family dynamics and societal organization reflected in some buildings. And of particular note is that 'critical regionalism'<sup>2</sup> is an approach to architecture that strives to counter the placelessness and lack of identity of the International Style, but also rejects the whimsical individualism and ornamentation of Postmodern architecture.

As far as we are concerned, critical regionalism is that after understanding and rethinking, the innovatory development

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1 <https://study.com/academy/lesson/regionalism-in-architecture-definition-characteristics-examples.html>

2 [https://en.wikipedia.org/wiki/Critical\\_regionalism](https://en.wikipedia.org/wiki/Critical_regionalism)

based on vernacular architectures in regions.

## The Beginning of the Regionalism Movement

Not only that, under our research, regionalism is also a historical phenomenon, with its own evolution process and purpose. At an early age, regionalist architectural design arised, it was a design principle that was contrary to existing local standards and official dogmas. We might even call them minorities. Regionalist architecture rarely emerges without its social and cultural background. It has distinctive features and its purpose is to help build the identity of a group of people.

During the Roman Empire, Roman architecture became a symbol of autocratic monarchy style. To show the glory of the Roman Empire. The first feature of the Roman Empire architecture is large.<sup>1</sup> Whether it is a temple or a public gathering or entertainment venue, the building is very large in size and capacity. The rulers of Rome want to embody their sacredness and greatness with a combination of huge volume and

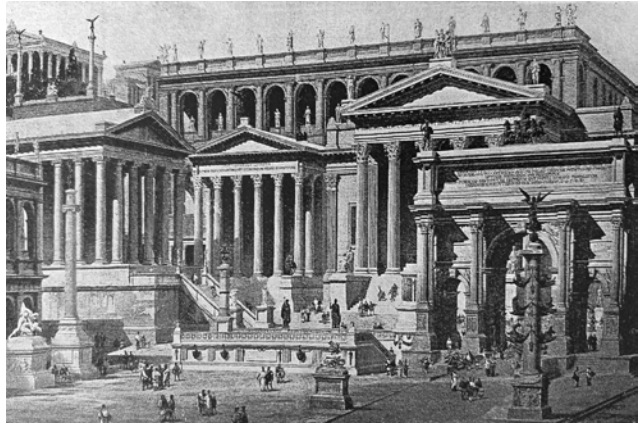


Fig. 1.01 The Roman Forum  
Source: <http://www.mayaincaaztec.com/roar.html>

appropriate planes. The second feature of the Empire architecture is the luxurious decoration. Luxury in the Roman Empire was prevalent, and the decoration of the building became ambiguous, cumbersome and bloated. The third major feature of the Empire period is that as a work of art, the grandeur of its quantity, volume and external form exceeds the pursuit of artistic appeal.

Gradually, in this social context, more and more regionalists struggle to resist the rule of authoritarianism and defend the values of freedom. Regionalist buildings rarely emerge from their backgrounds, they are distinctive, and their existence is meant to help build a status symbol of a faction and a group of people.

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<sup>1</sup> Liane Lefavre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 3.



This ideology was reflected signally by the garden architecture at the time. The origin of British landscape garden emerged in England in the early 18th century.<sup>1</sup> It was influenced from the paintings of landscape by Claude Lorrain, and spread across Europe, replacing the more formal, symmetrical *jardin à la française* of the 17th century as the principal gardening style of Europe.

When sculpted, fascinating French architecture and gardens were all the rage, he focused on pioneering fresh, native-style early Italian paintings. Such landscapes attracted the British who traveled to Italy at the time and were brought back to the Britain. At that time, those landscape painting influenced English garden went into a special style of praising the natural beauty and anti-dogma.

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1 Liane Lefavre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 5.



Fig. 1.02  
A view of the Roman  
Campagna from  
Tivoli, evening by  
Claude Lorrain,  
1644-1645  
Source: [https://  
en.wikipedia.org/  
wiki/Picturesque](https://en.wikipedia.org/wiki/Picturesque)



Fig. 1.03  
In The Shade Of  
The Med Wall The  
English Landscape  
Garden  
Source: [http://  
antigaigreja.  
blogspot.com](http://antigaigreja.blogspot.com)

The English garden is a style of landscape and presented an idealized view of nature. It also drew inspiration from the classic Chinese gardens of the East. In 1692, William Temple put forward his proposition in his article which about anti-uniformism. He shared his experience while he was traveling in China: the territorial of China is vast, as well as the way of thinking from Chinese is also very broad.<sup>1</sup>

Different from European architectures and European garden, instead of the beauty of geometrical proportion, Chinese people always take inspirations from nature while they were making buildings. Even William presented his statement from a Chinese in his notes: 'it is simple to arrange the roads in a straight line and plant the trees

at the equal distances.'<sup>2</sup> From these we can understand clearly the otherness between western ideology and Eastern ideology.

Make a conclusion for the beginning phase of the regionalism movement, we can say its primary Picturesque Regionalism was presented by the landscape painting in Britain and the evolution of the Idea of the English Picturesque Gardens in the beginning of 18th century.

### Romantic Regionalism

The picturesque movement in Britain is only the beginning of regionalism. Political

1 Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 5.

2 Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 7.



Fig. 1.04 Three Factors of Memorial Architecture  
Source: Produced by authors

liberation is increasingly manifested in the shaping of the uniqueness of the group. And Germany continues to deepen this process and evolve into a movement, a movement that was called as Romanticism. Accompany with this movement, the Regionalism developing to Romantic Regionalism. The key and transition of this new era is indispensable to the writing of Johann Wolfgang von

Goethe in 1772 (Figure 05). Goethe, who was only 19 years old, used architecture to awaken the common memories of the Germanic people.<sup>1</sup> In his writing, he attempted to compare Cathedrale Notre-Dame de Strasbourg which completed in the Middle Ages with the rule of classic architectural aesthetics. The short experience brought by architectural details and materials has evoked a common memory of the past for those people. It is precisely because a departure from the principle of classic architectural aesthetics, Cathedrale Notre-Dame de Strasbourg become the unique existence of this unique land.

That means, while Germanic people standing on this land and looking at the Strasbourg Cathedral, people's alone memories would be brought from the past by the materials and details from the architecture increasingly. Human emotions and the building itself will resonate at this moment.

Fig. 1.05  
Yongzheng  
December  
Music Map  
Source: June  
Naliang.  
Sakamoto  
color. Beijing  
Palace Museum  
Collection



<sup>1</sup> Liane Lefavre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 6.



The image above is obtained from archive, there is a historical drawing which presents the perspective view of city Strasbourg in 1493. (Figure 6) There's such a beautiful picture presented in front of us. For Goethe, when he first saw the cathedral, he was shocked by the many decorative details of the cathedral. At this moment, the cathedral is no longer

an expressionless barbaric building for him, and Goethe is no longer ashamed of the cathedral. The cathedral with local characteristics makes its people proud. When the first rays of the sun shone on the walls of the church in the morning, Goethe could not help but sigh: "This is our building, this building can bring our memory to us."<sup>1</sup>

Fig. 1.06  
View of Strasbourg  
in 1493  
Source:  
The Hebrew  
University of  
Jerusalem & The  
Jewish National &  
University Library  
<http://historic-cities.huji.ac.il/france/strasbourg/maps>

<sup>1</sup> Liane Lefavre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 7.

After that, combining with the various interpretations of relevant materials we have, we put forward our consideration refer to regionalism of this stage, the Romantic Regionalism from Goethe's philosophy was showing the three basic points of its style. First, people finally get rid of the traditional architectural aesthetic standards to observe the architecture. Second, observers must discern the quality and uniqueness of the building. Last, observers can establish an intimate relationship with the building, because the building can evoke the viewer's perception of the past and his own community.

## Regionalism Movement in An Extreme Direction

This phase of regionalism has moved towards commercial and propaganda. In the beginning of 19th century, Romantic regionalism has been introduced into the study of folklore in order to describe these encircled territories through buildings with common quality characteristics: the common way to design the project site, the same building materials and the decorative details to clarify Uniqueness and labeling the "domain of influence" of this region. On the other hand, a large number of new buildings have been given the characteristics of "regionality".

Fig. 1.07  
Bird View of  
La Plaza de  
España  
Source: www.  
independent.  
co.uk



In response to this trend, those areas which were lacking regional architecture had been risen a fad of imitation about history and excavated underground culture to establish the necessary local characteristics. The trend of regionalism in the extreme direction had led to not only public buildings, but also private houses were trying to achieve localization. To build an independent country divided by race to participate in national territorial competition. These commercial regionalists give the illusion that "the world is there." A hypocritical geographical entity that is easily accessible, even without the need for a translator, can be as nourished as other shoddy items or products of the mass media, so that emotions are nourished and rationality is exhausted. This typical method of using the masses to create consumption is an international Expo.

In the last 50 years of the 19th century, it not only displayed a variety of regional style architecture, but also sold a wide variety of local cuisine and crafts. Among them, the most successful regionalist building is the huge art square designed by Anibal Gonzalez in 1929 for the Iberian Exposition in Seville.<sup>1</sup> (Figure 07)

Among them, the most successful regionalist building is the huge art square designed by Anibal Gonzalez in 1929 for the Iberian Exposition in Seville, its plan is shown above (Figure 08). The local-style elements from Bilbao, Santander, Valencia and Madrid, connected with other various elements from the Iberian Peninsula, form a collection of architectural montages. It should be pointed out that the Seville Art Square is not just a commercial project. It also shows a political attitude: how to maintain the unity of the world, give a variety of diversity, and maintain the unity of the country. As Goethe's evaluation of the Cathedrale Notre-Dame de Strasbourg, there is no need for interpreters, as long as a large number of buildings can directly transmit information of vernacular region.

The turning point was that the Great Depression of 1930 and the political crisis have affected all modern countries. Since then, regionalism has developed with its extreme tendency, then regionalism has become vulgar at this stage. Even regionalism was used as a political tool by Nationalism. Regionalism architectures in this period just like a shoddy or media product, for the propose of propaganda

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<sup>1</sup> Liane Lefavre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 9.

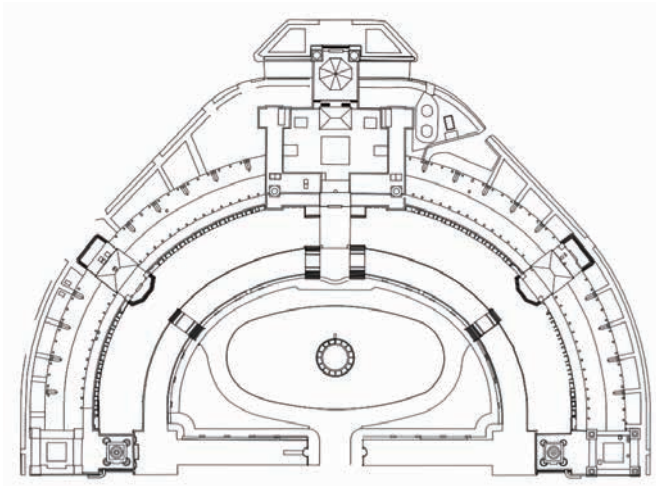


Fig. 1.08  
Bird View of  
La Plaza de  
España  
Source: exp  
osicionibero  
americanade  
sevilla1929.  
blogspot.com

and commerce. Even get worse in later stages. In the 19th century, the regionalism architectures exploited by politics had become a propaganda weapon of extreme nationalism. As far as I am concerned, this was a hypocritical regional manifestation and an

architectural form that was independent from vernacular essence.

### Nirvana and Rebirth of Regionalism

The Nazis distorted regionalism into the “homeland’s” architecture, the close connection between regionalism and the ideological liberation movement in the past is gradually becoming out of touch at this stage. Regionalism has further turned into a propeller for business, a propaganda position for chauvinism, or become a weapon for political movement. Under this background, Lewis Mumford proposed a new concept of his standpoint about regionalism architecture, the Critical Regionalism during this critical

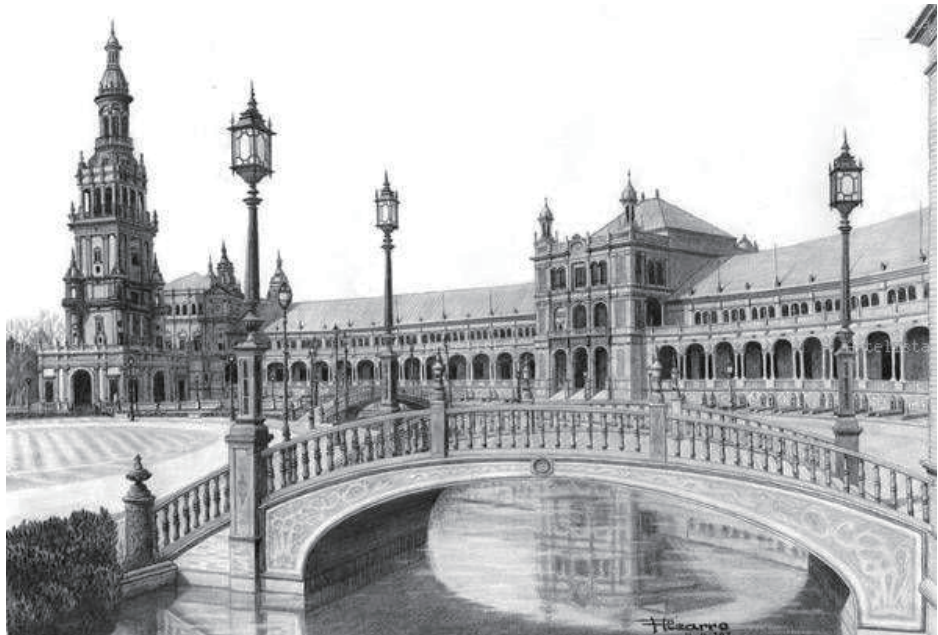


Fig. 1.09  
Drawing of La  
Plaza de España  
Source: http://  
Franciscopizarro.  
Artelista.com

period. And he was developing it in order to against into propagandistic regionalism.

He criticized this propagandistic regionalism as neglect of the local land. Think of land as “the means of obtaining benefits and the object of investment” rather than as “homeland”, as well as increased consumption and the gap between wealthiness and poverty. The building is not built for the site and user. Lewis Mumford stood for the regional architecture is that the architecture is built on deep understanding of the site. It is from scientific achievements and true democratic politics, not controlled by the empire and dogma.

At the same time, Mumford’s redefined regionalism also emphasizes the role of the relationship between man and real life, and make the people feel comfortable. Then the ruminating on regionality drive people not blindly rely on the technology-oriented internationalism which is more about technology-oriented. Let people liberate from the dogmatic architectural design principle. In his column on October 11, 1947, in the *New Yorker* magazine<sup>1</sup>, Mumford once again elaborated on the concept of regionalism. The task of

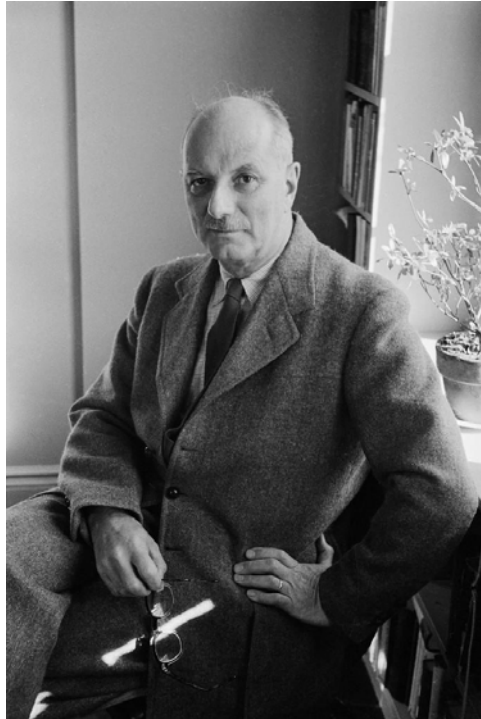


Fig. 1.10  
Lewis Mumford,  
1961.  
Source:  
<https://www.wnyc.org/story/206665-lewis-mumford/>

criticizing regionalism is to reflect on architecture in terms of region. And how can universal dogmatism describe the complex but harmonious relationship between humans and ecosystems in a single and absolute way? <sup>2</sup> Blindly accepting these dogmas in a holistic manner can only bring about the economic cost and the destruction of human ecology. The critical regionalism design method we are talking about is to benefit from universalism while maintaining the diversity of architecture.

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1 The *New Yorker* is an American magazine featuring journalism, commentary, criticism, essays, fiction, satire, cartoons, and poetry. Started as a weekly in 1925, the magazine is now published 47 times annually, with five of these issues covering two-week spans. ([https://en.wikipedia.org/wiki/The\\_New\\_Yorker](https://en.wikipedia.org/wiki/The_New_Yorker))

2 Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 14.



## Five characteristics of Critical Regionalism from Lewis Mumford:

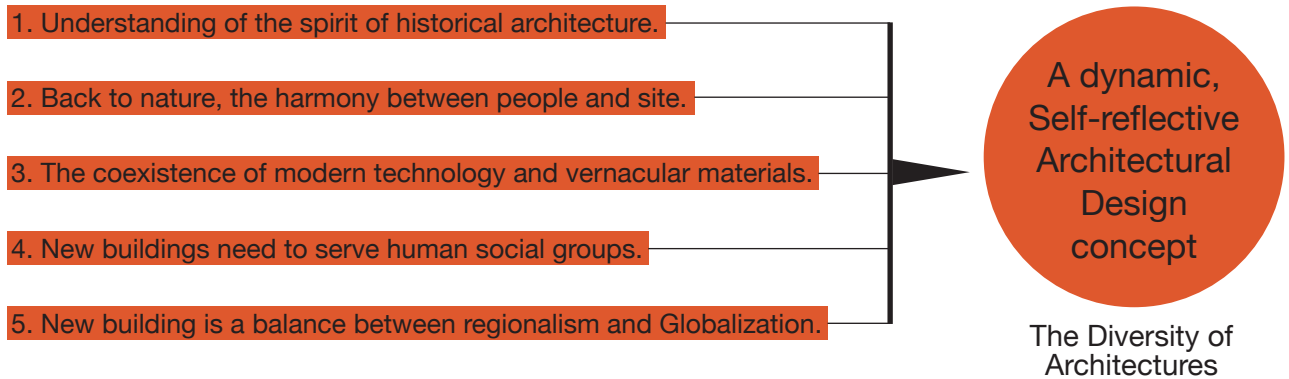


Fig. 1.11  
Scheme of 5  
characteristics  
of Regionalism  
from Lewis  
Mumford  
Source:  
Produced by  
authors

With such a trend of development and maturity, the new definition of Regionalism by Lewis Mumford was gradually accepted and learned by everyone. And there is scheme illustrates five characteristics of Critical Regionalism from Lewis Mumford above (Figure 11), then the more detailed explanation from these five characteristics of Critical Regionalism from Lewis Mumford as following<sup>1</sup>:

1. He refused the new building to completely imitate the historic buildings, and he rejected absolute historical determinism. The historical form of those architectures was according to previous civilization and the era of the past. Nevertheless, these buildings are just empty envelopes because they were lack of the foundation of previous life. The vernacular materials should be preserve

and should be the part that are adapt for modern life. Understanding historical buildings can't just understand their appearance, but more importantly understand their spirit. (Understanding of the spirit of historical architecture.)

2. Back to nature, the harmony between people and site. Mumford still has no stagnation. He opposes the picturesque, purely aesthetic and spiritual enjoyment of the landscape with personal taste. Although Mumford loves this land, for him, regionalism is not limited to the spirit of the place, but also "a place where people can touch and create memories." He believes that true regionalism should be the closest to real life situations and needs, and in the environment to give the most sense of home, but also to reflect the local cultural background at that time.

<sup>1</sup> Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 27.

3. The coexistence of modern technology and vernacular habitude. On the other hand, his ecological view is not a revolt against all machine civilizations. Mumford endorsed the most advanced technology at the time, as long as it was functionally sound and acceptable. For example, although he believes that natural ventilation is still the best choice in most residential environments, mechanical air conditioning is an effective aid to natural ventilation in some cases. Let traditional habitudes and modern technology blend harmoniously.

4. New buildings need to serve human social groups. Mumford's definition of a human social group, he believes that the community should play a central role. He once said, "We can't simply understand architectural art as just providing a place for people to shelter from the rain." Instead, use architectural art to show and enhance the will and ideals of an era and a group of people. This kind of effort stems from the actual needs of the environment to be transformed, but this transformation is not just a direct need to serve people, but also to form a multicultural symbiotic community.

5. New building is a balance between

regionalism and Globalization. Lewis Mumford did not confront the two concepts of " Regionalism " and " Globalization ". He did not completely regard regionalism as a tool to resist globalization, but to build a delicate balance between them. Regionalism and globalization are not mutually exclusive.

Regional characteristics need to be closely linked to context and urban design. Like Elizabeth Mock <sup>1</sup> believes that, regionalism is an essential part of modernism, not an opposite. Mumford's point interpreted a multi-faceted, versatile, and interdisciplinary approach to shaping the environment and facing demands of new social realities.

Through the study and research of Mumford's critical regionalism, Mumford's critical regionalism brings us not only the inner standpoints but also a critical mind to cognize objects. Liberating people's thinking about architecture from the old, dogmatic habits, multidimensionally and dialectically looking at things. As far as we are concerned, summarizing the education that history brings to us, not to be trapped in the current development trend, and feel and propose a new possibility to construct the world.

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<sup>1</sup> Liane Lefavre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003. Page 14.

All of these experimental parametric models we present above are applied parametric method with fundamental parameters. Honestly, based on the theory of critical regionalism architecture we study during research, we understand the process we have interpreted is just keep the vernacular characteristics from traditional Chinese house, and import basic parameters into algorithm in a formalistic way. According to this mentality of integration, we should critique ourselves based on the theory from Luis Mumford who defined the critical regionalism architecture.<sup>1</sup> (Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003.)

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<sup>1</sup> Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003.



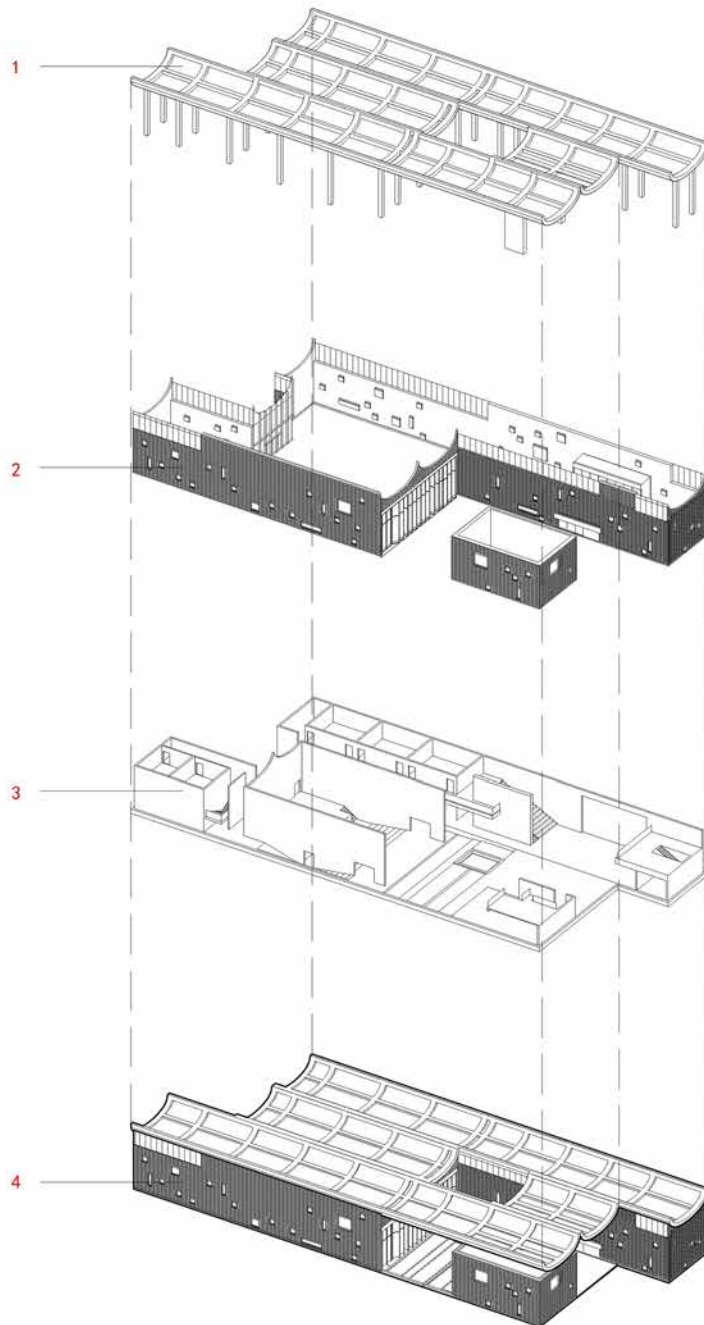
Fig. 1.12 Photography of Tian Han Cultural Park  
Source: <https://www.archdaily.com/905002/tian-han-cultural-park-wcy-regional-studio>

## Tian Han Cultural Park

WCY Regional  
Studio, 2018



Fig. 1.13 Perspective View of Semi-Open Space  
Source: <https://www.archdaily.com/905002/tian-han-cultural-park-wcy-regional-studio>

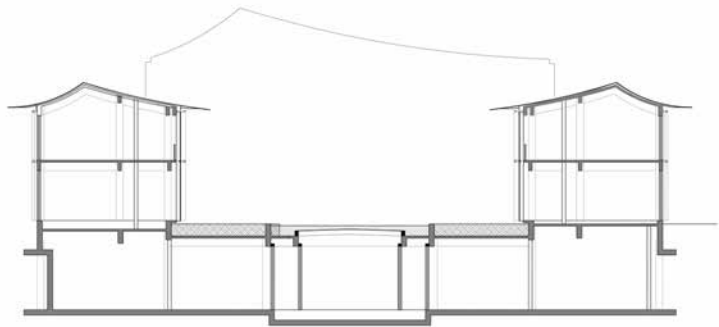


- 1 Building structure
- 2 Facade system
- 3 Interior function
- 4 Intergrated structure

Fig. 1.14 Axonometric View of Exploded Model with Different Functions  
Source: <https://www.archdaily.com/905002/tian-han-cultural-park-wcy-regional-studio>



Fig. 1.15 Front View of Shimao Longyin Leisure Center  
Source: <https://www.archdaily.com/916362/shimao-longyin-leisure-center-lacime-architects>



Shimao  
Longyin  
Leisure Cente

Lacime  
Architects

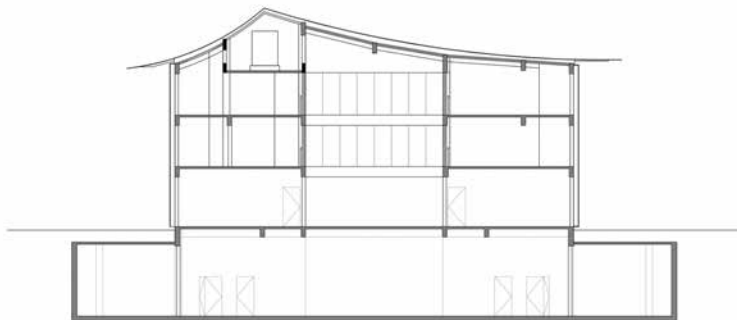


Fig. 1.16  
Section Drawing  
of Shimao Longyin  
Leisure Center  
Source: <https://www.archdaily.com/916362/shimao-longyin-leisure-center-lacime-architects>

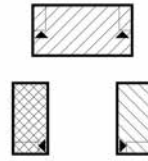
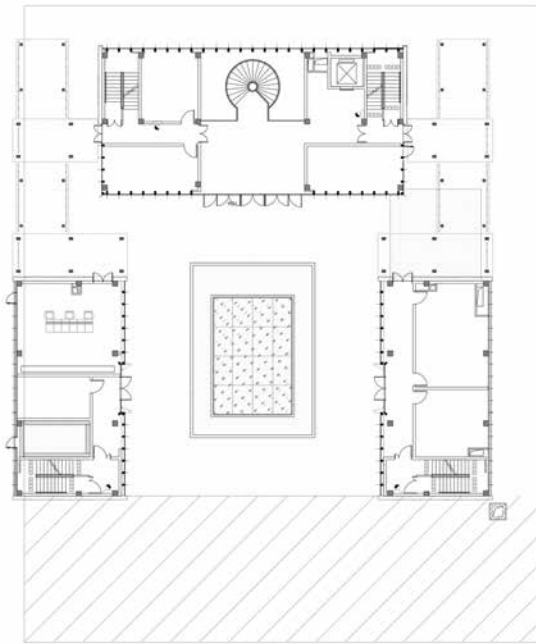
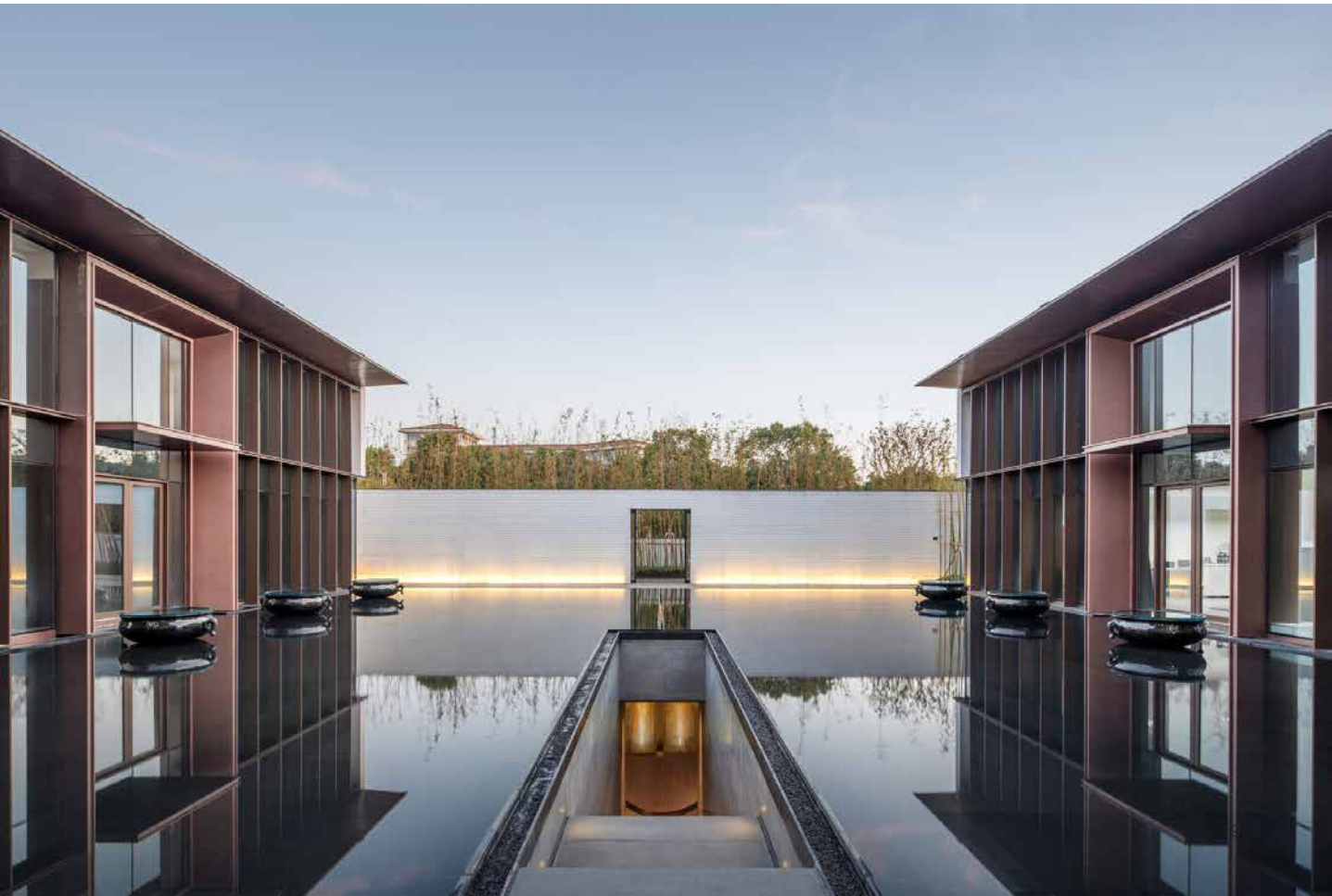


Fig. 1.17  
Plan Drawing of  
Ground Level  
Source: [https://  
www.archdaily.  
com/916362/  
shimao-longyin-  
leisure-center-  
lacime-architects](https://www.archdaily.com/916362/shimao-longyin-leisure-center-lacime-architects)

Fig. 1.18 Perspective View of the Enclosed Pool  
Source: <https://www.archdaily.com/905002/tian-han-cultural-park-wcy-regional-studio>



After this studying about Regionalism architecture from Lewis Monford, looking back at the current Chinese environment. It is not difficult to find that the environment of today's Chinese architecture is undoubtedly affected by globalization. Under the influence of Western modernist architecture, a large number of glazing - facade towers and massive masses rose up on the land in China. There are plenty of tradition or vernacular buildings are gradually disappearing and replaced by some cold, impassive buildings. Now we have this phenomenon in our homeland, no matter where in China, even if these cities have

different geographical conditions and cultural environment, all of them have the similar language of buildings, we could even say some Chinese metropolis are reproducing the same urban appearance of New York.

When the economic development of a city is less dependent on manufacturing and more dependent on knowledge, the value of culture to promote urban development is increasingly prominent.<sup>1</sup> Throughout the cultural development of Chinese central cities, the dominant factors determining urban development are shifting from economic aspects such

Fig. 1.19  
Urban appearance  
of one Chinese  
Metropolis  
Source: Tom  
Uhlenberg,  
uploaded 16  
January. Elevated  
view of highrise  
apartment  
buildings in Hong  
Kong/[https://  
www.stocksy.com](https://www.stocksy.com)

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1 Zhou Fan. *A puzzle of "Thousand cities have the same urban appearance"*. Article source: Journal of Social Sciences, August 31, 2017





as capital and resources to cultural and creative aspects such as talents, systems, environment and innovation. With the needs of urban transformation and renewal, the value and significance of urban cultural competitiveness is becoming more and more important.

Fortunately, some Chinese architects are working hard to explore Chinese regionalism, there will be success on the road of exploration and there also will be setback. For instance, the project from Wang Shu, New Academy of Art in Hangzhou, which demonstrating a integration between Modernism and vernacular presentation (Figure 24). Through repeated explorations and

attempts, as well as contemplating the limitations of postmodernist architecture in Post-Modernism. We firmly believe that imitating from Chinese traditional architecture blindly is not a proper way to carry forward the real Chinese vernacular architecture. Ruminating the real soul of Chinese traditional architecture, instead of mimetic skin of Chinese buildings would be our task in this thesis to explore.

Meanwhile, after the conclusion, we produce a chronological diagram (Figure 25) to present the different origins of Chinese architecture and western architecture for the guiding significance about the impact of different ideologies on architecture.

Fig. 1.20  
New Academy of  
Art in Hangzhou  
/ Wang Shu,  
Amateur  
Architecture  
Studio  
Source: Sharon  
Lam. Focus:  
Wang Wei.  
[https://www.  
archdaily.cn/  
cn/801319/jiao-  
dian-wang-shu](https://www.archdaily.cn/801319/jiao-dian-wang-shu)



The origin of western European culture we think it could start from Mycenae (Ancient Greek), different from Chinese culture in the east. The architecture in this region is root in "Stone Culture". The geographical features of the Mediterranean coast, and local resource characteristics. People are used to constructing buildings with stones.



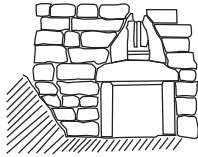
**Primeval era**



**Civilization**

The period of Greek history from about 1600 BC to 1100 BC, is called Mycenaean in reference to Mycenae. At its peak in 1350 BC, the citadel and lower town had a population of 30,000 and an area of 32 hectares.

Due to the belief in the deities of ancient Greece, the building began to develop in large and high altitudes. The Lion Gate at Mycenae, the only known monumental sculpture of Bronze Age Greece



Under the rapid development of democracy and freedom, people's exploration of nature is deeper. Unlike the oriental thought, the fear and the respect of nature. Western culture is based on human beings and transforms nature.

Then the results of scientific theory appear, the proportion of the human body, the proportion of golden division, these geometric orders affect the development of architecture. These orders have become the dominant factors affecting Western architectural design. Make its buildings become more rational. Parthenon illustration, 423BC.

1200 BC

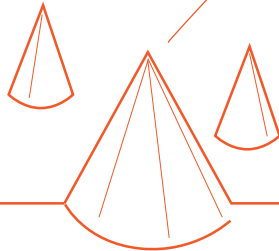
800 BC

**Organization and rulemaking**

The requirement of bigger space for organized activities, such as discussing issue and gathering people by the leader in the tribe.

**Primeval demand**

The origin of houses were using the wooden stick to create a triangle space. And the roof was roofed with straw. Following the basic requirement of survive.



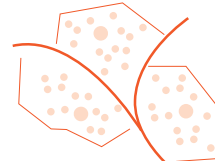
**Technological progress**

The consequence of the requirement of bigger space leading the development of building techniques. The ancient people start to use beam to create a cuboid space. They chose wood to be the main material, starting to search the better technique to join the woods. The mortise and tenon joint was the precondition for Tou-Kung to be formed.



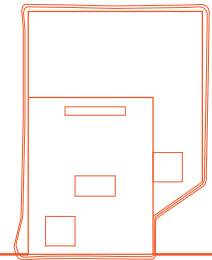
**Settlement and conflict**

The emergence of mutual struggle has led people to start building walls for maintenance. This is the source of the emergence of the city.



**Power and rule of emperor**

The slave society was born, the society was developing, the city was gradually formed, and people began to think about the layout of the city.



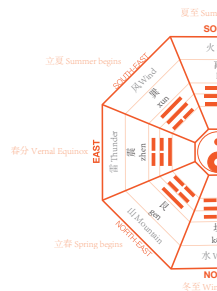
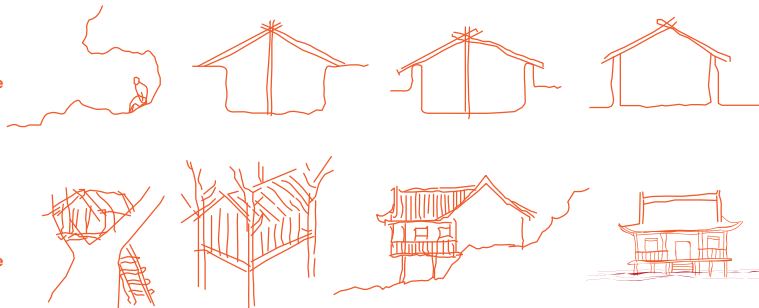
Rammed earth skill were matured and widely used.

East H Buddh

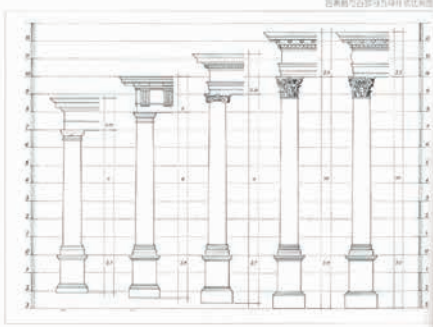
**Northern residential architecture**

variation in natural factor

**Southern residential architecture**



Classical order of Ancient Greek and Ancient Roman



Senātus Populus Que Rōmānus

754 BC

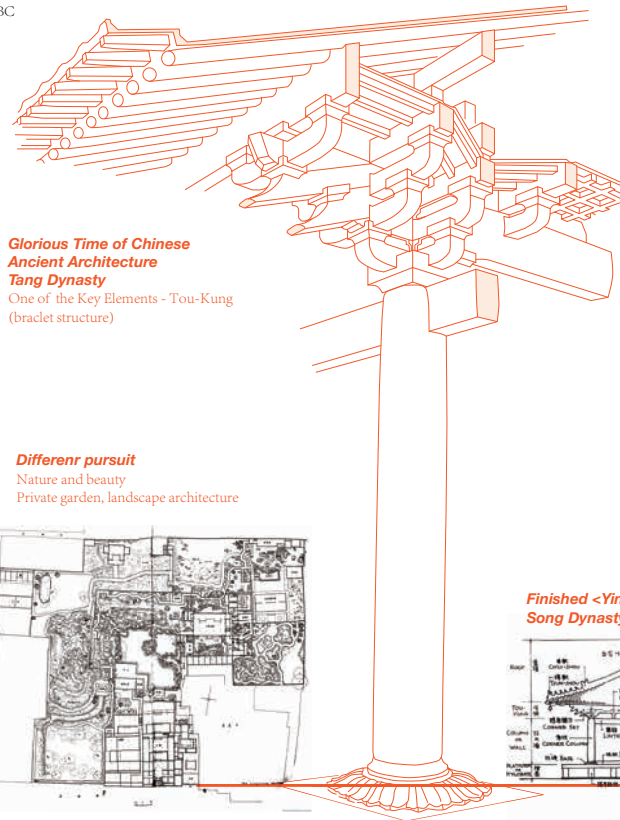
4 BC

Ancient Greece

Fig. 1.21  
Comparison  
Time Line  
about Chinese  
and Western  
Architecture  
Source:  
Produced by  
authors

Gothic  
architecture  
~16th Century

Modern  
Architecture  
20th Century



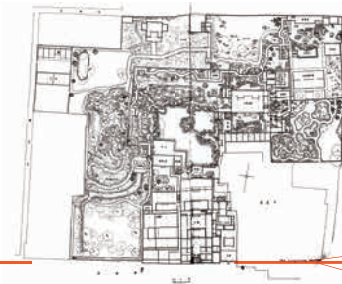
**Glorious Time of Chinese  
Ancient Architecture  
Tang Dynasty**  
One of the Key Elements - Tou-Kung  
(bracket structure)

**Differenr pursuit**  
Nature and beauty  
Private garden, landscape architecture

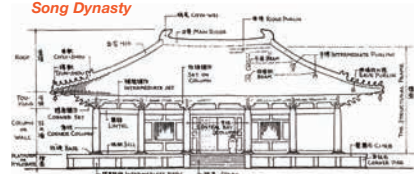


**Imperial authority and  
ideology control**

Feudal rule emerged, various ideological theories emerged, and the roots of the Chinese people's fear of nature began to appear in various architectural forms, including palaces that express the unity of man and nature or houses that fit the laws of nature.



**Finished <Ying-tiao fa-shin>  
Song Dynasty**

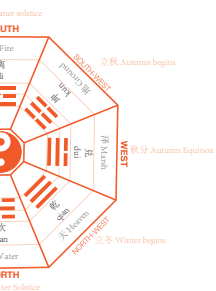


**Mature Form**

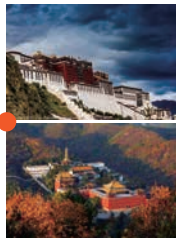
1840

**Modernization  
process**  
Late Qing Dynasty

an Dynasty  
ism Entered Chian



Architecture  
achievement  
in Qing Dynasty



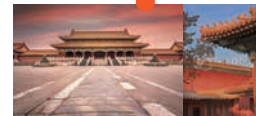
**Tibet Potala Palace**

Qing Dynasty

Buddhism entered China from India, and religious buildings appeared in China. However, the construction method was a wooden structure conforming to the traditional Chinese tradition. The strong regionality was not hit, but a good combination.

**Outer Eight Temple**

1713-1780



The Forbidden City in China is one of the best manifestations of the existing Chinese traditional style, architectural techniques, decoration, and ideological communication. The awe of nature is traditional, the imperial power is supreme, and the middle is conservative.



2

Chinese ideology and utility system



# 1 Chinese traditional ideology and its origins

In the early Chinese society, due to low productivity and undeveloped science, the ancestors could not make scientific explanations for natural phenomena, social phenomena, and human physiological phenomena, thus creating a worship of God and thinking that there is a supreme god behind things, who dominates everything in the world.

When people were repeatedly subjected to natural disasters and man-made disasters, they desired to predict the sudden consequences of their own actions in order to achieve profit and avoid disadvantages. In the long-term practice, various methods of communication between the gods and human had been invented, and the most convincing "I Ching (Book of Changes)" was produced under such conditions.

Originally it was a divination manual in the Western Zhou period (1000–750 BC) when it was named after King Wen as "Zhou Yi". Over the course of the Warring States period and early imperial period (500–200 BC), it became part of the Five Classics, and transformed into a cosmological text with a series of philosophical commentaries and serving as the basis for divination practice.<sup>1</sup>

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<sup>1</sup> [https://en.wikipedia.org/wiki/I\\_Ching](https://en.wikipedia.org/wiki/I_Ching)

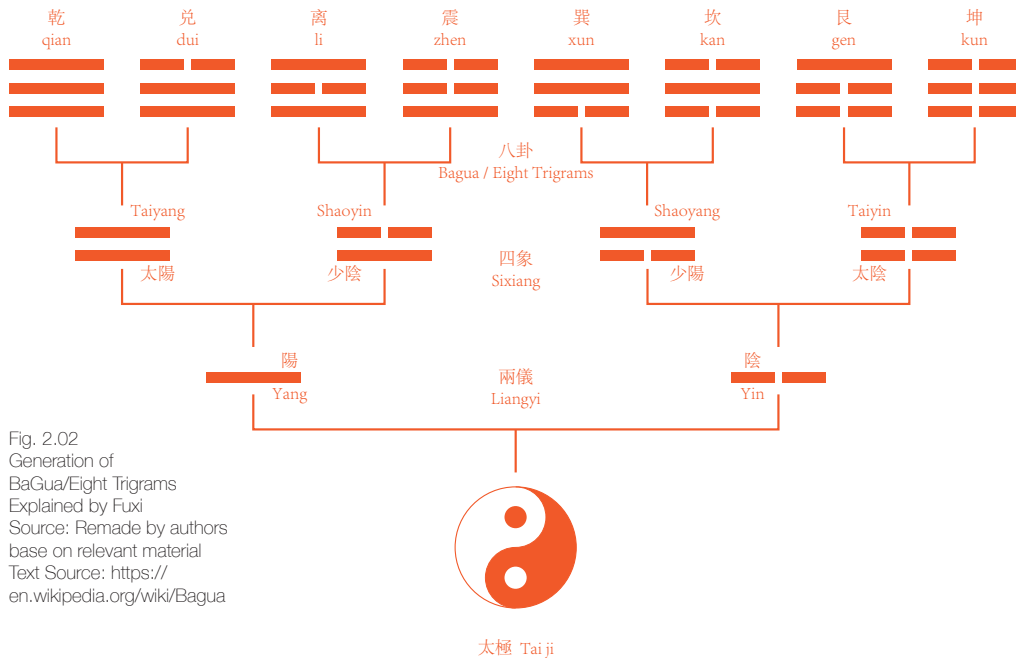


Fig. 2.02  
 Generation of  
 BaGua/Eight Trigrams  
 Explained by Fuxi  
 Source: Remade by authors  
 base on relevant material  
 Text Source: [https://  
 en.wikipedia.org/wiki/Bagua](https://en.wikipedia.org/wiki/Bagua)

The four phenomena ( 四象 ; Sixiang)  
 act on  
 the eight trigrams ( 八卦 ; Bagua).

These two forms produce  
 four phenomena( 四象 ; Sixiàng):  
 named  
 greater yang ( 太陽 ; taiyang, which also refers to  
 the Sun)  
 lesser yin ( 少陰 , shaoyin),  
 lesser yang ( 少陽 , shaoyang),  
 greater yin ( 太陰 ; taiyin, which also refers to the  
 Moon).

The Taiji (the two opposing forces in embryonic  
 form)  
 produces two forms,  
 named yin-yang ( 陰陽 )  
 which are called Liangyi ( 兩儀 , the manifested  
 opposing forces).

The Limitless ( 無極 ; wuji)  
 produces  
 the delimited ( 有極 ; youji),  
 and this demarcation is equivalent to  
 the Absolute ( 太極 ; taiji).

The core of the I Ching is a Western Zhou divination text called the Changes of Zhou (Zhōu yì) And its basic unit is the hexagram ( 卦 guà), a figure composed of six stacked horizontal lines ( 爻 yáo). Each line is either broken or unbroken.

From the starting to understand this system: these two lines are combined according to the Yin and Yang changes of nature to receive eight different diagrams called Bagua or Eight Trigrams (Figure.2.02). Eight Trigrams represents Chinese philosophical thoughts in ancient time, which are related to Taiji philosophy and "five elements".



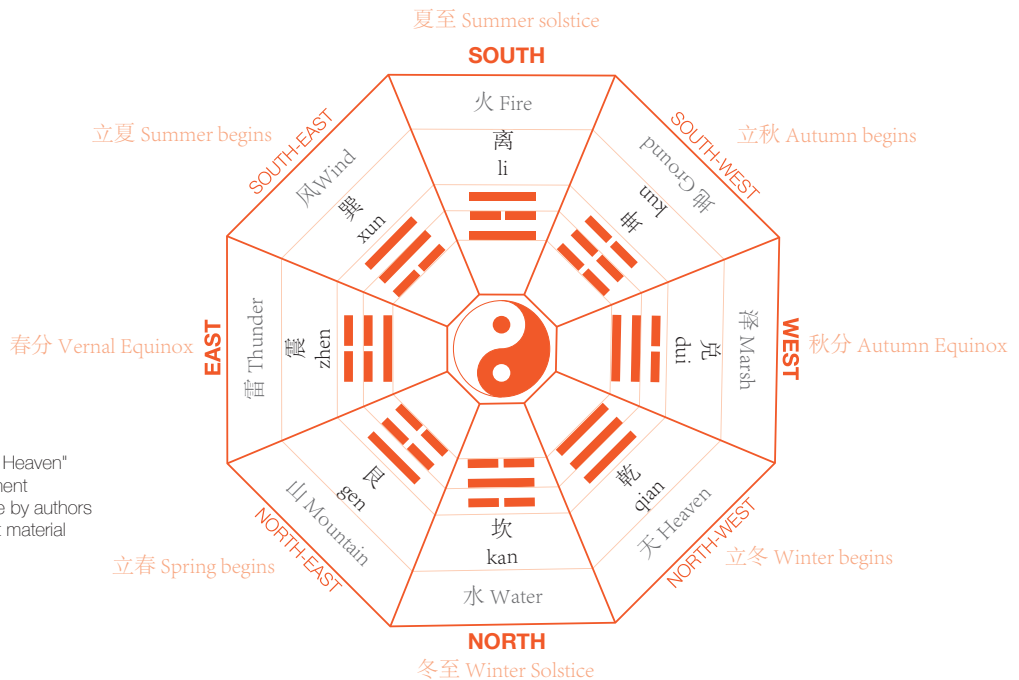


Fig. 2.03  
King Wen "Later Heaven"  
Bagua Arrangement  
Source: Remade by authors  
base on relevant material

The relationships between the trigrams are represented in two arrangements, the Primordial, "Earlier Heaven" or "Fu Xi" bagua, and the Manifested, "Later Heaven" or "King Wen" bagua.

Eight trigrams are pairwise permuted resulting in 64 possible hexagrams, along with the hexagram's name (卦名 guà míng), a short hexagram statement (彖 tuàn) and six line statements (爻 辭 yáo cí). The statements were used to determine the results of divination, which are used to symbolize various natural phenomena and personnel phenomena.

Each trigram represents a certain thing. Qian (乾) on behalf of the heavens, Kun (坤) represents the ground, Xun (巽) represents the wind, Zhen (震) represents the thunder, Kan (坎) represents the water, and Li (离) represents fire, the Gen (艮) represents the mountain, and Dui (兑) represents the Marsh (Figure.2.03).

For its application, except divination and Feng-shui, its influence involves Chinese medicine, martial arts, music, mathematics and so on. In Chinese culture it is used as a tools to derive the relationship between things and world and space and time.

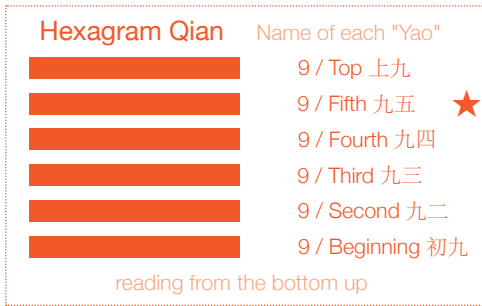


Fig. 2.04  
Diagram of Hexagram Qian  
Source: Remade by authors base on relevant material

For example, the head of the 64 hexagrams is hexagram Qian (乾), which symbolizes the heavens, is composed of six unbroken lines, which are extremely prosperous meaning (fig.0).

From the bottom up, the fifth is called the "Nine Fifth" and the nine means that this hexagram is Yang (usually represents positive meaning) and the fifth is its order. Because of the Yin and Yang transformation principle in the Book of Changes: after peaking it will decline. From this point of view, the "Nine Top" is the peak, and there is no room for improvement, then it is bound to decline. Therefore, the Nine Fifth is the best Line, which become a symbol of the emperor.

In ancient China, the numbers were divided into positive (Yang) and negative (Yin) numbers, that is, odd numbers were Yang, even numbers were Yin, and odd

numbers were used to symbolize the heaven, and even numbers were used to symbolize the ground.

There were several numbers that were commonly used. They are from the I Ching or the application of the interpretation of the I Ching. For example, the "nine" mentioned above is not a specific number, but a numerical Yin and Yang attribute symbol. In addition, it is also considered to represent the highest level. Qing Dynasty the answer of writer Wang Zhong to this is: "One is odd, two is even, that is, they are considered as number. Two plus one is three, so three, which is the integration of numbers. Until their accumulation reaches ten, then it means the number adds up to one, and ten can not be counted, so the nine is the end of the number." Therefore, nine is the peak of numbers and also the positive number.

The "nine" and "five" that are associated with the emperor are gradually used as concrete numbers to represent the highest level or the best things. Moreover, the use of the nine and five figures in architecture is suitable for the aesthetic principles of the Chinese, which is conducive to the construction of uniform symmetry. At the same time, in the

Chinese pronunciation the number "nine" homophonic "jiu", which is the meaning of long-term, and it is the reason why it is also regarded as the number of auspicious, loved and often used by people.

Fig. 2.05  
《热河行宫全图》  
Source: <https://www.loc.gov/item/gm71005055/>



Chinese architecture has symbolic characteristics. The symbol here does not refer to the symbol of the specific image, but the translation of Chinese traditional ideology. Chinese traditional philosophy, including Confucianism, Buddhism and Taoism, whose influence on Chinese architecture is inevitable.

According to Taiwan architect Qianlang Li, the external form of architecture is derived from Confucius and Buddhism, while the spatial structure has more influence from Taoism.<sup>1</sup> Taking residences

and palaces as examples, the layout of the houses is often symmetrical with the central axis. The middle is primary, and the side is peripheral. The master and the subordinates are distinctly distinct, embodying the Confucianism about the ethical relationship between people and code of conduct. The courtyard path outside the building is adapted to the situation of the terrain and environment, from small to large, from near to far, gradually integrated with nature, reaching the realm of harmony between man and nature, in harmony with what Taoism

<sup>1</sup> Li, Qianlang. Axonometric of Chinese Building. Guilin: Guangxi Normal University Press, 2009. Page 13.

present: “人法地，地法天，天法道，道法自然”，which means, people live and work according to the ground, and become prosperous; the ground is based on the alternation of the day and night, cold and heat, to cultivate all things; the heaven operate according to the changes of "Tao", to arrange the time series; the "Tao" is based on the nature of nature, and let it be natural.<sup>1</sup>

All in all, Chinese architecture presents the traditional ideology of respecting and fearing nature. In addition to the above-mentioned characteristics, Chinese architecture mainly uses wood because of the Chinese people's temperament, not seeking the original material to be endless, obeying the law of natural birth and death, regarding the architectures as something outside oneself, be content with the alternating and the supersession of the old by the new.

Fig. 2.07  
28 Stars and their Symbol  
Source: [http://blog.sina.com.cn/s/blog\\_852915980102xci9.html](http://blog.sina.com.cn/s/blog_852915980102xci9.html)



Fig. 2.06  
"Nature" in Taoism is associated with Natural law  
Source: [http://blog.sina.com.cn/s/blog\\_852915980102xci9.html](http://blog.sina.com.cn/s/blog_852915980102xci9.html)

<sup>1</sup> <https://baike.baidu.com/item/%E9%81%93%E6%B3%95%E8%87%AA%E7%84%B6/64671>

**Tortoise** in Northern Sky

北方玄武七宿：斗宿、牛宿、女宿、  
虚宿、危宿、室宿、壁宿



**Dragon** in Eastern Sky

东方苍龙七宿：角宿、亢宿、氐宿、  
房宿、心宿、尾宿、箕宿



**Suzaku** in Southern Sky

南方朱雀七宿：井宿、鬼宿、柳宿、  
星宿、张宿、翼宿、轸宿



**White Tiger** in Western Sky

西方白虎七宿：奎宿、娄宿、胃宿、  
昂宿、毕宿、觜宿、参宿





2

The Origin of  
Measurement  
System in China  
and  
Utility system

In the Shang Dynasty (around 1600 BC), measurement tools had begun to appear. Its Chinese name is 尺 (*chǐ*), which is ruler. It is a tool for measuring land and a quantitative tool for exchanges such as cloth. From the beginning, the length of the ruler is one *chi*, divided into ten *cun*, and each *cun* is divided into ten *fen*.

To determine the specific length of the ruler, the methods have gone through two stages in history in ancient China, first with natural objects as standards and then with artifacts. The most natural thing is the organ of the human body, that is, the action of the human hand, foot and their measurements as the standard of measurement (Figure.2.08).

《孔子家语》说：“夫布指知寸，布于知尺，舒肘知寻（八尺），斯不远之则也。”

《Confucius-phase》, Han Dynasty, The upper middle section of the middle finger is said to be a "*cun*"; the thumb and the index finger are a "*chi*"; the two arms are eight *chi*, which is called "*xun*".

《孔丛子》则说：“跬，一举足也，倍跬谓之步。”

《XiaoErYa》, Han Dynasty, "*ku*" is the distance of one step, double steps is "*bu*".

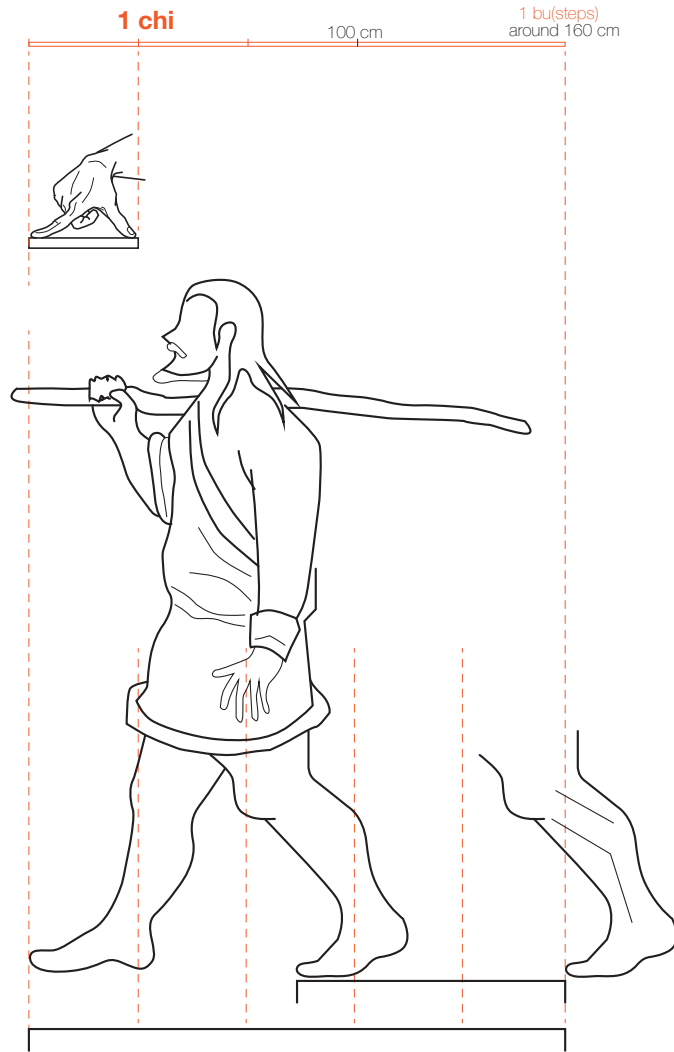


Fig. 2.08  
Origin of the Standard of Measurement  
Source: remade by authors base on relevant material

- Some useful chinese unit:
- 1 chi** = 1/5 bu
  - 1 chi** = 10 cun = 100 fen
  - 1 li = 10 zhang = **100 chi**
  - 300 bu = 1 li (Tang Dynasty)

The length longer than the "cun" and the naming of the capacity unit are also related to the movement of the person. The human body is the reflection of the most primitive state of measurement and measure methods in ancient times. At that

time, *chi* was inaccurate, and its length varied from time to time. For instance, in the Tang Dynasty, the two steps (one step for each leg) of Li Shimin, Emperor Shizong of Tang, were the determination of the distance of "bu" at that dynasty.





Fig. 2.09  
Black broomcorn in  
northern China  
Source: search on internet

The further development of measures is based on grain, black broomcorn, as "natural objects" and associated with the rhythm, making laws and regulations, and to create those such "human artifacts" as the standard for measures.

The ancients used twelve different lengths of tube instruments to blow out twelve different pitches, and this twelve-pitch scale was a standardized gamut

of twelve notes. The first instrument was the Huang Zhong, whose length was nine *cun*. In Han Dynasty, its nine-*cun*-length was stipulated as the length of an official ruler. As a standard to make other measurement tool for weight, length, capacity. Based on the Huang Zhong, the length is shortened according to a certain ratio, and other tubes were made for musical performance (Figure.2.10).

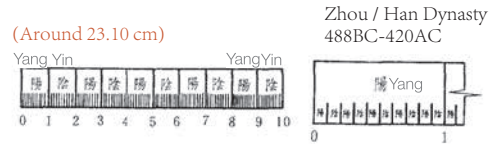
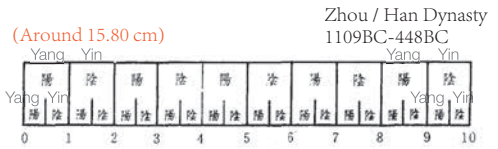


Fig. 2.10  
Twelve-pitch scale and Instruments  
Source: [http://www.sohu.com/a/253558399\\_807868](http://www.sohu.com/a/253558399_807868)

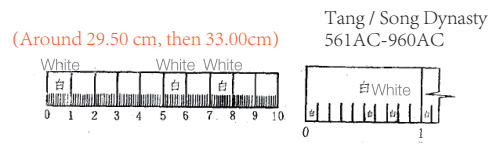
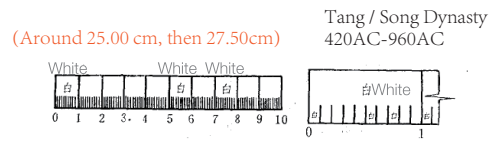
The above was the main method of establishing official measure standards in ancient China. The official ruler had two uses, one for astronomy and temperament, and the other for daily activities, such as tailoring and construction. However, the formulation of these standards was idealized. The most obvious reason was that size of each black broomcorn was different, and the harvest results were different every year and region. The long-term use of these methods leads to the accumulation of errors and became larger in times. In addition to this, there were more factors such as the intentional increase of tax standards under the tax system and the imbalance of regional development, resulting in the standard length of the official ruler was different in different dynasties and places.

As for the measurement apply to the construction activities, in ancient times, the size of a building was designed, Generally, at first, the fictitious size of the building size was determined by the legal scale of yin and yang with Official Ruler, and then it was adjusted by the Eight Trigrams and the 64-hexagrams with the Divination Ruler (Figure 4). Design various building sizes based on the principle that the lucky ones accounted for more.

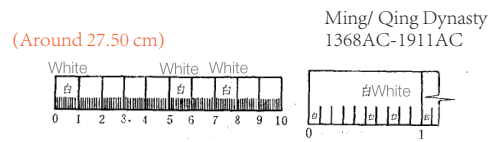
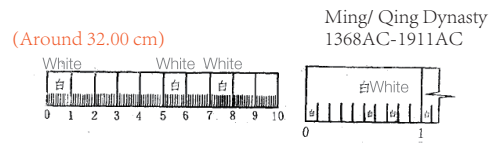
### Official ruler 官尺 / 法定尺



Every [1, 3, 5, 7, 9] for *fen'cun'chi'zhang* are Positive number, indicates the official building size.  
Every [2, 4, 6, 8, 10] for *fen'cun'chi'zhang* are Negative number, indicates the size of the civil building.



1white, 2black, 3green, 4bluish green, 5yellow, 6white, 7red, 8white, 9purple  
They all name after Stars. Only White Star is the most positive.  
Every [1, 6, 8] for *cun'chi'zhang* are Positive number, indicates the official building and civil building size



Every [1, 6, 8] for *fen'cun'chi'zhang* are Positive number, indicates the size of official, civil and temple building.  
Every [2, 9] for *fen'cun'chi'zhang* are minor Positive number, indicates the size of the civil building.

周小尺  
Zhou Small Ruler

.....

武王尺  
King Wu Ruler

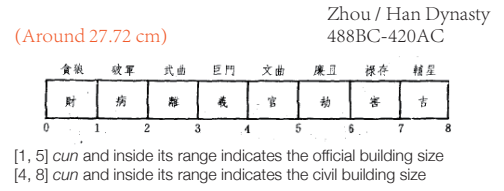
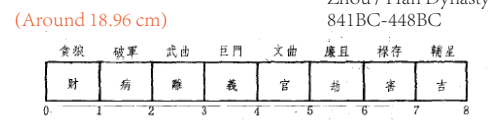
**Ratio 1.1 or 1.2 / Decimal or Octal**

周大尺  
Zhou Large Ruler

.....

鲁班尺  
Luban Ruler

**Divination ruler 占筮尺**  
(based on Bagua theory)



.....

唐小尺  
(宋南称“浙尺”)  
Tang Small Ruler

.....

初期真尺  
Initial Ruler

.....

后期南方真尺  
Anaphase Ruler in the South

唐大尺  
(宋北称“淮尺”)  
Tang Large Ruler

.....

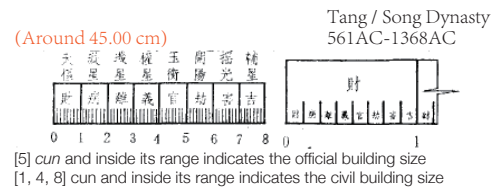
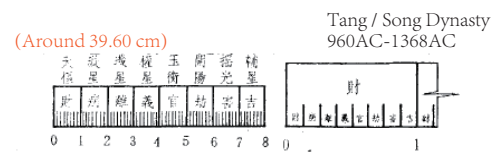
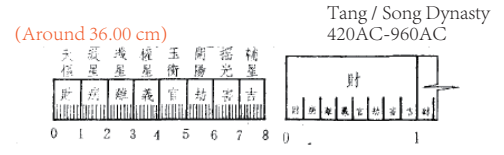
后期北方真尺  
Anaphase Ruler in the North

**Ratio 1.44 / Decimal or Octal**

工部尺 (North)  
Ruler of Ministry of Works

.....

鲁般真尺 (North)  
Ming/ Qing Dynasty



**Ratio 1.44 / Decimal or Octal**

曲尺 (South)  
Carpenter's square

.....

鲁般真尺 (South)  
Ming/ Qing Dynasty

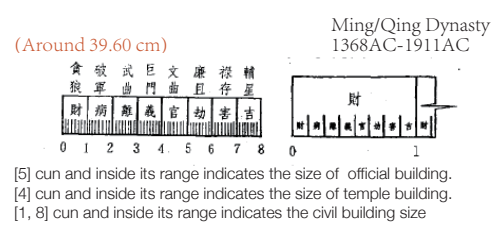
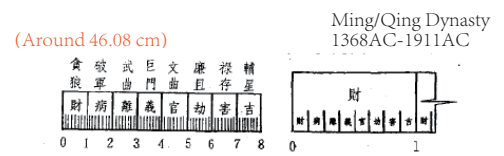


Fig. 2.11  
In Main Dynasty  
Examples of the Cooperative Use of Official Ruler and Divination Ruler  
Source: remade by authors base on relevant material  
Picture Source: Jin, Qixin. Research on Chinese Ancient Architectural Dimensional Design—On the System of < Changes of Zhou >. Hefei: Anhui Science & Technology Press, 1992.



The Ying-tsao fa-shin was compiled by Li Jie, superintendent of construction at the court of Emperor Huizong (ruled 1101 - 1125 AC) of the Song Dynasty.

Since ancient Chinese construction techniques were taught by masters to apprentice or between father and son, they did not attach importance to the records in books, but relied on oral teaching and personal practical guidance. More in-depth, the apprentice can only obtain general rules of knowledge, and the key technology is only passed on to their son. This agricultural consciousness that protects the technical secrets of the family system hinders the development of ancient building technology.

The technical books that could be handed down in ancient books for thousands of years were only these two volumes issued during the two dynasties of Song and Qing. In the mid-Song Dynasty, the rise of the fanaticism of construction, the problem of officer corruption occurred. In order to prevent further economic collapse, the state will strictly manage the project construction activities, so the Ying-tsao fa-shin was published as guidance for construction engineering.

Author Li Wei reorganized the traditional

theory, researched ancient books and traditional techniques, and personally discussed various construction steps with artisans, and sorted out the new and old methods to 3,555 standard cases. At the same time, he unified the name of the component and clearly defined the examples, scales, drawings, materials principles, and manpower allocation of various buildings. In addition to summarizing and comprehensively compiling the construction techniques and experience of various generations of artisans. The Ying-tsao fa-shin as the first officially published standard book. The importance of this book is also reflected in the standard modular system in ancient building technology. A detailed explanation was made to let future generations know the contents of the building standard factor at that time.

Since the main material of ancient Chinese architecture is wood, the modular system established in the Ying-tsao fa-shin was based on the basic attributes of the most important “major carpentry” structures in the Chinese architectural system (such as cross-sectional dimensions, wooden properties, etc.).

Ancient Chinese artisans, at the latest in the Tang Dynasty, have explored the most ideal ratio of vertical and horizontal beams and columns in materials and structures. At the same time, they also found that the rectangular cross-sectional aspect ratio from the sawed round wood having the highest bending strength was  $\sqrt{2}:1$  (about 3:2). The rectangular cross section of the wood mentioned here was the cross section of the Kung member in Tou-Kung (a bracket device with the most repeated number of wood components in a building). This wood was stipulated in the standard size, which was called

TS'AI. About this wood, that is TS'AI, was divided into eight specifications as eight grades in the Song Dynasty. It must be selected according to the type of house and the official level.

The specific modulus was explained as following: by first setting the height of the TA'SI of eight grades, and equally dividing the height by fifteen, each of which we call FEN°, and then its width is 10FEN°. Therefore, China's modulus is FEN°. It was the same idea as the Western setting the column diameter as the basic modulus.

Used in Palace  
bay 11 - 9

Used in Palace  
bay 7 - 5

Used in Palace  
bay 5 - 3 or  
Mansion bay 7

Used in Palace  
bay 3 or  
Mansion bay 7

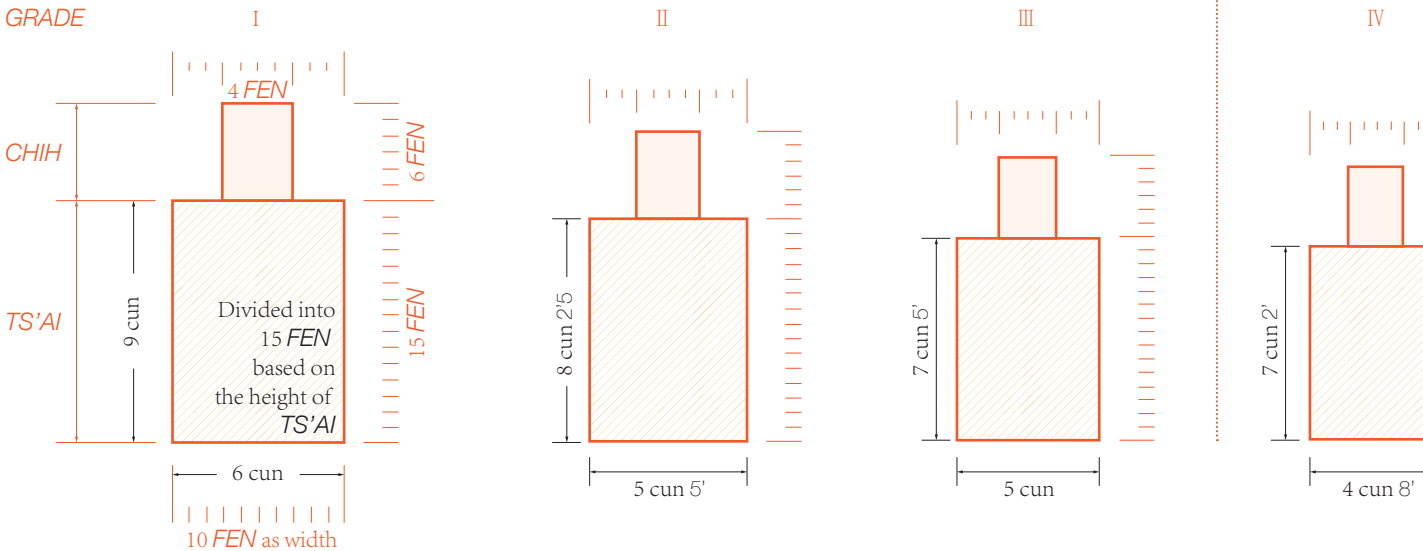


Fig. 2.15  
Classification in TS'AI FEN° System  
Source: remade by authors base on relevant material

At the same time, in the houses of the specific type and grade, all woods with the same height and width and the same structure should be of the same grade. Then, the height, depth, dimensions of the remaining components, roof fold height and curve were determined by the different ratios of FEN<sup>o</sup>, the basic unit. When two TS'Als were stacked, there would be a 6 FEN<sup>o</sup> height gap between them, which was called CHIN. A member measuring one TS'AI and one CHIN in height called "full TS'AI" (16 FEN<sup>o</sup>).

for constructing the entire building (even the building complex), from the foundation to the ridge, the material and size of each part were within the calculation range of the proportion of FEN<sup>o</sup>. Any minor changes, the rest would be adjusted accordingly. Its advantage was that various components could be pre-made and transported to the construction site, or it could be easily dismantled and rebuilt easily, which increases the construction speed. In addition, it can also prevent work materials, save money and ensure quality.

The establishment of the modular system

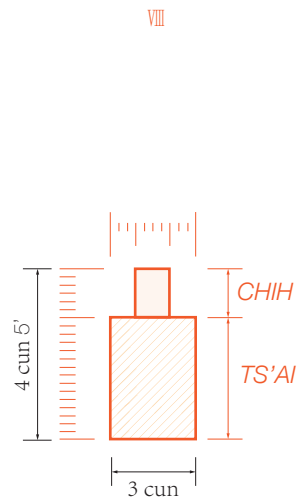
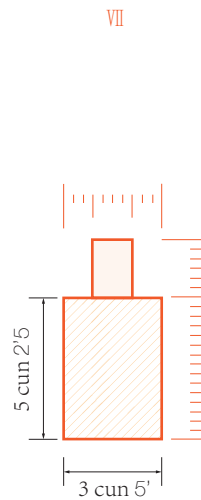
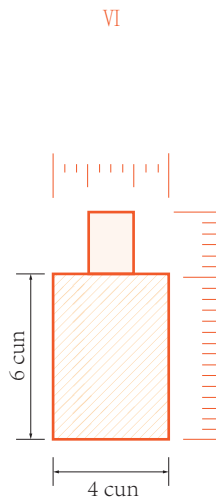
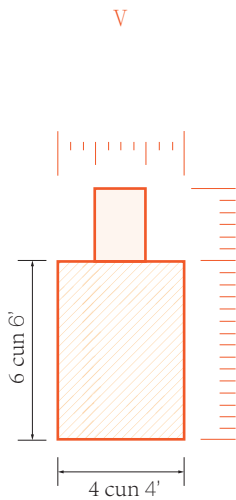
Palace  
bay 5

Used in Palace  
bay minor 3 or  
Mansion  
bay major 3

Pavilion  
or  
small Mansion

Pavilion  
or  
small Palace

Small pavilion



The formulation and use of the measurement standard system in ancient China has two characteristics: the first, it had the influence from superstitious thought, that was, leading by the I Ching, and formed in order to promote a series of divination behaviors; the second, there was an obvious hierarchical relationship, which was the role of social factors which was the influence of ancient Chinese feudal hierarchy.

In the western building modulus system, the column diameter is usually the basic unit, and the Chinese wood building modulus system is based on the size of the bucket parts. They all use the size of the most basic components as the smallest modular unit of the building.

Western modular units attempt to find a connection between the human body, geometry, and numbers. The basic unit of the Chinese modular system always reflects a very clear concept of construction, and is more inclined to the empirical value of wood performance. It is a scale suitable for wood properties and building construction that has been explored by craftsmen for many years.

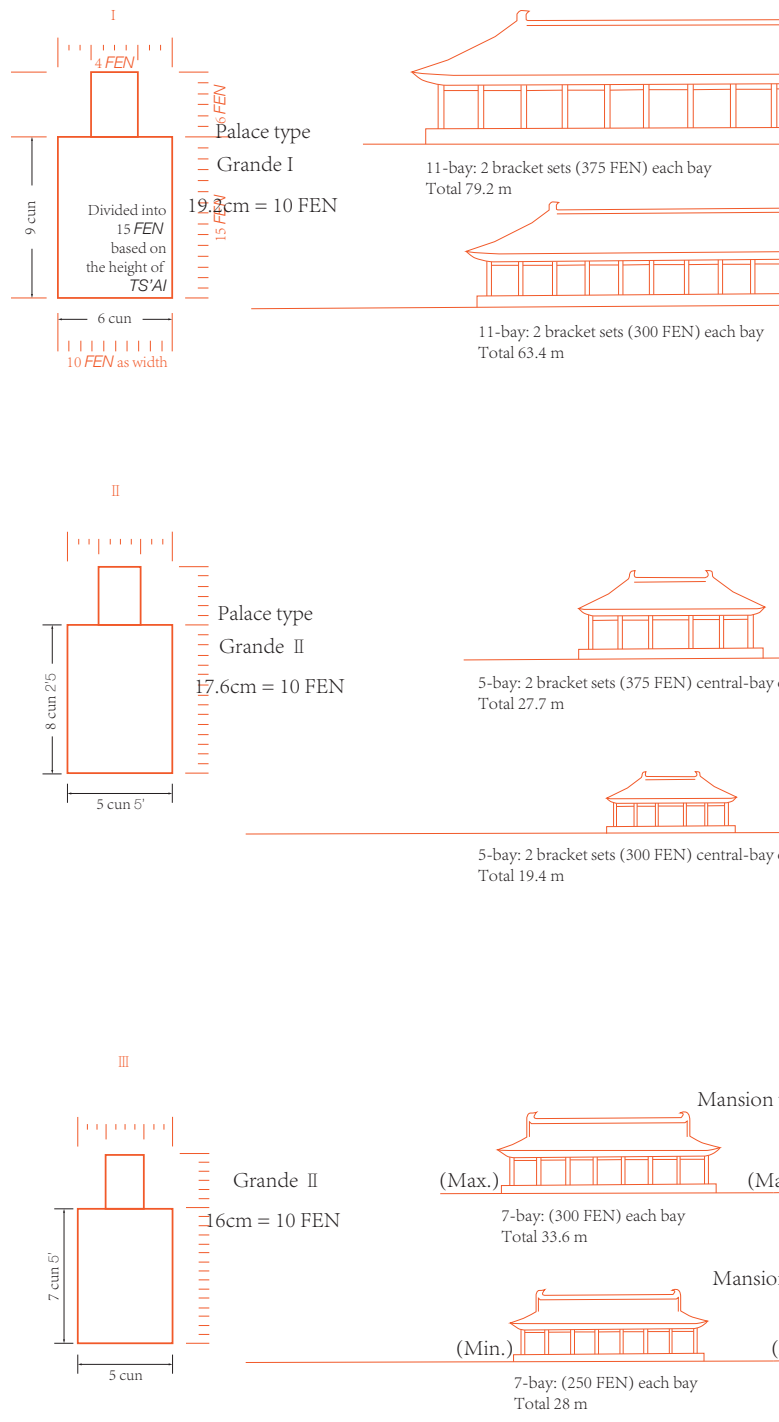
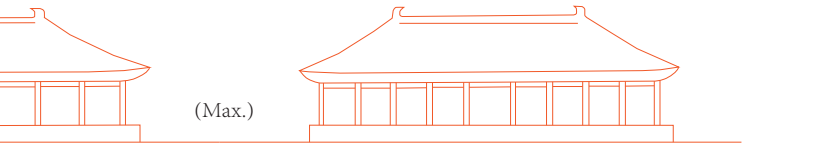


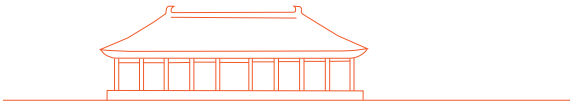
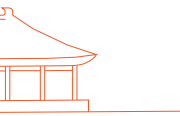
Fig. 2.16  
Different Class of Palace Corresponding to The Class of Wood  
Source: remade by authors base on relevant material





(Max.)

9-bay: 1 bracket sets (300 FEN) each bay, except 2 set centr-bay (375 FEN)  
Total 79.2 m



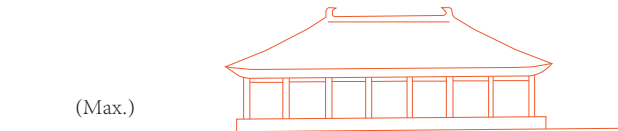
9-bay: 1 bracket set (200 FEN) each bay, except 2 set central-bay (300 FEN)  
Total 36.5 m

Standard Bay-dimension

Palace type  
375 FEN (double sets)  
250 FEN (single set)

Mansion type  
300, 250, 200 FEN (single set)

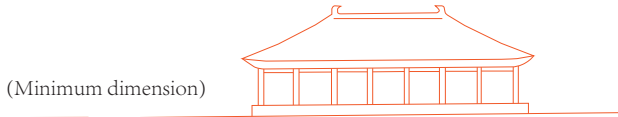
Pavilion type  
square: 225, 250, 300, 375, 500 FEN  
octagon: 375, 500, 750 FEN



(Max.)

7-bay: 2 bracket sets (375 FEN) each bay  
Total 46.2 m

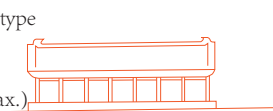
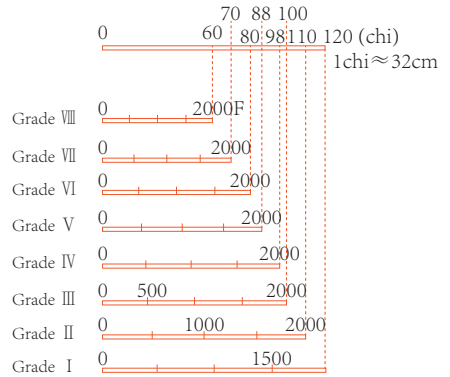
only



(Minimum dimension)

7-bay: 2 bracket sets (300 FEN) each bay  
Total 40 m

only



(Max.)

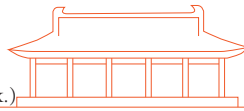
7-bay: (300 FEN) central-bay, others (250 FEN)

n type



(Min.)

7-bay: (250 FEN) central-bay, others (200 FEN)  
Total 23.2 m



(Max.)

5-bay: 2 bracket sets (375 FEN) each bay  
Total 30 m

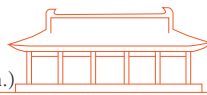


(Max.)

5-bay: 2 bracket sets (375 FEN) central-bay  
others (250 FEN)  
Total 14 m

Palace type

n type



(Min.)

5-bay: 2 bracket sets (300 FEN) each bay  
Total 24 m



(Min.)

5-bay: 2 bracket sets (300 FEN) central-bay  
others (200 FEN)  
Total 11.2 m

Palace type

## 9, 7, 5, 3

As the grade mentioned above, these four number can be a grade of size classes in an architecture.

## 1, 3, 5, 7, 9 and odd number

Positive number in ancient China, from examples of palace grades in <YING-TSAO-FA-SHIH>, their width are measured in odd number of bays. And these rules help to generate the symmetric layout.

## 8 and Eight Trigrams

There complicated rules come from Bagua system and seperated in 8 can be easier to follow the rules.

## 3

From ancient Chinese philosophy "Tao", 3 can means everything in universe, that means 3 can be the BASIC.

Fig. 2.17  
Useful Numbers in Chinese Tradition  
Source: Made by authors

《礼记》曰：“天子之堂九尺、诸侯七尺、大夫五尺、士三尺。”

《Book of Rites》, Han Dynasty, the temple of the Son of Heaven (Emperor) is 9 *Chi*, the princes are 7 *Chi*, the officer is 5 *Chi*, and the staff is 3 *Chi*. "

It does not mean the real size, but it shows the grade system of building for the people in different classes. The grades of ancient Chinese architecture are very different and the regulations are very strict. The emperors of all ages will,

in spite of the interests of the people, rush to build a tall palace to show power.

In ancient architectural design, the classification of buildings is mainly based on the size of the building.

The leading ideology philosophy indicated the influence from I Ching. For the useful number in ancient China, there are several rules to abstract them, in order to provide an option to design Chinese modern architecture.

The terrain in Daxing City is high in the southeast and low in the northwest, and the height difference is more than 30 meters. There are 6 slopes about 6 meters high from north to south. The characters of 6 slopes are compared to the six checkpoints in the planning. According to the interpretation of Diagram Qian, the 2nd, 3rd and 5th is important. Then there were planned or built the imperial palace, governing apartments and Taoist temple and a Buddhist temple are used to promote the feng-shui on those high-level earthen posts which cannot be used for ordinary people. That is, the Xuan Duguan of Chongyefang and the Daxingshan Temple of Jingshanfang and there were also occupied by Wang Zhai and Temple.

There are 13 rows of Lifang in the north and south of the city, which symbolizes 13 months of the year (including the month of the moon); there are four lines of Lifang in the south of the imperial city, symbolizing the seasons; the four-lines-Lifang are divided into nine rows, symbolizing the "Zhou Li" system of highlighting the important position of Imperial City. Although such an explanation is suspected of being unconvincing, it also reflects the idealization of the capital city planning. It realize people's hopes to conform to some auspicious meaning and achieve the perfect situation in cultural imagery.

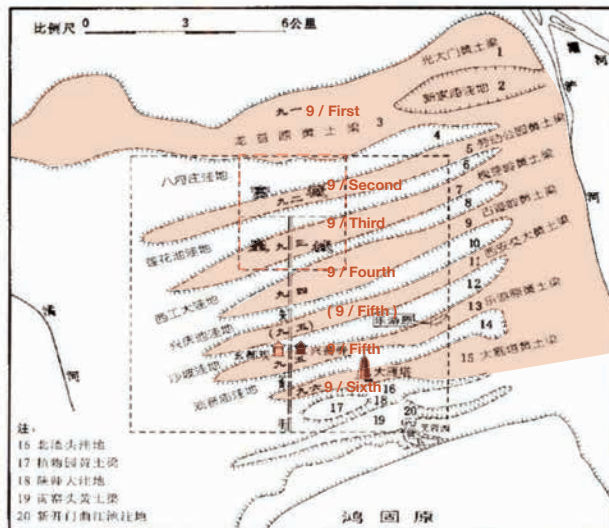


图1.13 隋大兴六爻地形

Fig. 2.18  
Topography of DaXing City  
Sui Dynasty, 581-618 AC  
Source: He, Congrong. *Ancient Capital City Xi'an*. Beijing: Tsinghua University Press, Jul. 2012. Page 40.



3

## Learning from Chinese cities



# 1

## The Fading of Traditional Urban Fabric from Urban Modernization

As mentioned above, Chinese ideology is influencing the way to design buildings by our ancestors. Likewise, such ideology is also reflected in urban planning. Especially the principles for planning a capital. These principles for laying out the capital city of a ruling king or emperor were specified as early as the eleventh century BC. In the *Zhouli* or Book of Rites, in the chapter “Kaogong Ji” which narrates the work of crafts: “方九里，國中九經九緯，經塗九軌，左祖右社，面朝后市。”<sup>1</sup> It is mentioned that the capital of a king should be “nine Li square with nine boulevards running longitudinally and nine boulevards running latitudinally. The longitudinal boulevards should be the width of nine carriages. The palaces should be located in front and the market places, at the rear; the ancestral temple to the left and the temple of the god of lands to the right.”

In this simple statement, the basic principles are precisely put down. In the period of ancient China, it is a faithful testimony of the social and political systems of the early days of feudalism. The lord was supreme. His palaces must be put in the centre-front. The places which were market, were the only places related with the common people, logically, these market places were located in the least important quarter.

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<sup>1</sup> Sicheng Liang. *Chinese Architecture: Art and Artifacts*. Foreign Language Teaching and Research Press, Beijing. April 2011.

It is interesting to note that this principle was not strictly adhered to in earlier dynasties, such as the Chang'an of the Han Dynasty. It was not until the time when the teachings of Confucius were proclaimed by the feudal rulers as state teachings and the *Zhouli* included into the Thirteen Classics that the planning of an emperor's capital was given such ritual considerations. These planning principles not only makes imperial power become prominent, but also the Chinese ideology is presented. The Chang'an of the Sui and Tang Dynasties, and Beijing of the Ming Dynasty are two typical cities on the principle specified in the *Zhouli* <sup>1</sup>.

After our academic researching, we try to make hypothesis about the formation of ancient Chinese cities. From the perspective of the reason for urbanization, here are two conjectures for origins of Chinese cities. First, the city is differentiated from the general village settlements by the production and development of handicrafts and commerce. This view holds that the origin of Chinese cities is the same as the origin of Western cities. The changes in

production and lifestyle have emerged in the form of commercial handicraft cities, and agriculture-based villages, these reasons created the opposition of Urban and village. Another conjecture is that ancient China was deeply rooted in the small-agricultural economy because of the single agricultural economic impact. The purpose of the rise of ancient Chinese cities was to defend the monarchy and to prevent looting from others. Naturally, the origin of ancient Chinese cities exists as a vassal of politics. Thus, there is not doubts that the similarity between urban life and village life. <sup>2</sup>

## Beijing

On the site where Beijing, the capital of the people's Republic of China, stands today, a town or settlement have been in existence as far back as the Yin Dynasty, started from 1765 BC and ended in 1122 BC. After having sacked the capital of the Jin Dynasty, Yanjing, which had grown up through nearly thirty centuries of development, Kublai Khan of the Mongols ordered the building of a new capital just

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1 *Zhouli* is actually a work on bureaucracy and organizational theory. The book consists mainly of schematic lists of Zhou dynasty bureaucrats, stating what the function of each office is and who is eligible to hold it. Sometimes though the mechanical listing is broken off by pieces of philosophical exposition on how a given office contributes to social harmony and enforces the universal order.  
Source: [https://en.wikipedia.org/wiki/Rites\\_of\\_Zhou](https://en.wikipedia.org/wiki/Rites_of_Zhou)

2 Pengzhan Hao. *Public Space, Urban Sprawl and Social Control – based on the study of Chang'an*. Shanxi Normal University, PHD thesis, May of 2017.



to the northeast of it, called Dadu. It was planned according to the principle set in the Zhouli. The palace in the front, the market place at the rear, the ancestral temple to the left and the temple of the god of lands to the right. But Dadu suffered the same fate as that of Yanjing when the Mongols were driven out by the Han people who established the Ming Dynasty in 1368.

Shortly afterwards, the ruined capital was reconstructed and renamed Beijing, the North Capital, known to Westerners as Peking. It has been, except for two short intervals, the capital of China ever since. The Beijing had the national liberation from the capital of an absolute monarchy in 1949.<sup>1</sup> It took its final shape in the year 1553 after three successive large-scale alterations. Particularly worth mentioning is that In the Ming and Qing Dynasties, Beijing was located on the Yongding River alluvial fan on the three sides of the mountain. The city used the mountain stream from the west to form the urban water supply and drainage system. Based on this, the Beijing Royal Garden System and the urban water supply system were built. The city uses the Beijing Quadrangle or “Si He Yuan” as a cell to organize into an urban fabric with a north-south axis,

adapting to the temperate climate of North China, and utilizing natural light and heat.

The reconstruction in 1553 added an outer city to the original square city, thus lengthened the principal axis of the city to eight kilometres. The composition of the entire city was basically symmetrical. The street system was laid out with that of the Mongol city as basis. The chessboard main streets divide the city into large super-blocks, within which most of the minor streets run in the east-west direction. This fish-bone pattern of street system defines clearly the different functions of the major and minor streets on the one hand and enabled all the houses to have a southern exposure on the other. The planner had shown great ingenuity in the creation of such a system. After the restudying from this fish-bone urban fabrication, we consider this pattern also catalyzed the formation of hutong culture and atmosphere in later period.

As the rapid urban development happened in China in recent years. The scale of the city continues to expand, the roads have been widened as well. With the renovation of the old city, the low-rise bungalows and the “Beijing Quadrangle”

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<sup>1</sup> Sicheng Liang. *Chinese Architecture: Art and Artifacts*. Foreign Language Teaching and Research Press, Beijing, April 2011. Page 47.

are gradually replaced by new residential communities and high-rise buildings that are constantly rising. The small alleys which called “Hutong” in Beijing are also constantly disappearing and reducing. The small alleys, “Hutong” existed along with the birth of Beijing City. At least 800 years of history, they have accompanied by the rise and fall of the glory and shame of the dynasties, and the hutong is the witness of Beijing's history. The long-standing culture and unique charm of Beijing are preserved in the hutong, and the joy and bitterness of the people living in the hutong are also included.<sup>1</sup>

Thus, we select and present the evolution of our capital in three different epochs as following, to interpret the metabolic urban texture through urban generation. Three maps refer to Beijing in 1861, Beijing in 1948 and Beijing in 2018 respectively. (Figure.3.01,3.02,3.)

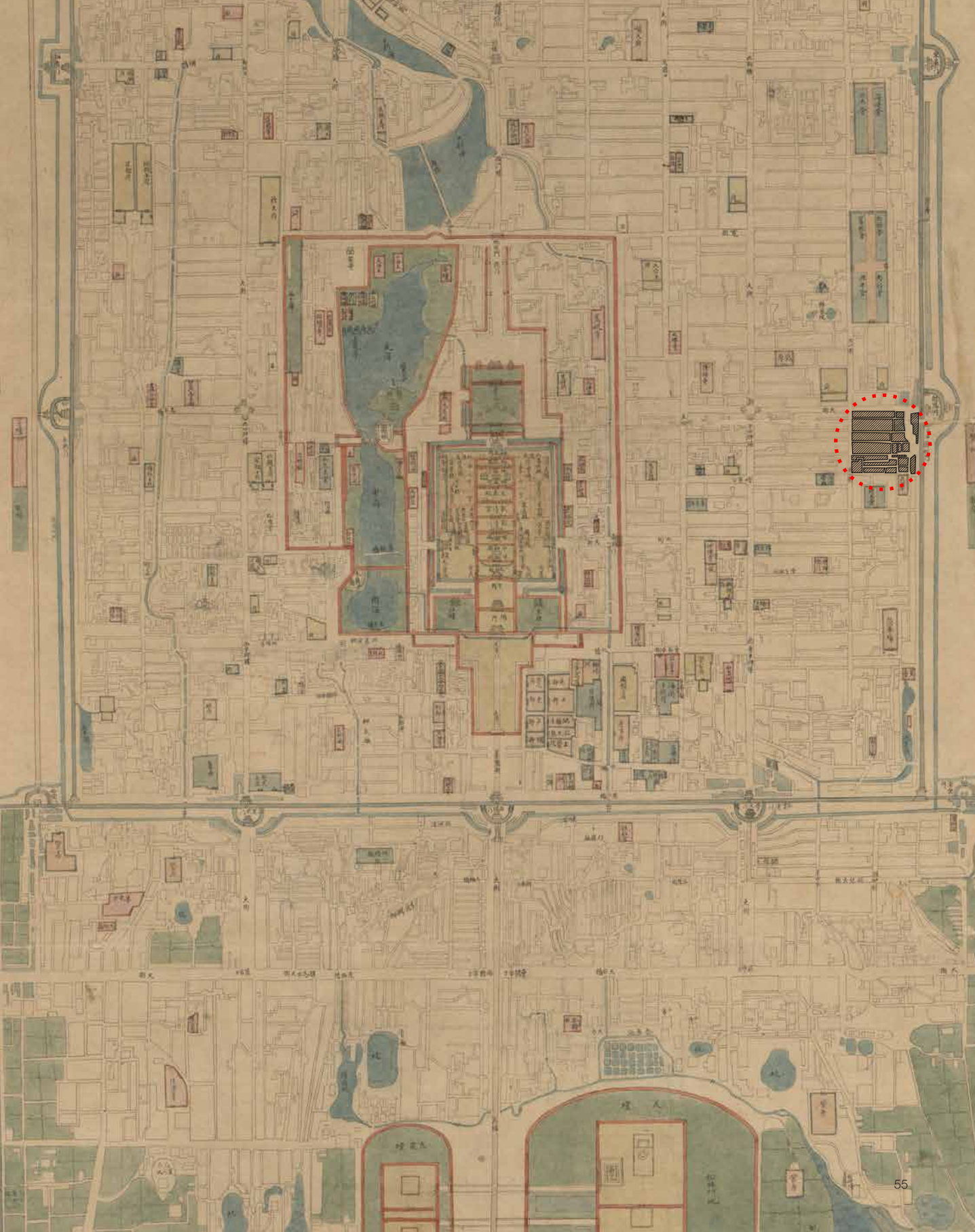
Fig. 3.01  
Map of Beijing  
in 1861  
Source:  
Category:Maps  
in Chinese,  
[https://  
commons.  
wikimedia.org](https://commons.wikimedia.org).

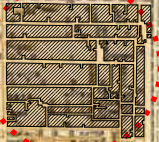
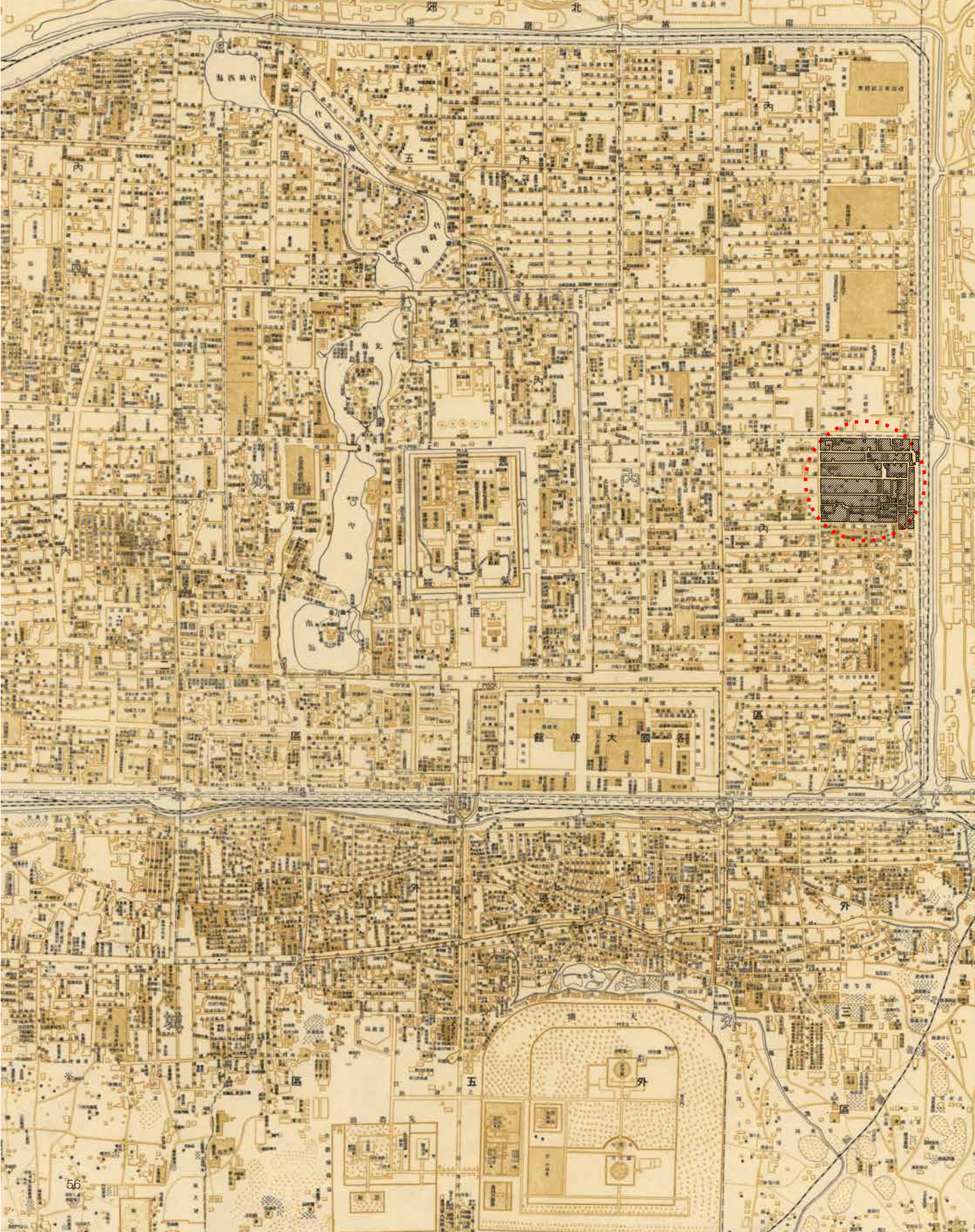
Fig. 3.02  
Map of Beijing  
in 1948  
Source:  
Category:Maps  
in Chinese,  
[https://  
commons.  
wikimedia.org](https://commons.wikimedia.org).

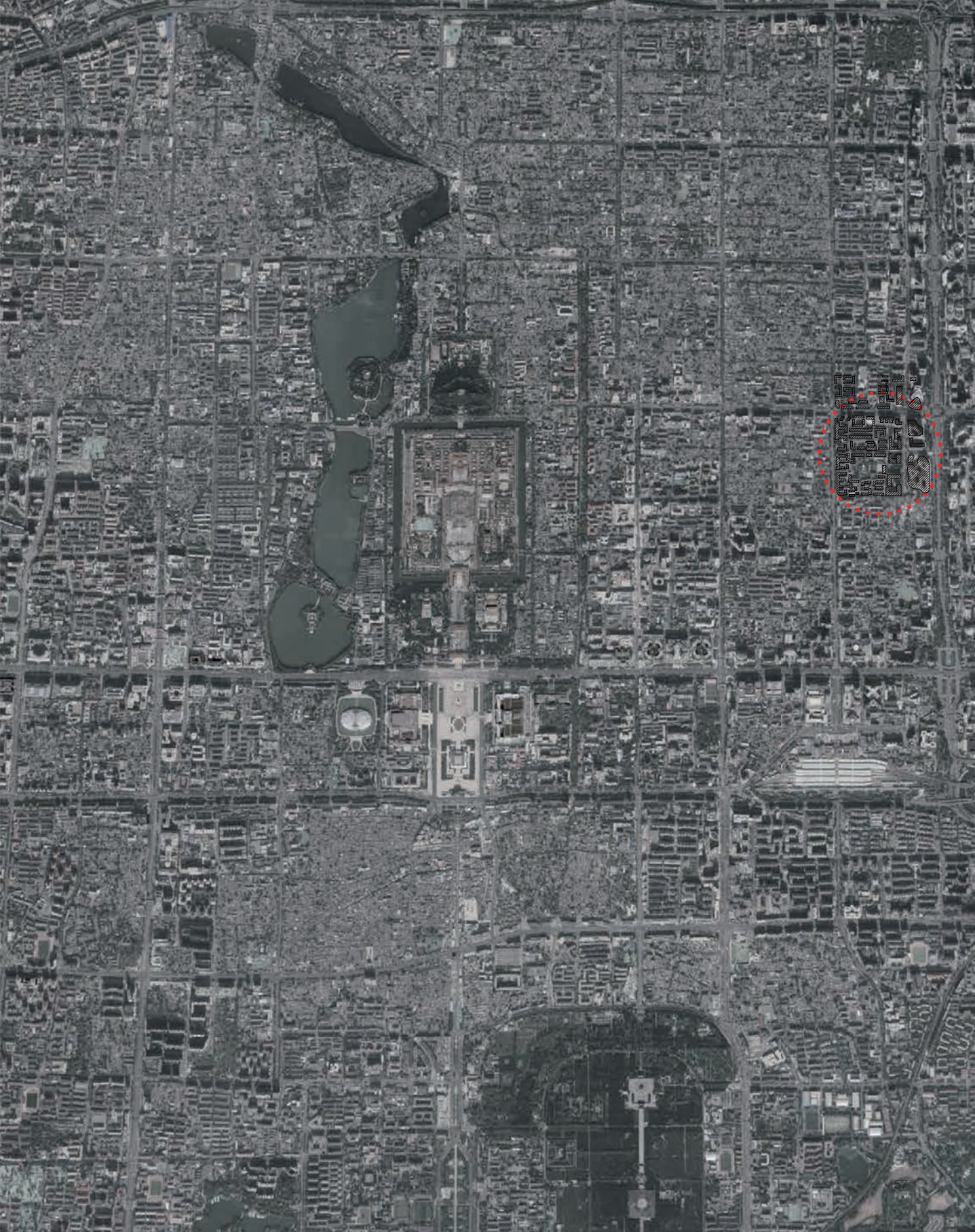
Fig. 3.03  
Map of Beijing  
in 2019  
Source:  
Google Earth  
Pro

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<sup>1</sup> Qian Guang Fang. *The fading of Beijing Hutong*. Uploaded on Yu Xi Wen Zhuang on 31st of August, 2001.







THE  
CITY  
OF  
NEW  
YORK  
PLANNING  
DEPARTMENT

Then, in order to demonstrate and present the rapid urban change impact the vernacular urban texture specifically. We start to select one specific district in Beijing that can demonstrate such a significance metabolism of Chinese urbanization in twenty-first century. Since the New China Government was established in 1949 and Beijing became the capital. To manage the country and build the country, we must first have offices and places for people to work. This has led to the first change in the hutong. The confiscated houses of the reactionaries and the houses donated by the national capitalists have become state property and are set up as institutions and dormitories.

In the 1950s, the construction of the country required a large amount of manpower. Beijing recruited a large number of farmers from neighbourhoods Hebei and other places to participate in the capital economic construction.<sup>1</sup> These people brought their families to Beijing and settled in the Hutong. They rented the public housing of the Housing Authority and became a new Beijinger. There is a situation in which a yard lives in several families and more than a dozen family members. Hutong has been alive

since then.

The great earthquake of the 1970s destroyed the old houses that had been repaired for a long time. The house was fractured and the house was broken.<sup>2</sup> In order to prevent another earthquake, various households set up earthquake-proof sheds in the courtyard. They have lived in the earthquake-proof shed for a long time. Some people have long-term plans to transform the earthquake-proof shed into a fixed house of their own home. People started to built house in the courtyard without organization.

In the 1980s and 1990s, these families living in hutongs were families with many children. Four, five, eight or nine children were in their 20s, ready to become a family, and with an informed return, crowded the originally small house. Unbearable, the yard saw needles, the place where the cover can be built, the whole house was built, and the entire courtyard was completely unrecognizable. Furthermore, with the economic developed and the modernization of the city, developers began to destroy the old Beijing quadrangle in Hutong to build high buildings. An urban problem now is rising that we have to face and solve recently.

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1 Hong Zhao. *The disappearance of Beijing Quadrangle and Hutong*. Uploaded on 1st of September, 2017. <http://www.sohu.com>

2 Hong Zhao. *The disappearance of Beijing Quadrangle and Hutong*. Uploaded on 1st of September, 2017. <http://www.sohu.com>

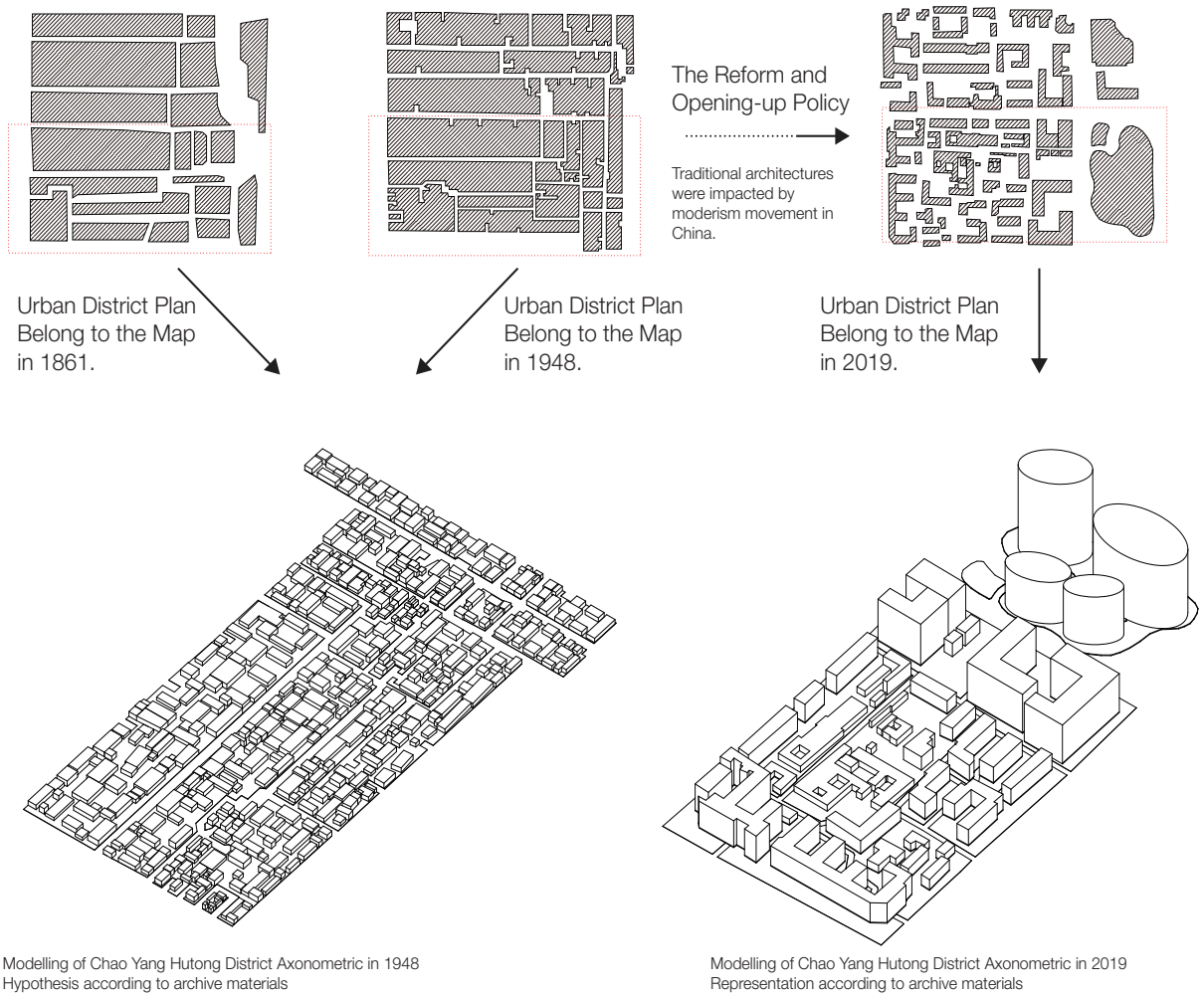
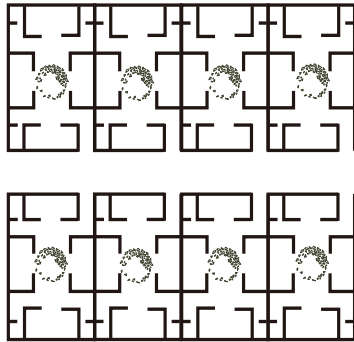


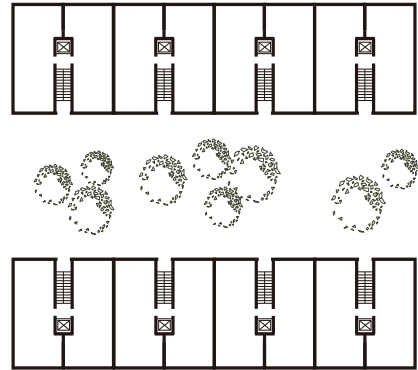
Fig. 3.04  
 Chronological  
 Scheme of  
 Hutong Fabric  
 in Beijing  
 Source:  
 Produced by  
 authors

According to the materials that we have, we used digital modelling to simulate a quarter of selected district. This district is dominated by residential area, supplemented by commercial functions, the road name of the hutong is still there, but the dwellings are no longer the Beijing Quadrangles, and the well-known

Galaxy SOHO complex is next to them. Nevertheless, follow the chronological diagram s we made based on maps. (Figure 29) When we go back to the same block in the past, we still discover the urban context of the hutong. In 1861, low density of architectural area and spacious street. When it was 1948, the similarity of

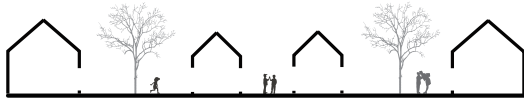


Simulated Drawing of Chao Yang Hutong Urban Fabrication in 1948  
Architectural forms influenced the urban fabrication.  
Drawing Scale 1:700



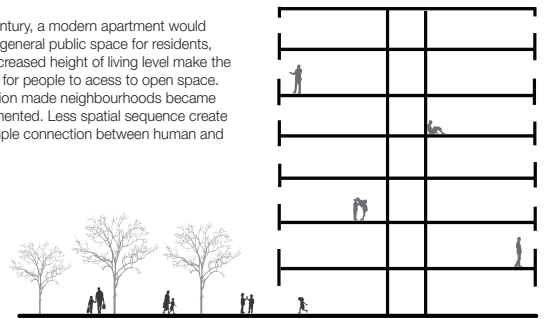
Simulated Drawing of Chao Yang Residence Urban Fabrication in 2019  
Architectural forms influenced the urban fabrication.  
Drawing Scale 1:700

People who living in the Quadrangle houses would gain more open spaces per family. The composition made neighbourhoods became closer, and the spatial sequence made a strong connection between human and building.



Section of human life-style in Hutong  
Drawing Scale: 1:400

In 21st century, a modern apartment would provide a general public space for residents, but the increased height of living level make the difficulties for people to access to open space. Composition made neighbourhoods became estrangement. Less spatial sequence create a very simple connection between human and building.



Section of human life-style in a modern apartment  
Drawing Scale: 1:400

Hutong texture was preserved. But architectural area has increased to high density, with dense and constricted street in between. It is obviously that this kind of metabolism was due to population increasing, the changing had orientated to social demand. When the timeline comes to 2019, the reform and Opening-up policy promoted the process of urban modernization. From diagrams above, accompany the comparison between

the Modelling of Chao Yang Hutong District Axonometric in 1948 (Hypothesis according to archive materials) and the Urban Model in 2019, although we can notice that the modern fabric gains more open space for residents, reduced the cover area of buildings, the density of urban fabric was relieved to low density on the top view. However, after we made digital urban models in three dimensions, the result is showing above that even the

Fig. 3.05  
Comparison  
Scheme about  
Urban Context  
of Ancient  
and Modern  
Source:  
Produced by  
authors



modern fabric helps residents gain more open space, but it is disappointing that the volume of residential buildings has increased along vertical direction dramatically. And our Hutong context has vanished completely.

Based on the results of the previous model analysis, we try to produce simulated drawings of Chao Yang Hutong urban context in 1948. Then we believe that different architectural forms and typologies influenced the urban fabric absolutely. New residential buildings in new modern urban have replaced the traditional Hutong dwelling, Beijing Quadrangles, thus, because the urban fabric is affected by architectural forms, these urban metabolisms are even changed without any doubts. People moved to new residential apartments instead of quadrangle dwellings, and per capita living area is drastically reduced, the condition of human living became worse than before. Accompanied with the deficiency of human's regional affiliation and their sense of identity with local culture. Compared with the past (Figure 30), people living in the quadrangle houses would gain more open spaces per family. The composition made neighborhoods become closer, and the spatial sequence made a strong connection between

human and building. Different from that, in the twenty-first century, a modern apartment would provide a general public space for residents, but the increased height of living level makes it difficult for people to access to open space. Composition made neighborhoods become estrangement. Less spatial sequence creates a very simple connection between human and building.

But what is worthy of recognition is that the increased urban public space gives people more opportunities to communicate with the city. This is an advantage we are willing to use for reference.

## Guangzhou

The same traces of the times with obvious characteristics can be said to the cities in the south, taking Guangzhou City as an example. Guangzhou is a famous city with more than 2,000 years of civilization. She was the political, economic, cultural and military center of Lingnan. Since the Han and Tang dynasties, she had developed into a famous metropolis in the south, and was a world-famous trading port city. The merchants gather and trade is booming. It is a starting point for the ancient Maritime Silk Road in China. During the Five

Dynasties and Ten States, Guangzhou became the capital of the Southern Han Dynasty. In the changing history of the Ming and Qing dynasties, Guangzhou, as a contact point for cultural exchanges and integrations between China and foreign countries, shines with dazzling brilliance.

As early as the late Neolithic period more than 4,000 years ago, our ancestors worked on this land, engaged in fishing, agriculture and other production activities, creating the original culture of the Guangzhou area. According to the <Records of the Grand Historian>, after First Emperor of Qin unified the Six Kingdoms (221 BC), sent Ren Xiao and Zhao Tuo to lead the army south, who unified Lingnan in 214 BC, divided the Lingnan area into three counties such as the South China Sea. The county governs Fan Zhou, which was called Panyu City in the <Records of the Grand Historian> and <Book of Han>.

Qin died (around 207 BC), Zhao Tuo occupied Lingnan, built South Nanyue Kingdom, and Panyu City as the capital. The artifacts of Han tomb excavated in Guangzhou today reflect that the buildings at that time were towering, guarded castles and extremely simple houses coexisting. Among them, the earliest

ones are “stilt wooden style” (the high-rise building of the upper house for living and the lower space for raising livestock), later there was the “curved rule style” (the flat indoor space is turned at a right angle), the “three-in-one” and the “louver style”, adapting to the natural environment of high temperature, humidity and rain in the south. In terms of form characteristics, this was the product of the combination of the Han style architecture from Chinese Central Plains and the Southern Yue style architecture<sup>1</sup>.

According to the records, before the Tang Dynasty, people in Guangzhou used bamboo and straw to build houses. Since the officers in Tang Dynasty who managed the Guangzhou area, tried to separate the areas of residential and commercial shops and taught the people how to make the tiles. They gradually turned the cottages into tiles-covered houses, and the initial reasons for these methods were to reduce fires and prevent fire hazards. Song Dynasty, the first year of Xining (1068), Zhangtian, major of Guangzhou, built the sub-city at the city east with perimeter in seven miles. In July of the same year, Lu Jujian and Wang Jing burned bricks and converted eastern-city and sub-city. This was the earliest brick city recorded in Guangzhou<sup>1</sup>.

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<sup>1</sup> Bureau of Culture of Guangzhou Municipality, Guangzhou Local Chronicle Office, and Guangzhou Institute of Cultural Relics and Archaeology, eds. Guangzhou Cultural Gazetteer. Guangzhou: Guangzhou Press, 2000. Page 2.

Then, during the Ming Dynasty (about 1380), Guangzhou City expanded again, and the city north expanded more than 800 feet to Yuexiu Mountain. It also built Zhenhai Building (commonly known as the five-story building) next to the wall on the mountain, and expanded the wing city on both west and east sides until the Pearl River in Qing Dynasty. As for the construction of the Republic of China, it was the modernization process (about 1918). The government presided over the demolition of the city walls and paved the road.<sup>1</sup>

From the first map, we can see the situation of Guangzhou city and blocks in the Qing Dynasty. As the last node to enter the modernization process, urban planning thought is still influenced by the leading agricultural economy. The city center is planned with political purpose as the center, in line with the defending monarch and the purpose of preventing looting. First, the buildings used by the manager was planned and organized. For example, the central area of the city was still in line with the central axis rule, ancestral temple and temples of gods respectively located to the left and right, and administrative offices and temple buildings distributed in many places in the city.

However, most of the people living in the city are still farmers who were dependent on the land outside the city. The vast agricultural production areas outside the city are the hinterland of the city. Nevertheless, comparing the street names used in modern maps with historical street names, we can know that there were also residential areas outside the city walls. In this era, the economy was dominated by agriculture, but at the same time it is gradually affected by the commercial development of handicrafts, thus forming different lifestyle between city and rural areas.

The maritime traffic trade in the South China Sea is no later than that of the Han Dynasty and flourished in the Tang and Song Dynasties. In Tang Dynasty, the sea route started from Guangzhou in the east and east to East Africa. Since the Ming and Qing Dynasties, it has reached Europe and America. According to historical records, Panyu City in the Han Dynasty has long been one of the most developed cities in the country.

The main influence to the formation of Guangzhou's urban fabric also appeared in the middle of the Qing Dynasty when the economic policy has been turbulent. The government stopped trading in

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<sup>1</sup> Bureau of Culture of Guangzhou Municipality, Guangzhou Local Chronicle Office, and Guangzhou Institute of Cultural Relics and Archaeology, eds. *Guangzhou Cultural Gazetteer*. Guangzhou: Guangzhou Press, 2000. Page 2.



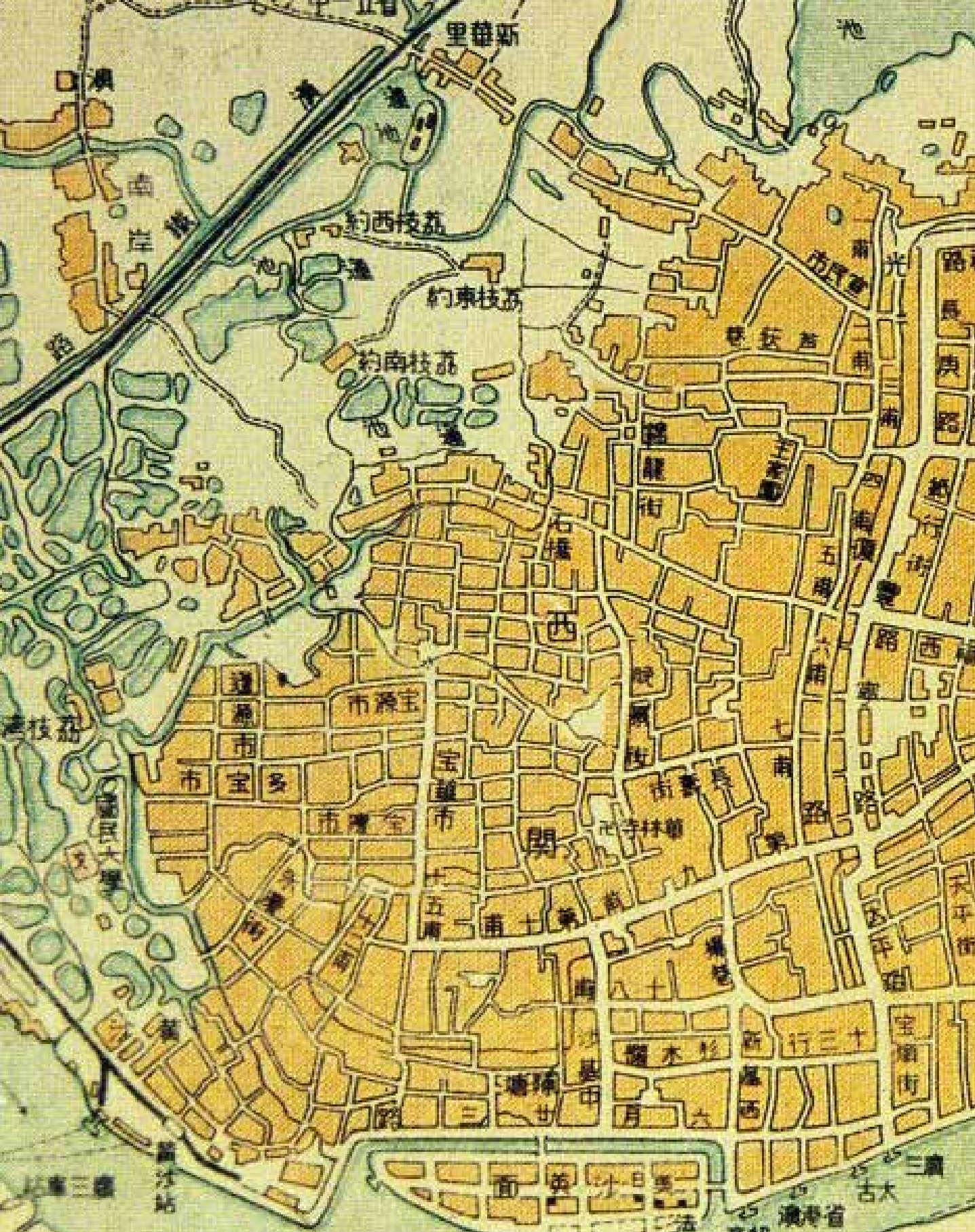
Fig. 3.06  
 Map of Guangzhou City  
 Qing Dynasty (1644-1922)  
 Source: Bureau of Culture of  
 Guangzhou Municipality, Guangzhou  
 Local Chronicle Office, and  
 Guangzhou Institute of Cultural Relics  
 and Archaeology, eds. *Guangzhou  
 Cultural Gazetteer*. Guangzhou:  
 Guangzhou Press, 2000. Page 9-10.

Fig. 3.07  
 Map of Guangzhou City  
 1928  
 Source: [http://blog.sina.com.cn/s/  
 blog\\_406290f50100953t.html](http://blog.sina.com.cn/s/blog_406290f50100953t.html)

Fig. 3.08  
 Map of Guangzhou  
 2019  
 Source: [www.map.baidu.com](http://www.map.baidu.com)



总图一



里巷新

池

南岸

約西枝荔

約東枝荔

約南枝荔

市民街

巷長

龍街

石橋

西

道風市

市源宝

市宝多

宝華市

市廣全

街書長

關

寺林前

十五甫

甫十

甫九

七甫路

路西

路

天平街

太平街

三甫

欄木珍

新

行三十

宝順街

塘孫

中

月六

古大

三甫

面

英

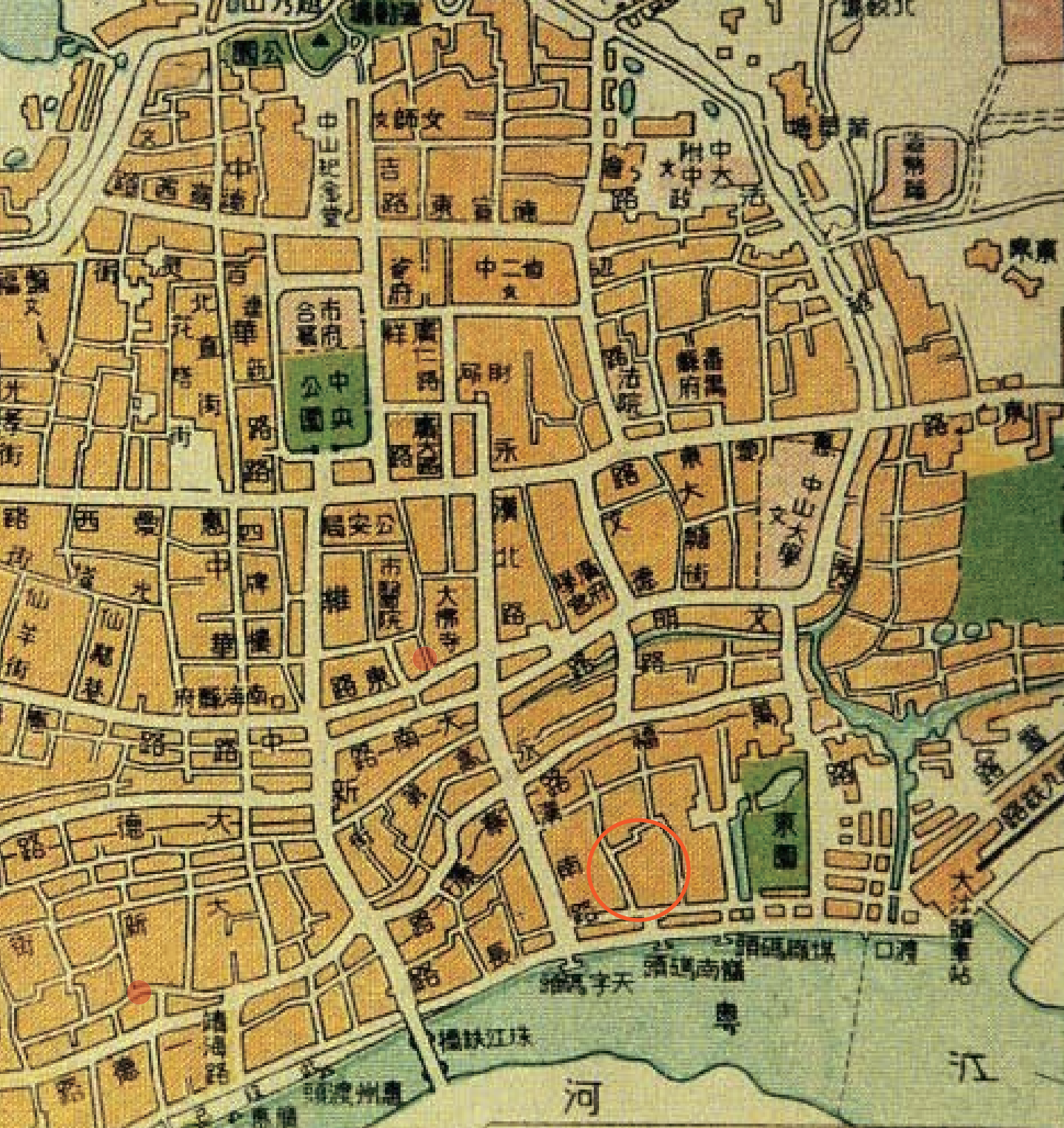
小

日

法

三甫

廣海省



# 廣州街道圖

1 : 37,000







multiple ports, only retaining the Guangzhou Port, and licensed the Thirteen-Trades Monopoly in Guangzhou to operate the national foreign trade. At this time, the architecture of Guangzhou was influenced a lot by the West, and great changes took place. The decorative arts tend to be magnificent and finely carved. From the end of the 19th century to the beginning of the 20th century, European-style Western architecture appeared. In the 1930s, a new type of Chinese-Western architecture was introduced. In the late Qing Dynasty and the early Republic of China, there were also Xiguan Mansion, bamboo houses, arcades, and Chinese-Western-style bungalows with unique styles and local characteristics.

The second map shows the city map of the downtown area in the late Qing dynasties. Since the middle of the Qing Dynasty Guangzhou was the only trading port, there were trading houses from various foreign countries. They were mostly two-story to three-story buildings, showing the form of general western-style architecture with western-style façade and a tropical-style arcade portion. Foreign trade has driven local economic development and urban construction, forming a pattern of urban commercial

streets driven by individual businesses.<sup>1</sup>

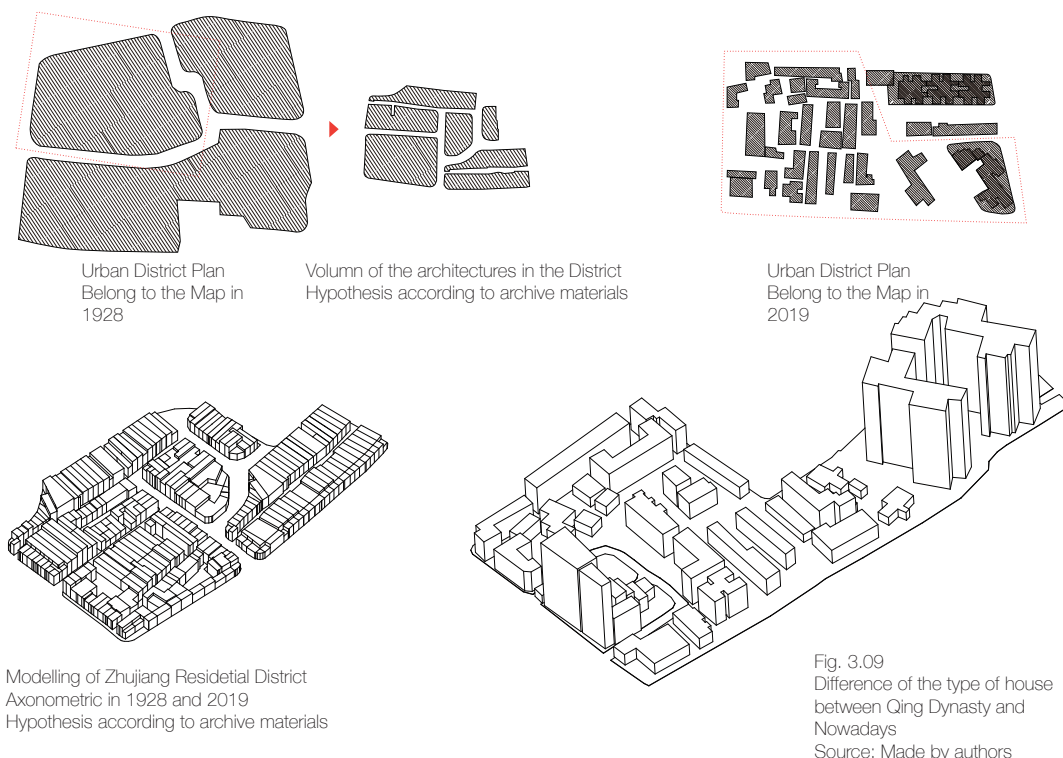
At the same time, as a provincial city, Guangzhou has a tight land. When arranging the houses, they can only be developed in depth to save land. Therefore, the "bamboo house" that has great depth has become one of the typical residences in Guangzhou. Because the local climate is hot and humid, and the ventilation, lighting, drainage and circulation of the bamboo house can be solved by the open halls, patios and corridors.

Merchants used foreign decoration style to attract local customers. Therefore, in the collision and fusion of Western architectural style and traditional Lingnan culture in China, there was a new type of southern retail building, the arcade-house. During the promotion of the modern "urban transformation movement", in the building regulations formulated by Guangzhou government in 1912, there were clear standard on the construction of the arcade architecture.<sup>2</sup> In the old Guangzhou city, the streets were curved and roundabout. In order to minimize the impact to the official residence of the bureaucracy and shops, the arcade-house became the main architectural form of the commercial block and was

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1 Gao, Haipeng. "Arcade-house and Arcade-house Street in Guangzhou - the research of historical development and conservation." Master's thesis, Xi'an University of Architecture and Technology, Sep. 2003. Page 19.

2 Gao, Haipeng. "Arcade-house and Arcade-house Street in Guangzhou - the research of historical development and conservation." Master's thesis, Xi'an University of Architecture and Technology, Sep. 2003. Page 30.



built along various roads. The emergence of such a corridor has an inseparable relationship with commercial economic activities, reflecting the development of the city's economy and the improvement of the status of the citizens. The business has gradually developed into an open commercial market from the original closed "market".<sup>1</sup> The subtropical climate of Guangzhou is adapted to the open space on the ground floor of the arcade-house. The historical tradition of Guangzhou attaching importance

to business provides a good cultural environment for the development of commercial and residential combined buildings.

With the development of the times, especially since the 1980s, China's economy is in a period of rapid development that has never been seen in history. Most cities are transforming old towns with large-scale construction. Many of the arcade buildings were demolished, which interrupted the unique traditional

1 Gao, Haipeng. "Arcade-house and Arcade-house Street in Guangzhou - the research of historical development and conservation." Master's thesis, Xi'an University of Architecture and Technology, Sep. 2003. Page 16.

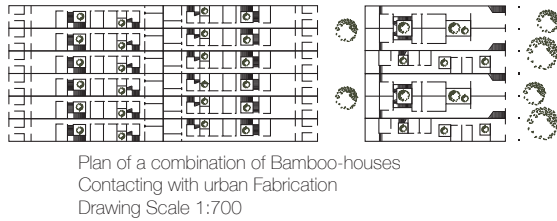
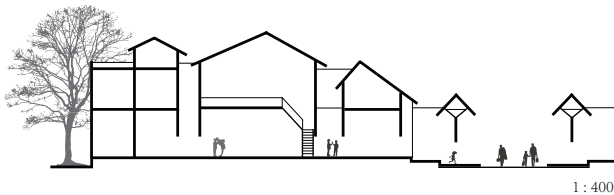


Fig. 3.10  
Traditional House  
Bamboo House  
Source: remade by authors  
base on relevant material



culture and architectural context of Guangzhou that many locations could have apparently felt.<sup>1</sup> We made the model to understand the changes and compare the space experiences. The traditional residential areas where built with bamboo houses have various approachable and intimated public or family activities space. In the inner streets between storied buildings and houses inside the block, there will be some small open space and front house garden where the neighbours can meet and have leisure

1 Gao, Haipeng. "Arcade-house and Arcade-house Street in Guangzhou - the research of historical development and conservation." Master's thesis, Xi'an University of Architecture and Technology, Sep. 2003. Page 13.

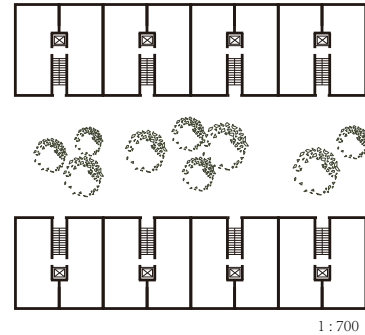
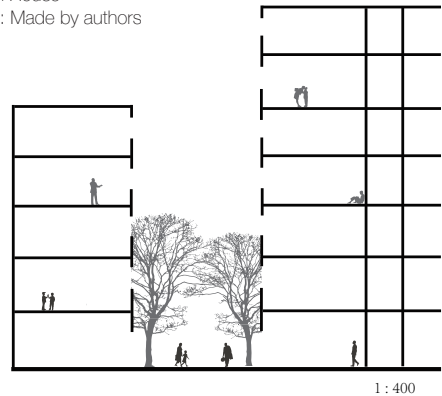


Fig. 3.11  
Modern House  
Source: Made by authors



time together, and also its a space with quite envirnment more like a home with more sense of belonging. Another area is inside the house which is the patio which exist to solve the ventilation and lighting problems of narrow bamboo house, but it provides a lovely area for family with many possibilities. The modern residential building make people estrange each other with independent space without many familiar meeting points. Moreover, the decoration and construction style lack the regional vernacular characteristics.

## Xi'an

In Chinese history, Xi'an is the longest ancient capital in history, and its history has been more than a thousand years. The land where Xi'an is located has been the capital of thirteen large and small dynasties. It was no accident that Xi'an flourished before the Song Dynasty. It had a special position and superior geographical defense situation, which was undoubtedly the reason why it had attracted generations of emperors to build capitals here.

Xi'an located in the center of China, although deviates from the eastern economic center in the history, it had an advantage in defending the border threat of the nomadic regimes in the northwest and the north, as well as exploring the territory. When Chang'an (the name of Xi'an during Sui and Tang Dynasty) was the capital, Luoyang was often accompanied by the capital (called Dongdu), and Chang'an was regarded as the political and military center and Luoyang was the economic and cultural center. This situation has been maintained until the end of the Tang Dynasty.

This land was inhabited by primitive humans 700,000 years ago, and the first

capital of the Guanzhong Plain region was built here during the Zhou Dynasty.<sup>1</sup> The Western Zhou Dynasty and the Spring and Autumn and Warring States Period were an active period in the planning and construction of ancient Chinese cities. Since the beginning of the Zhou Dynasty, with the implementation and development of the sub-sealing system (Feudalism), the lords who have been sealed to various countries have established or expanded the cities in their own territory. As their political, economic and military bases, the capital construction has also begun. And there was a summary of methods and systems for capital construction.

The location of the ancient capitals must not only meet political planning, military defense, but also an environment suitable for survival, ample land to protect the housing of a large political institution, the army to support the population, and the production and living of a large number of people in the city. The Guanzhong Basin provides excellent conditions for convenient transportation, abundant water resources, mild climate, abundant products and economic development.

After the gradual decline of the Zhou Dynasty, the Qin State in the northwest gradually became stronger. In 221 BC,

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1 He, Congrong. Ancient Capital City Xi'an. Beijing: Tsinghua University Press, Jul. 2012. Page 13.

Emperor Qin Shihuang ended the battle between the vassal states for many years. After the destruction of the six countries, the first unified dynasty in the history of China was established. This Xianyang became the capital of the entire Qin Dynasty, and therefore has an unprecedented scale and construction. Xianyang located in the center of the Guanzhong Plain. The city was built along the topography and the palace as the core. The overall layout of the city was relatively loose. The palaces were large in scale and numerous in number, but there was no built defense wall, might there no worries about security after unified the world. There were official hand workshops on both sides of Castle city and folk pottery workshops four kilometers away from the west side of the palace, and more than 100 wells were found.<sup>1</sup>

Later, the Western Han Dynasty was first built. For military reasons, the special strategic location and superior defense conditions of Guanzhong were selected. In the south of Xianyang City, which has been destroyed by war, a new capital, Chang'an, was built. In Chinese, it means long-term and safe. Many new palaces were built. After the completion of Changle Palace, Changan officially became the political, economic

and cultural center of the Western Han Dynasty. After the Han Dynasty, the Wei, Jin, Southern and Northern Dynasties and the replacement of several dynasties in the Sixteen Kingdoms period, the dynasty fell and was ruined. Until the most prosperous period of the Tang Dynasty.

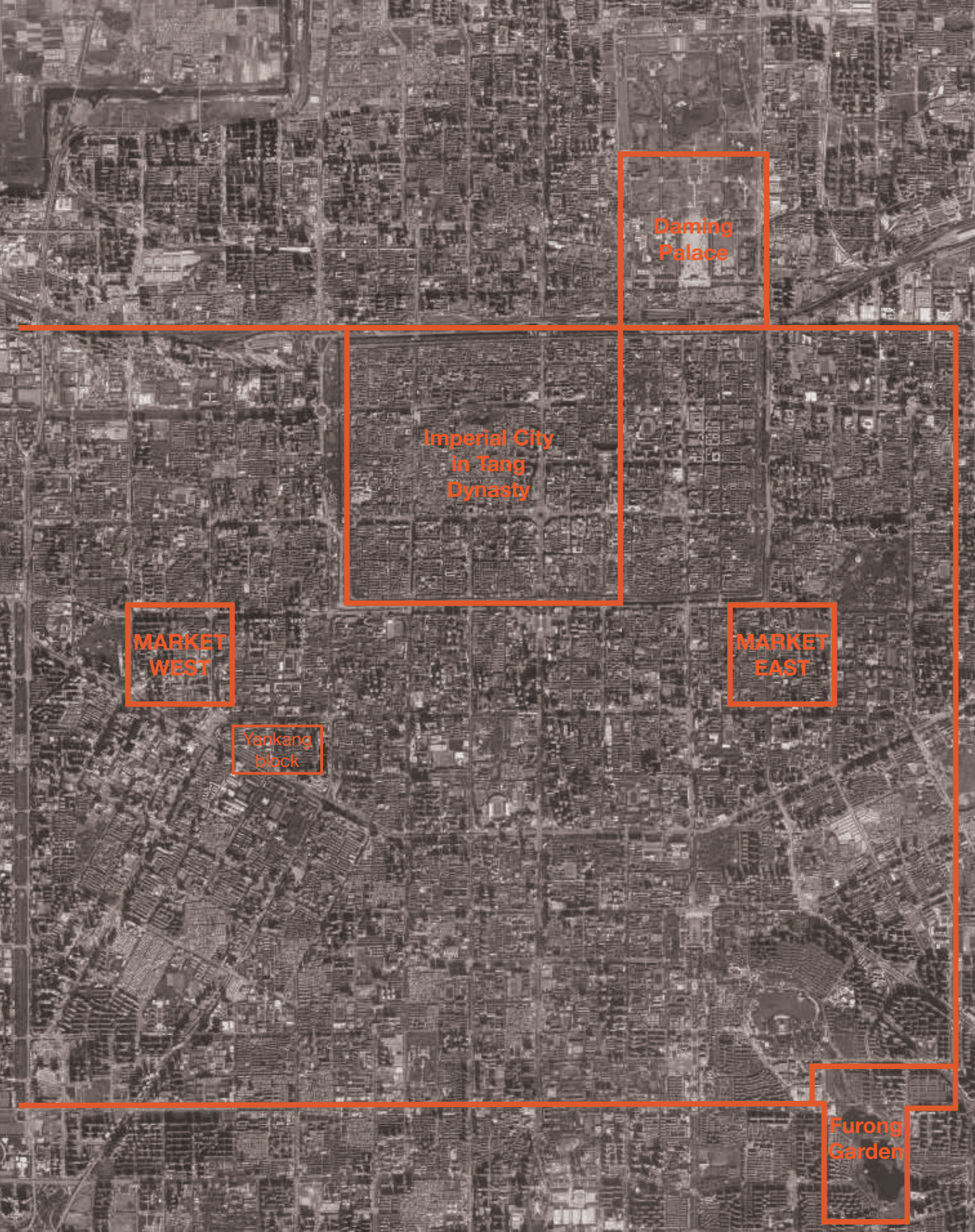
During the Sui and Tang Dynasties, China's economy was highly developed, its national strength was unprecedentedly strong, and the scientific and cultural undertakings have achieved many amazing and brilliant achievements, becoming the most glorious and prosperous stage in Chinese history. The trade exchange between the Tang Empire and the surrounding countries was frequent, and its influence was far from Central Asia and the Arab region. It not only attracted a large number of foreign merchants to trade, but also attracted many foreign scholars to study. Japan, North Korea, Southeast Asia, and South Asian countries have sent messengers to Changan for many times. For these foreign emissaries and scholars, the Tang government has properly arranged their accommodation in Chang'an. The extremely regular urban streets and the Blocks system, the orderly and centrally symmetrical urban layout, the Imperial City was in the middle, facing the

Fig. 3.12  
Recovery Map of Chang'an  
Song Dynasty  
Author: Lv Dafang  
Source: [http://blog.sina.com.cn/s/blog\\_406290f50100953t.html](http://blog.sina.com.cn/s/blog_406290f50100953t.html)

Fig. 3.13  
Map of Xi'an 2019  
Source: <https://www.google.it/maps>

1 He, Congrong. Ancient Capital City Xi'an. Beijing: Tsinghua University Press, Jul. 2012. Page 20.





Daming  
Palace

Imperial City  
in Tang  
Dynasty

MARKET  
WEST

MARKET  
EAST

Yankang  
block

Furong  
Garden

spectacular scene of the broad Suzaku Street, showing the great spirit of a unified and strong country.

In the old Han Changan wreckage, there were many deficiencies, so the Emperor Wen of the Sui Dynasty built a new city. In the planning, the distinction between Palace complex, Imperial City, Outer city, the halls, mansions, the official office and the residential house was clear. At the same time, the redistribution of land in the new city in order to avoid the vested interests of Han Changan should also be an important consideration for strengthening the centralization of emerging centralities. The specific planning implementation was responsible for Yu Wenkai who was familiar with the palace system of the past, had ingenuity, was good at building, and it was said that he invented the scale and used the model to express the design method.

The front of the new city was directly opposite the Zhongnanshan Ziwu Valley, the back of the Longshou Mountain, the east was next to Bashui, Chanshui, and the west to Fengshui. In the city, three water channels of Longshou, Qingming and Yong'an were excavated, and they entered from the east and the south of the city, and used water for the city and

the palace. It was called "eight waters around Chang'an".

The whole city was divided into three parts: Palaces complex, Imperial City and Outer City. First built the palace area, the second was the imperial city, and finally the outer city. The outer city was divided into several blocks through north-south and east-west streets. According to archaeological excavations, the city's east-west wide is 9721 meters (the document contains: 18 li and 150 steps), and the north and south are 8651.7 meters long (the document contains: 15 li and 115 steps). The outer city area was about 84 square kilometers. Beyond the wall of the outer city, 3 meters from the wall base, there was a moat that is about 9 meters wide and about 4 meters deep. <sup>1</sup>Palaces complex and the imperial city located in the middle of the northern part of city. According to the rules of <Book of Rites · Zhou etiquette · Diverse Crafts>, there should be three doors on each side of imperial city. There should be three gates on the east, west and south sides. In addition to the south wall, there were five doorways facing Suzaku Street, and the rest were three doorways.

There were 12 north-south streets in outer city and 14 east-west streets. The

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1 He, Congrong. Ancient Capital City Xi'an. Beijing: Tsinghua University Press, Jul. 2012. Page 41.



three main roads leading to the south gate and the east and west gates were called the “six-street”. They were the main roads in the city. The “six-street” scale were very large, with a width of 55 meters or more than 100 meters. Especially on the central axis, Suzaku Street was the widest, about 150~155 meters. Other streets that do not pass through the city gate are generally between 35 and 65 meters wide. The road between imperial city and Palace complex was about 220 meters. These roads divide outer city into 108 blocks.<sup>1</sup> There was a strict curfew system in the city. When sky getting dark, the drums on streets were ringing together, and the gates of blocks were closed immediately. The residents were not allowed to walk except the patrol guards. This curfew system was not relaxed until the middle Tang Dynasty.

The area dimension of each block was different, but their dimensions of the length of each side were in regular pattern. From north to west were 450 steps, 550 steps and 350 steps, and from center to both sides were 350 steps, 450 steps, 550 steps and 650 steps (one steps is around 160cm).<sup>1</sup> With the comparison between the imagine recovery map of Chang'an city the Xi'an city nowadays, we can know one block

1 He, Congrong. Ancient Capital City Xi'an. Beijing: Tsinghua University Press, Jul. 2012. Page 43-44.

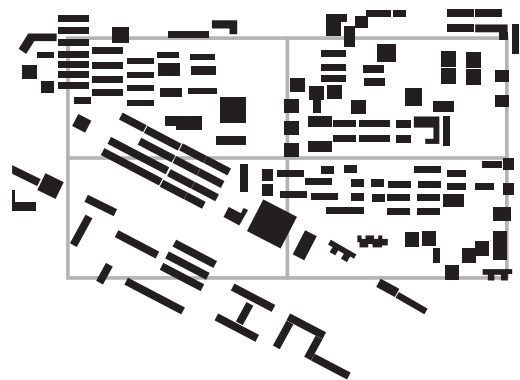
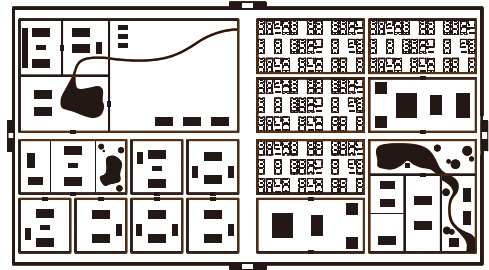


Fig. 3.14  
Noll-map of Block Yankang in Tang Dynasty and Nowadays  
Map. Source: Made by authors

has really huge dimension, which even can be consider the size of a small town.

The arrangement inside a block was also in regular and strict principle. It was divided into 16 areas. For the different class of people at that time, they could received one or more than one "piece" of the 16 areas. For example, there was a royal family member even received the whole block at a time, like a small city. For the normal citizen, their houses were arranged in a specific area in 16, which we can see the highset density of houses area in the nolli-map analysis.

From the comparison of the city map, we can not found much similar between, only some parts of the wreck of the Chang'an city wall and the Furong imperial park were transformed into the city park for leisure for the citizen.

Taking the same dimension of a block in Tang Dynasty on the same area of the nowadays city map, from which we can see the city fabric the the area was total changed with different language for planning. The concept of city planning of Sui and Tang Dynasty time is not suitable for the development of modern city, because the society political environment and standard of needs of citizen were

totally changed through the time. But now what we consider most is the vanish of the Chinese traditional culture and urban context during the demolishing activities in modern metropolitan movement.

We can see how the city changing of Xi'an city step by step in history from the historical city maps by following. The red line rectangular highlight in the map is the general area of imperial city area. From the latest city map we can understand how much the city has been extended after time. And the imperial city ruins located at the center of the city.

From the build-up day Chang'an city in Sui Dynasty, it usually remain in its square shape as its most prosperous period. Later after the dead of Tang Dynasty, Chang'an was gradually no longer as capital city. It was developed as a normal city. As the requirement for economics and transportation construction, the expansion was no longer followed its regular rectangle shape.

After 1949, as the provincial capital of Shaanxi Province, as the central and northwestern hub, Xi'an has gradually developed into a modern metropolis.

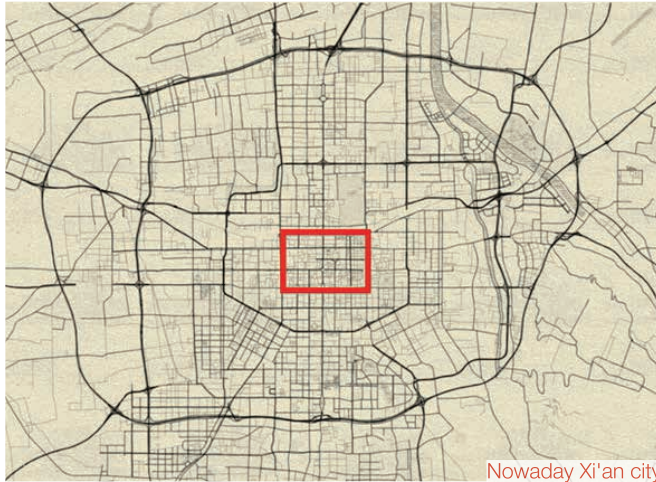
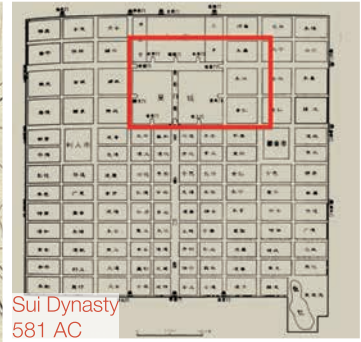
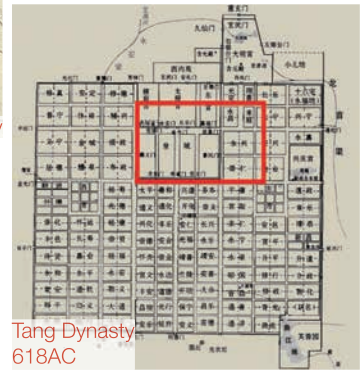


Fig. 3.15  
Remained Imperial City Wall Now  
Source: <https://www.zhihu.com/question/27549539/answer/43136807>



Sui Dynasty  
581 AC



Tang Dynasty  
618AC

Nowaday Xi'an city

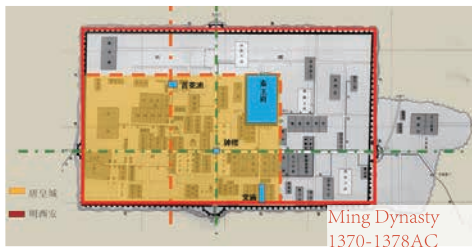
Fig. 3.16 and Fig. 3.17  
Remained Imperial City Wall of Now  
in Most Brilliant Period of  
Capital City Chang'an  
in Sui and Tang Dynasties  
Source: <https://www.zhihu.com/question/27549539/answer/43136807>



Five Dynasties 904AC



Song Dynasty 979 - 1276 AC



Ming Dynasty  
1370-1378AC  
under construction



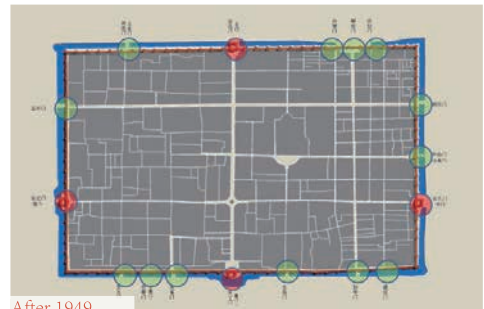
Qing Dynasty  
1469-1781AC

Fig. 3.18  
The Changing of  
City Area  
with the Remained Imperial  
City Wall Border

Source: <https://www.zhihu.com/question/27549539/answer/43136807>



Republic of China



After 1949

## Tianjing

The opening of the Grand Canal of the Sui Dynasty made the intersection of the South Canal and the North Canal “Sancha” River estuary is the earliest birthplace of Tianjin. In the last years of the Jin Dynasty, in order to ensure the safety of the capital and salt storage and transportation, the government established a military base here. In 1404, Tianjin officially set up a military site and set up a city wall at the military site in Tianjin.

During the Ming Dynasty (1493), Liu Bing, the deputy of Shandong Armed Forces, built the Drum Tower in the cross street in the centre of the old city of Tianjin. At that time, the Tianjin City Pool was rectangular in shape, with a length of 1570 meters from east to west and 900 meters from north to south, with a total area of 1.55 square kilometres.<sup>1</sup> There are four gate towers on the four sides of Tianjin Old City Wall. The southeast and northwest are “Zhendong”, “Dingnan”, “Anxi” and “Gongbei”. Since then, from the Qing Shunzhi to Jiaqing more than 140 years, the walls of Tianjin Old Town have been rebuilt more than 12 times. After the construction of the Ming and Qing

Dynasties, the Tianjin city has begun to take shape and gradually develops along the South Canal and Haihe River.

On the map of Marco Polo, Tianjin is known as “Tiancheng”. In 1656, the first Dutch mission to China came to Tianjin from Tianjin Port. The two envoys, Peter De Goyer and Jacob De Keyzer, talked about Tianjin in their report to China<sup>2</sup>: There are three rivers that meet here, where there are strong forts, the walls are covered with watch towers and fortifications. There are plenty of temples here, very dense population, transactions are frequent, and the prosperous business scene is rare in other parts of China. This is because ships that drive from Beijing or drive to Beijing must pass here, which promotes the extraordinary development of water transportation, and had become a distribution centre for various commodities.

When Qingdao entered the modern urban planning, the establishment of the trading port and the division of the concession were the beginnings of the urban regulating pattern and spatial evolution in Tianjin. From the division of the British and French concessions in 1860 to the

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1 [https://zh.wikipedia.org/wiki/Tianjin\\_Urban\\_Planning](https://zh.wikipedia.org/wiki/Tianjin_Urban_Planning). 天津城市规划

2 Yuxin He. *Tianjin Past Events: Secret Maps Hidden in the Old Time*. Northern Literature and Art Publishing Press, 1st June, 2015

end of the last expansion of the concession in 1903, 20th century. Tianjin had successively occupied the nine-nation concession, and the total area of the concession was several times that of the old city. . In the late Qing Dynasty and the early Republic of China, Tianjin was called “Little Paris”. People used “Tianjin in the north and Shanghai in the south” to describe the scene of Chinese massive and prosperous cities.<sup>1</sup> When the theory of urban garden planning in the United Kingdom prevailed, the British rent in Tianjin was built according to this theory, and the family lifestyle centred on living, dining, and dance halls was promoted. The social lifestyle in city which formed by parks, churches and halls. Complete public facilities and pleasant space scales for a comfortable living environment. It is the pioneering nature of this kind of urban context. Afterwards, a group of wealthy people from other regions have moved into Tianjin, and they have built a large number of western villas in the concession. Thus, the city started to present a strange and mixed urban texture and unrecognizable culture since then.<sup>2</sup>

Therefore, we searched old documents from Chinese archives to find numbers of

narrated maps. Fortunately, there is a website that have collected plenty of documents and cartographies about ancient China. Afterwards we picked two maps, first is Tianjin Cheng Xiang Bao Jia Quan Tu, in 1899. And the second is the General Plan of Concession Tianjin, in 1932. Then we make cartography of Morden urban map of Tianjin in 2019. Three of them (Figure 3.19; Figure 3.20; Figure3.21) are presented as following:

Fig. 3.19  
Map of Tianjin  
in 1899  
Source:  
Category:Maps  
in Chinese,  
[https://  
commons.  
wikimedia.org](https://commons.wikimedia.org).

Fig. 3.20  
Map of Tianjin  
in 1932  
Source:  
Category:Maps  
in Chinese,  
[https://  
commons.  
wikimedia.org](https://commons.wikimedia.org).

Fig. 3.21  
Map of Tianjin  
in 2019  
Source:  
Google Earth  
Pro

1 Yuxin He. *Tianjin Past Events: Secret Maps Hidden in the Old Time*. Northern Literature and Art Publishing Press, 1st June, 2015.

2 Sun Shiwen. *On Urban Planning System in China*. Urban and rural planning, phase 1, 2017.

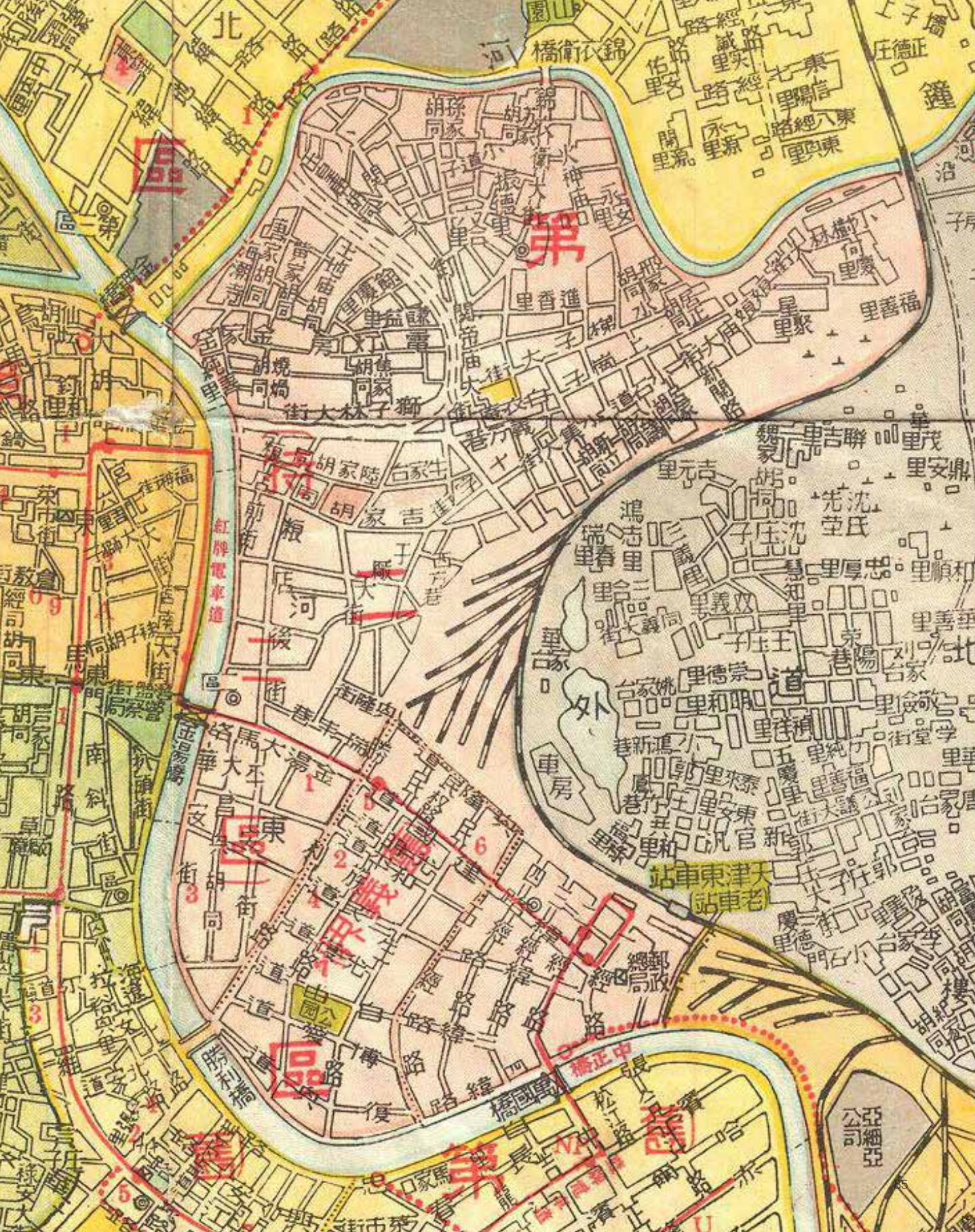
# 天津城廂保













Current  
Position of the  
Reconstructed  
Drum-Tower

Original  
Position of  
Drum-Tower



The reason why we compared three maps in 1899, 1932 and 2019 is that we want to use maps which we could obtain to elaborate common characteristics about Tianjin fabric as convinced as possible. After study from the illustrations above, we could gain some obvious urban phenomena in Tianjin. Although, the first map portrays the community self-defense system of the walled city of Tianjin and its environs. We could say that: let us trace back to last two centuries, the idea of enclosure is deeply embedded in Chinese minds. Although Tianjin is a harbour city, so the influences of different cultures become frequent and easy. It is evident to observe the eastern pagoda is coexisted with western cathedrale. But we still found most of houses in the wall have enclosed courtyard. Even the blocks are showing their enclosed layout. Next then the urban sprawl take place in the second map in 1932. The area enclosed by defend wall which is Cheng Xiang area is showed in the area highlighted by red line in this map. The Jintang Bridge plays the important role to connect the city centre in east and the second district in west. It was during this period that Western modern urban planning theories and spatial models began to be introduced into Tianjin, and the western urban planning was permeating into

Chinese urban fabric gradually. Last is the urban map in 2019. We drew important roads to access the historic city centre and remark the Chenxiang area with red lines. The Tianjin urbanization is incredibly growing. Both the city centre and the costal region developed rapidly till 2019. Countless skyscrapers and huge modern cubes have risen up against original buildings, the impacts make the ancient city centre lose its identity and destroy its original cityscape. The only recognisable railway has been given a modern station without any original contexts. Even more incredible is that in order to increase the passability of intersections, they moved historic drum-tower from original location.

Total absence of the phenomenon is telling us Chinese cities are losing their identity and tradition urban fabrics. We feel urgent to bring their original urban contexts to these cities, and developing Chinese stylish urban contexts is becoming valuable development topics for us.

2

Study from  
Traditional Urban  
Fabric in District  
and Open Space

With the deeply research of urban fabric. We started to apply a method that is select a typical region of a city or town to study specific features of its local district pattern. Because of the rapid of urban modernization, and there is increased number of people study from western urban planning regulations, plenty of scholars have brought western urban planning theory into this land and the injection of modernism mentality, all of them have begun to broke connection from Chinese urban history. Enthusiasm, even fanaticism of acquisition to the urban modernization, we feel that in this period it is lost the correct direction that Chinese people built modern infrastructures and imitate modern or western stylish architectures. As far as we consider the urban modernising blindly without concerning the existing urban fabric and contexts is not an appropriate urban strategy even it could not be called as urban developing.

At this moment, we want to emphasize the proposition from Aldo Rossi <sup>1</sup> in his book, “the architecture of the city”. Different from Architecture that emphasizes individualism in American, Aldo Rossi underlines that the community public space and city are much more

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<sup>1</sup> Aldo Rossi. *The Architecture of the City*. The MIT Press, Cambridge, Massachusetts, and London, England. 1982

important, without considering the urban connection with architecture, the fancy architecture is just stand with insignificance. In our opinion, city influences districts, districts influence architectures. Meanwhile, architectures impact districts, districts impact city as well. So when we develop a project we have to interface different scale which are urban scale, district scale and architecture scale to consider in multiscale formations. Never ignoring the connections between urban, district and architecture. So now we are going to introduce several cases of different districts, each of them is belong to its representative city as following. The eight cases we selected are base on our consideration and we think they could present their various characteristics to a great extent.

### Chang'an City in History

Li-Fang unit system, block planing, the urban planning method in Chang'an city from Sui Dynasty till Tang Dynasty (581 - 907 AC) divided the city into blocks made the city like a regular checkboard with straight and wide city roads. At the same time, the strict law of curfew and large dimension of roads between blocks resulting they were independent and isolated with each other.

People can not go out of the block after nightfall, and common citizen could only have the door opened inside the block, the house of nobleman were allowed to open the gate face to the road outside the block. Although the market block for commercial activities distinguishing from residential block had been stipulated to locat in certain site, it did not mean there were none of these kind of facilities in the block but only existing few to meet the basic needs.

Apart from the wall of blocks, the areas inside the blocked were also distintced. In Chang'an city, the house of bureaucrats and nobles called mansion house which was classified as bigger or smaller. Their house distributed near imperial palace and the emperor thought the closer of officier's house to palace, the higher honor to their status.

As the reason that there were many people living in a noble or imperial family, who owning many horses and storeroom so that they needed huge house to accommodate. The mansion house usually occupied at least one sixteens of the whole block with the open space, gardens and serval independent buildings or rooms with courtyard and there might be a big court where the games with ball

and horse were played. In addition, there was a wall to define this scope of their property area.

For the lowest class of the citizen, there usually the single houses were arranged in one sixteens area which were really small buildings without much beautiful landscape. But the land for them was very limited which meant that there not many common people could live in the city, whose house usually located in the north-east section in the city. According to the archaeological excavation data, there many people were speculated living outside the Chang'an city wall.

Because of the social institution was classified people and the city were planned to regular and rule people. And there were so large gap between different classes that although they lived in the same city, they were having totally different life style, not even allowing us to talk about enjoying the space of a city or having the sense of belonging, which is one of the problem what we consider most nowadays when we talking the city life. Everything has two sides, under this situation, Tang Dynasty was the most prosperous period in chinese ancient history. As the natural development of city, commodity economy was gradually



Fig. 3.22  
Restoration model of Chang'an City  
Tang Dynasty - 720 AC  
Source: He, Congrong. Ancient Capital City Xi'an. Beijing: Tsinghua University Press, Jul. 2012. Page 274.

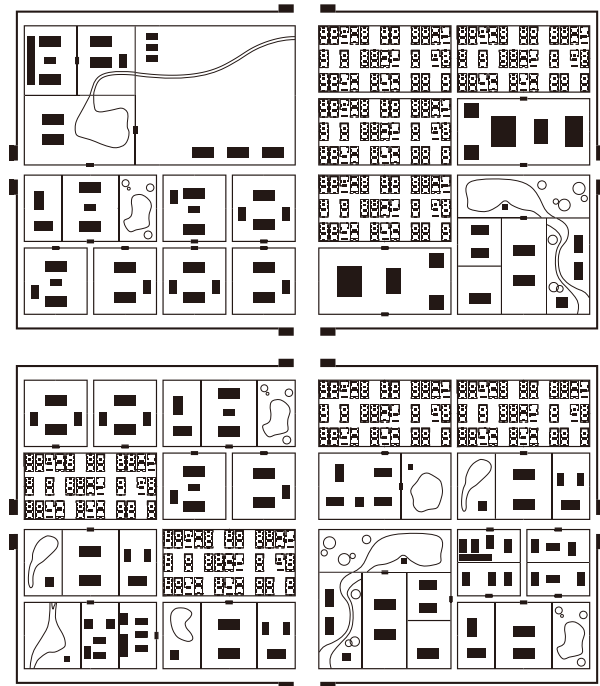


Fig. 3.23  
Chang'an city - Block Pingkang and Block Xuanyang  
Tang Dynasty - 720 AC  
Source: Remade by author base on relevant material



dominant, which provided the chance for the people to break the "wall" of the blocks. The spectacle appeared until Song Dynasty, when it was the time people could use the open public space in the city.

### Kai Feng

Since the opening of the city system in

the Song Dynasty, the Kaifeng of the Song Dynasty was a veritable city that never sleeps. Kaifeng implemented the system of unity in the city, and there was no time or place restriction. The night market was not over yet, and the morning market opened. . Under such a system, it is not difficult to imagine that the Song Dynasty has rich products and developed commercial trade, which should be far

Fig. 3.24  
Along the  
River During  
the Qingming  
Festival, painter  
Zhang Zeduan  
(1085–1145),  
Source: Palace  
Museum([https://  
commons.  
wikimedia.org/wiki/](https://commons.wikimedia.org/wiki/))





superior to other dynasties. The full-time model of the Song Dynasty completed the continuous operation of the dynasty. The Song Dynasty had its inevitability in surpassing the previous dynasties in terms of economy, culture, commerce and technology. The city streets of Kaifeng City in the Song Dynasty are no different from modern cities. The former wall of the

square was completely disappeared, and the buildings facing the street were open to the street, and became the store, hotel, restaurant, and guest shop that opened the door to welcome guests. The advertising signs that the merchants hang out are dazzling. The street is also full of various mobile stalls for small businesses. As depicted in the Qingming River map, at the crossroads in the city,

at the top left is a mobile stall selling snacks, a pharmacy, and at the top right is a bookstore and a butcher shop. At the bottom right is a hotel and there is a pawn shop at the bottom left. Such a city scene is actually a modern street form that we are familiar with today. That is to say, in the era of the map drawn by Zhang Zexuan, the Fangshi system has completely collapsed. As long as you have a house on the street, you can tear down the wall, open a shop freely, and sell any legal goods other than government products. The government only collects business tax from people and does not interfere with people's freedom of doing business. The city opened the original wall to make the urban context more open and provide people with a better urban environment.

## En Yang Town

En Yang Town in Sichuan province is a typical Sichuanese vernacular town which different from the metropolis in Sichuan province. En Yang Town still keeps its original local characteristics that based on its tradition urban fabric. Instead of modern residences, the vernacular housing composes this town with its local identity that could clearly propagandize local cultural features and customs in

Sichuan region. Use an old Chinese poem to describe the urbanscape in En Yang: "The sound of the rain in the ancient town, the bluestone is far away."

Enyang Ancient Town is located in Enyang District, Bazhong City, the old revolutionary area in the northeastern part of Sichuan Province, and borders on Bazhong City in the east. The Enyang River flows from the side, hence the name of the ancient town of Enyang. Here is a place of a climate characterized by more precipitation, and the town is surrounded by mountains, its terrain has a slight fluctuation in somewhere.

The ancient town of Enyang has a long history. The ancient town was developed from the original water terminal. It was once prosperous in ancient times dominated by water transport. There are still 28 ancient streets and hundreds of ancient buildings in the Ming and Qing Dynasties. In 1933, the Sichuan-Shaanxi Revolutionary Base was established. Based on aerial photographs of this town<sup>1</sup>. We make masterplan drawing in order to analysis urban layout of En Yang Town. High density of vernacular dwellings are adjoining with each other. Longish eaves are covering the road that was not too wide. Urban fabric is not following the

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1 From online resource: <https://baike.baidu.com/item/恩阳古镇>



Fig. 3.25  
Aerial photographs of En Yang Town in Sichuan Province  
Source: <https://kknews.cc/zh-sg>



Fig. 3.26  
Masterplan Drawing of En Yang Town in Sichuan Province  
Source: Produced by authors

regular grid pattern but presenting a dynamic tendency. According to our research, this reason might due to the geographical feature of local terrain. In the centre of this illustration, there is an abandoned public space that is covered by green. Comparing with the urban access, the living area occupied a big amount of area. Different from common traditional quadrangle dwellings that have enclosed courtyard, most of residential houses are single building without courtyard, but attach with neighbourhoods tightly. Only large families have enclosed courtyards. We could regard it is because of scarceness of their land resources.

## Beijing Hutong

The hutong, also known as “li (nòng)” and “alley”, refers to the relatively small streets between the main streets of towns or villages, which lead to the interior of the residential area.<sup>1</sup> It is an integral part of communicating local traffic. According to the road access situation, the Hutong is divided into a dead alley and a live alley. The former has only one opening, the end is deep into the residential area and is interrupted inside; the latter communicates with two

or more main streets. Hutong is a major feature of Beijing. Both In history and in reality, Hutong is a place where ordinary citizens of the city live. The formation and existence of Hutong and Beijing culture play a decisive role. Compared with the Forbidden City, the Temple of Heaven and the Summer Palace, which represent the royal culture, Hutong can be said they are presenting the culture of Beijing civilian.

Beijing's hutong originated in the Yuan Dynasty. In the Yuan Dynasty, the hutongs in Beijing were wide, and the Yuan Dynasty was basically the distance between the three large courtyards. Therefore, the descendants who built the courtyard in the middle of the open space must rely on the small alley as the access passage. This has produced a large number of unknown small alleys in many famous big alleys. So there is a saying: "The are thousands of famous Hutong and the number of unknown hutongs is even greater. Because Beijing Hutong is not only the fabric, the traffic channel of the city, it is also the place where ordinary people gather and live, and Hutong is also the important stage of the Beijing culture development. It records the changes of history, the style of the epoch, and contains a strong cultural atmosphere,

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<sup>1</sup> From online resource: <https://baike.baidu.com/item/胡同>



Fig. 3.27  
Aerial photographs of Hutong in Beijing  
Source: La Chine A Terre Et En Ballon, 1902.

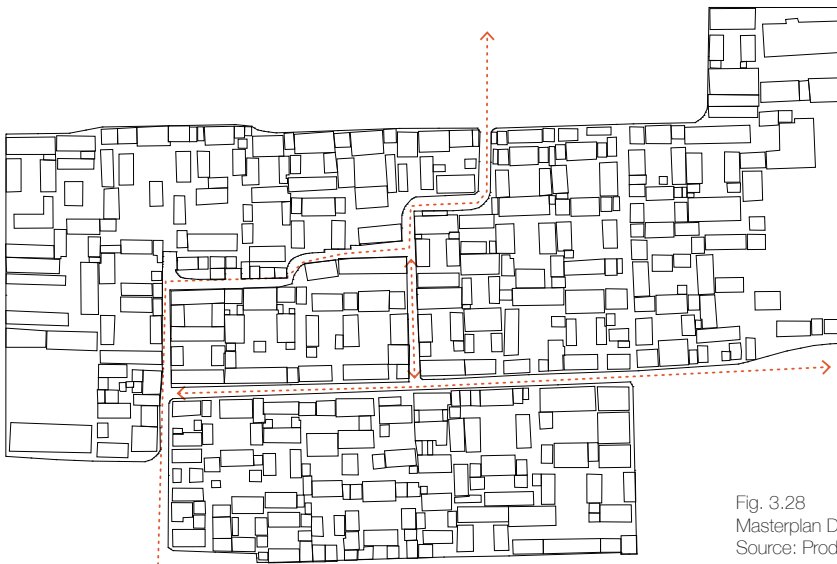


Fig. 3.28  
Masterplan Drawing of Hutong in Beijing  
Source: Produced by authors

like a museum of folk customs that carries all the memories of different generation. Strolling through Beijing Hutong, there are places of interest and monuments everywhere. From the courtyards of large and small hutongs, you can learn about the lifestyle of Beijing citizens.

Pleasantly, let us take a broad view of the photography above (Figure. 3.27), pitched roof arrange in a crisscross pattern, horizontal and vertical direction intervein with each other. Different from the previous cases, exquisitely decorated roofs exude the life attitude from Beijing people, and the slop of roofs demonstrates their gentle gradient. Eaves are seeking out but still leave the space for light coming through Hutong. Every family has their own courtyard no matter the dimension. The human kindness scale of the Hutong is weaving all the residential building and their courtyards. Each of these elements compose as typical Beijing Quadrangle housing. The environment of Hutong interprets local culture and vernacular urban contexts.

## Wu Town

Wu Town, located in Tong Xiang, Jia Xing City, Zhejiang Province. It is located in the

“Golden Triangle” of Jiangsu, Zhejiang and Shanghai, and the hinterland of Hang Jia Hu Plain. It is 60 kilometers away from Hang Zhou and Su Zhou and 106 kilometers away from Shanghai. It belongs to the Tai Lake water system, and the rivers are intertwined. The Beijing-Hangzhou Grand Canal passes by the town. Wu Town, located in Tong Xiang, Jia Xing City, Zhejiang Province. It is located in the “Golden Triangle” of Jiangsu, Zhejiang and Shanghai, and the hinterland of Hang Jia Hu Plain. It is sixty kilometers away from Hang Zhou and Su Zhou and one hundred and six kilometers away from Shanghai.<sup>1</sup> It belongs to the Tai Lake water system, and the rivers are intertwined. The Beijing-Hangzhou Grand Canal passes by the town. Its excellent geographical location and the dense urban characteristics of the river network have contributed to the rapid economic development of the region and the modernization of the city. At that time, the local government tried to preserve the traditional city as much as possible.

From the aerial photo on the right side (Figure.3.29), the region is in the west gate of Wu Town. Apparently, there is a typical vernacular town in this region which in south of the Yangtze River,

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1 From online resource: [https://baike.baidu.com/item/ 乌镇](https://baike.baidu.com/item/乌镇)



Fig. 3.29  
Aerial photographs of Wu Town in Zhejiang Province  
Source: [www.wuzhen.com.cn](http://www.wuzhen.com.cn).



Fig. 3.30  
Masterplan Drawing of Wu Town in Zhejiang Province  
Source: Produced by authors

completely preserves the style and pattern of the ancient towns in the late Qing Dynasty and the Republic of China. The urban characteristic of intertwined river network is evident to understand from the photography above. The usual land route has been replaced by waterway, like Venezia in Italy, boats are playing the same roles of automobile. Besides the main transport waterway, there are narrow alleyway on the rest of mainland. Urban fabric is much more clear than previous cities. The streets and their nearby waterway are parallel with each other. The house located on these streets are following the tendency of the street. All of them are recognizable vernacular housing. Their typical eaves are the most authentic portrayal of the local season. Moving from the main waterway into inland, courtyards appear due to the rich families' work, a majority of residential house are single house and attach with neighbourhoods tightly. Such features were generated by local climate and Geographical factors. Thus, with the urban developing, this area has created a cultural environment and typical urban texture with local characteristics.

## Shan Zhou Bei Ying

Bei Ying village is located in Shan Zhou, He Nan province. Bei Ying is famous for its nearly a hundred of sunken Yao Dong. As an ancient and magical residential style, the sunken Yao Dong is rich in local traditional culture. It is the only underground ancient residential building in China and even in the world. Meanwhile the sunken Yao Dong is one of the four unique ancient residential buildings in China. Known as the ancient village under the horizon, the construction skills of the underneath excavation were included in the national intangible cultural heritage protection list in 2011.

The sunken courtyard has a history of more than six thousand years.<sup>1</sup> As early as the Miao Digou culture period, it has already had the prototype of the sunken Yao Dong. Because of its special geographical location in the Chinese yellow loess region, these places have formed their own urban environment which is dwelling below, fields upstairs.<sup>2</sup> Each sunken courtyard is basically six to ten meters underground, in order to ensure that the land on the roof is safe enough to provide people with normal living places. The fundamental reason of this special urban phenomenon was

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1 Sicheng Liang. *A History of Chinese Architecture*. SDX Joint Publishing Company, Beijing. 2001.

2 Bernard Rudofsky. *Architecture Without Architects: A Short Introduction to Non-Pedigreed Architecture*. The Museum of Modern Art, 11 West 53rd Street, New York, 1965.





Fig. 3.31  
Aerial photographs of Bei Ying Village in Shan Zhou  
Source: [www.schoolside.net/](http://www.schoolside.net/) 陕西文化网

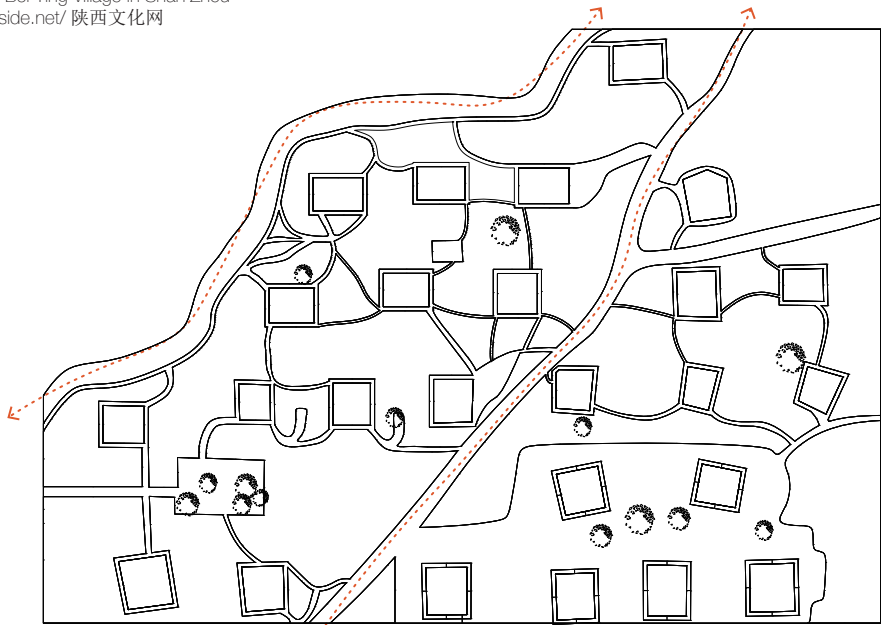


Fig. 3.32  
Masterplan Drawing of Bei Ying Village in Shan Zhou  
Source: Produced by authors

due to the peculiarity of loess. The loess is actually sand, thanks to the migration and deposition of loess with the wind, as well as it has high softness and porosity, local people were easier to excavate to create some liveable spaces.

The top view photography (Figure.3.31) of the sunken Yao Dong in Bei Ying village tells us the different cityscape of this area. Barren soil and a small amount of greenery brought local people an unsatisfied living environment, but the locals have used their ingenuity to make good use of vernacular materials to create a living environment that suits them. Here, the land plays a dual role, agricultural fields on the surface of land, vernacular dwelling under the land. The local thick land provides good thermal insulation and keeps living environment in a good condition. Although the local people living underneath, but each family possess their own courtyard. Residences use the L shape staircases access to sunken courtyard from ground level. Family has their own courtyard for communication and some sporadic open spaces are built on the land for the general community. That is interesting to concern the unique urban fabric with this underground system and how local residents creating their own identity on this land.

The Feng-shui factors related to the exit orientation in the sinking cave are highly cared. Because the location of the house is different from the original Feng-shui, the requirements for the entrance and exit of each sinking cave dwelling are different. Everyone will choose the direction that is most conducive to their own entrance and exit, so that their houses have the best Feng-shui, so the location of entrance and exit of each cave dwelling are not exactly the same.

The sunken cave dwelling is a cave dwelling below the ground. It is a courtyard that is excavated underground on a relatively flat and open ground. Then, several bedrooms are drilled across the walls of the courtyard, or as a living room, either as a bedroom, as a kitchen, as a livestock room, or as a warehouse. Based on family needs and economic capacity to decide the number of excavation caves.

From the distance, the sinking cave dwelling has no expression of dwelling at all, because its upper edge of the courtyard is parallel to the ground, and the distance so far away that it looks as flat as the ground. Only a close look can see a concave courtyard, and the caves dig on four walls in the courtyard are the space to live. Normally, each sinking



Fig. 3.32  
Aerial  
photography of  
Bei Ying Village in  
Shan Zhou  
Source: [www.  
szdky.cn/index.  
aspx](http://www.szdky.cn/index.aspx)

courtyard is a family, independent from each other. This kind of pityard under the ground, for the first time, it is very interesting and strange for outsider, and it is also a very special form of traditional dwellings in China. According to the survey, this form of housing is extremely rare in the world. The size of the courtyard of the sinking cave is limited. This requirement is not determined by the owner's economic capacity and status, but by safety. The best length and width of the underground courtyard of the sinking cave is generally nine meters or ten meters. There are disadvantages in too large and too small. At the same time,

the depth of the sinking cave should be about ten meters. If it is too deep, it is not easy to dig and it is not convenient for people to go up and down. If it is too shallow, the top of the cavern dug in the lateral direction will be too thin. Because the ground above the ceiling of the sinking cave dwelling is an important area where people usually walk and move, in addition to ensuring the thickness of the ceiling of the cave dwelling, a parapet wall is added to the four sides of the sinking courtyard to prevent the people and things falling into the sinking courtyard from the ground level.

## Yongding Village

Yongding Village located in Fujian province which is a typical village with Tulou house numerous distributing, which is an unit residence with defensive function. The appearance of this kind of house closely relate to the history. In the 4th century AD, the war in Yongjia of the Western Jin Dynasty led to the emergence of hundreds of years of ethnic Han people movement from the central plains of China, with two directions. The first was the integration of the central plains immigrants passing River Huai Area into Fujian Province merging into the local aborigines, forming the "Fumin folks" characterized by the Minnan dialect. The second was the Hakka people entering the west of Fujian by the city of Ganzhou, Jiangxi Province, which was characterized by Hakka dialect.<sup>1</sup>

During the Ming and Qing Dynasties, the Hakka population surged, prompting them to expand eastward from the inland, and the Fumin closer to the ocean were invaded by the Japanese pirates and the consequent severe sea ban pressure began to migrate westward. The two ethnic groups met in Boping mountain range, where the hills are undulating, the beasts are infested. They were in conflict

with each other and the local southern Chinese cultivating people. The Hakkas and the Fumin who lived in troubled times can only live with their own blood. However, the quadrangle houses of the ancestors from central plains occupied too much space in the courtyard, and the defense ability was not worth mentioning, so it needed a comprehensive upgrade to meet the two needs of settlement and defense. The form of the fortress was the most preliminary goal. That was the reason why Tulou had been created, which is an architecture mainly made by simple and availability material, earth.

The construction of the Tulou spreads in mountains. These people are different ethnic minorities, or different brothers of the same family name, and formed together after many reproductions. The group of the Tulou is generally arranged according to the surname clan, three or five in groups on the slope or the foot of the mountain, or where the mountain is undulating, a Tulou occupies a small mountain peak, forming a group across the mountain (Figure.3.05).<sup>2</sup> Nowadays, without the chaos of the world, the demand for family and collective defense has been broken by smaller family units, and the construction of Toulou has lost its social meaning.

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1 Institute For Planets. "土楼从何而来? *Where Does the Tulou Come From?*" Weibo Sina (blog), July 22, 2018. [https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#\\_0](https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#_0).

2 Lu, Yuanding, and Yanjun Wei. *Tranditional Dwelling in Guangdong*. Beijing: China Architecture & Building Press, 1990. Page 30.

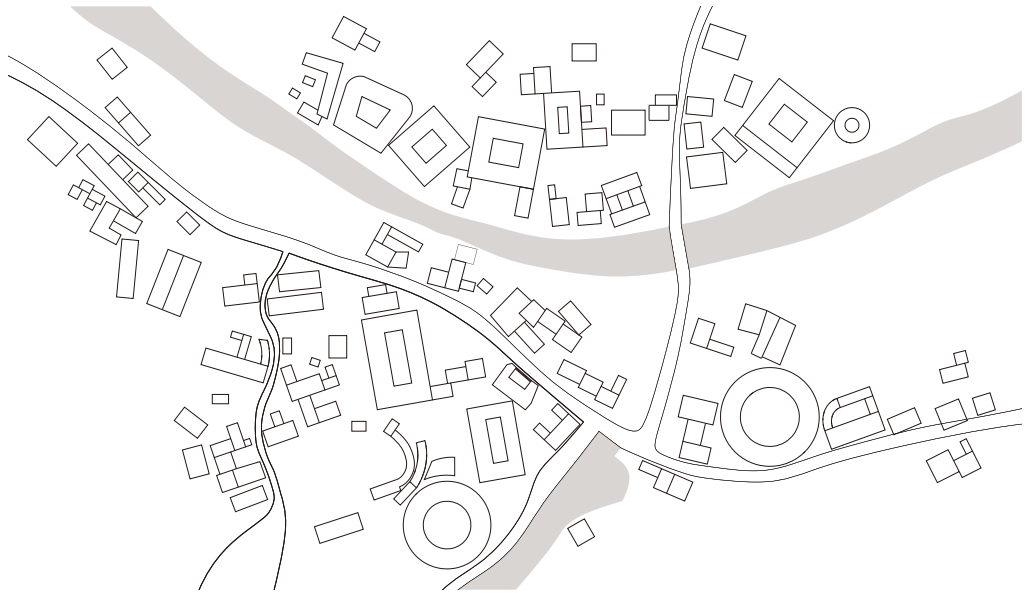


Fig. 3.33  
Plan of Yongding Village with  
Hakka Tulou  
Yongding, Fujian province  
Source: Remade by authors  
base on relevant material



Fig. 3.34  
Distribution of Tulou  
Source: Institute For Planets. "  
土楼从何而来? Where Does  
the Tulou Come From?"

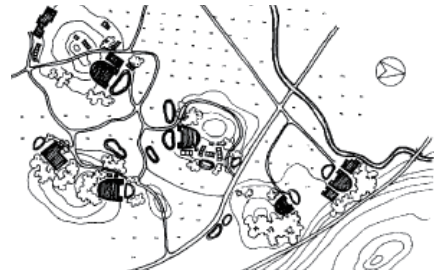


Fig. 3.35  
Perspective view of Group of  
Hakka Tulou distributed  
Source: <http://kt811022.pixnet.net/blog/post/349971241-chuxi-tulou>

Fig. 3.36  
Independent Tulou - Hengjia Tulou  
Yongding  
Photographer: Li Yishuang  
Source: Institute For Planets

Fig. 3.37  
Group Arrangement of Tulou  
Source: Lu, Yuanding, and Yanjun Wei.  
Traditional Dwelling in Guangdong.  
Beijing: China Architecture & Building  
Press, 1990. Page 30.

## Majianglong Village

Diaolou, as a house type with defensive function distributes in Kaiping Guangdong, its architectural form has been influenced by traditional defensive architecture more than 2,000 years ago, and it has gradually developed in the continuation and inheritance. In areas where disputes or large wars often occur, the rulers or ordinary people want to have places to escape and save their lives, so such buildings are created. Most of the squatters in the Kaiping area are wealthy non-official people who were contract workers who have experienced hardships in foreign countries. That is why one of the special features of Kaiping Diaolou is that its design and construction materials have absorbed a lot of experience from Western architecture and become a residential form of traditional Chinese residence with both culture.

This area is the junction of four counties and cities and difficult to control. It has become a chaotic area of social order. In addition, there are often typhoons and rains, and floods are rampant. Therefore, in the late Ming Dynasty and the early Qing Dynasty, there were villagers who spontaneously raised funds. These houses are used as important facilities

for flood defence. In the last years of the Qing Dynasty, after the Opium War, social turmoil was chaotic. At the same time, the United States, Canada and other countries recruited Chinese workers in the coastal areas of China for railway construction and gold mining development. After the First World War, European and American countries had a relatively stable period of development, and these overseas Chinese earned a net worth at this time. The traditional Chinese thought of "falling leaves to the roots" made them return to China. But China in civil war was still turbulent. Most of the overseas Chinese returning home were wealthy and became an important target of banditry, kidnapping, looting of property, so Diaolou was built. At this time, people like to quote the characteristics of Western architecture, the most obvious of which is the decoration of various roofs and facades, and also the significance of the traditional Chinese architecture to the level of roof performance.

The Diaolou is distributed in the ordinary villages in the south of Kaiping or similar turbulent areas. Therefore, there are common residential comb layouts and defensive squatter houses scattered in the village. However, there are also purely squatting villages that

Fig. 3.38  
 Connection between Buildings  
 of Diaolou Village  
 Source: Made by authors

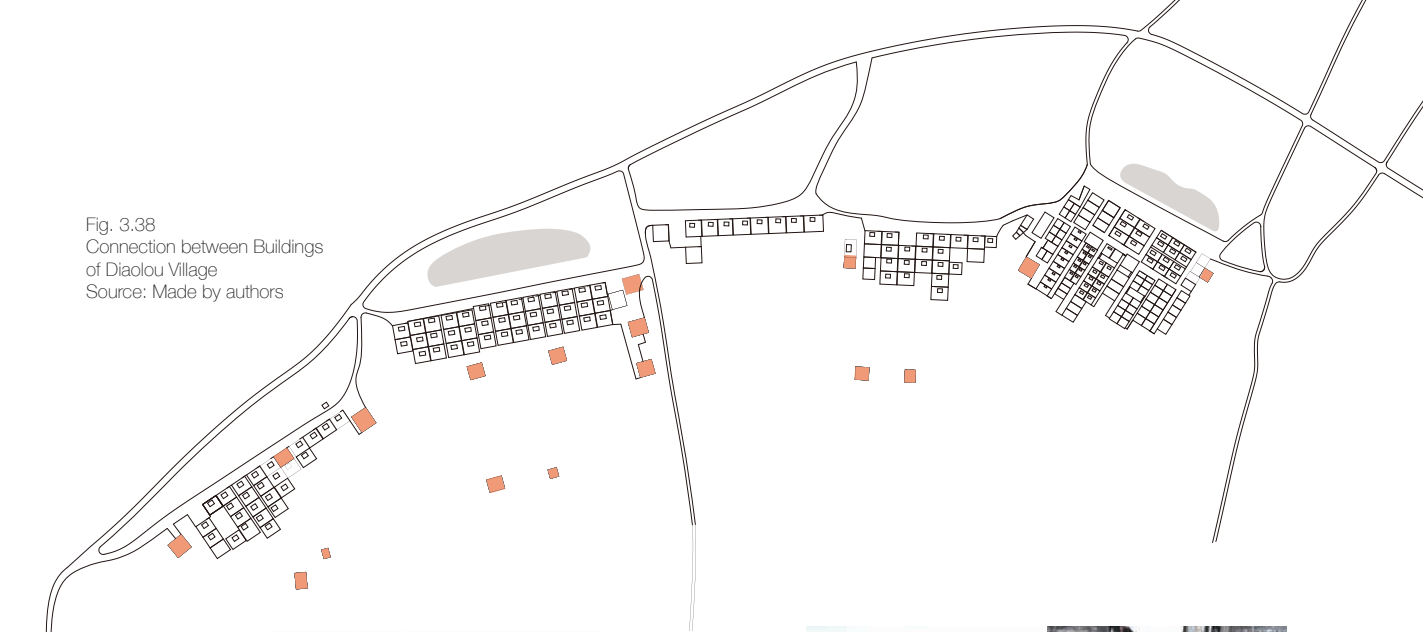


Fig. 3.39  
 Comb Pattern Layout of  
 Village House  
 Source: Lu, Yuanding,  
 and Yanjun Wei.  
*Traditional Dwelling  
 in Guangdong*. Beijing:  
 China Architecture &  
 Building Press, 1990.  
 Page 24.



Fig. 3.40  
 Comb Pattern Layout of  
 Village House  
 Source: Lu, Yuanding,  
 and Yanjun Wei.  
*Traditional Dwelling  
 in Guangdong*. Beijing:  
 China Architecture &  
 Building Press, 1990.  
 Page 19.

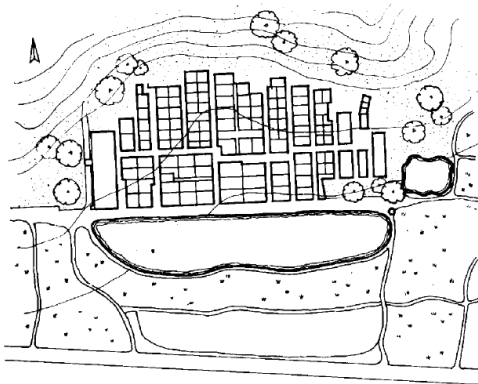


Fig. 3.41  
 Interior View of Diaolou  
 Source: <https://baike.baidu.com/tashuo/browse/content?id=eba29de2a5cf9cc00214e03f&lemmal=1769007&lemmal=1769007&fr=qingtian>

Fig. 3.42  
 Li Xiang Between Houses  
 Source: [blog.sina.com/gjgilulu](http://blog.sina.com/gjgilulu)

Fig. 3.43  
 Village View  
 Source: <http://dz.cppfoto.com/dz482.html>



are centrally planned and arranged, such as the Liyuan, which is a group of western-style squatters that are combined with private gardens.

## Ma'an Village

The architecture type of this village is in stilt style, which are mainly concentrated in the northern part of Guangxi Province, on the edge of the Yunnan-Guizhou Plateau. They belong to the large hilly landforms. The terrain is high, the mountains are continuous, the streams are numbers in vertical and horizontal, warm and humid, and the forests are dense. This mountainous area is home to a variety of ethnic minorities. Because each ethnic group has its own unique cultural traditions, customs, and religious beliefs, and its geographical location is remote, the terrain is dangerous, and long-term traffic is inconvenient. The Central Plains culture has little impact on it in history. So there is a special form of architecture that is free to develop considering mainly natural environmental factors.

Under the economic basic conditions of agriculture, making full use of natural topography, relying on mountains and rivers, and adapting to local conditions,

many villages of different sizes have been built on the top of the mountain, halfway up the mountain and the banks of the river. "beneficial to production and facilitating life" is the basic principle followed in the selection of their villages. The specific requirements are that the water source is sufficient, the land is fertile, easy to develop, the terrain is superior, the ventilation is good, the traffic is convenient, and the connection is convenient. Villages can be built on the foothills, ridges or riversides. The houses are freely embedded along the contours of the mountainside slopes. They are stacked and undulating, and they are coordinated with the terrace curve.

The terrain is complex and the landform is diverse, the steep slopes above 35 degrees in the mountainous area account for half of the land area, the slopes of 15 degrees to 35 degrees account for 37%, and the gentle slopes below 15 degrees only account for 13%<sup>1</sup>. So stilt style architecture is fit for adapting to the humid and rainy weather conditions and the changing geographical environment. It means a frame made of wood, the upper floor is occupied by people, and the lower floor can be housed in captivity. To organically combine the environment, houses are cantilevered, base, overhead,

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<sup>1</sup> Li, Changjie, ed. Vernacular Architecture in North Guangxi. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 9.



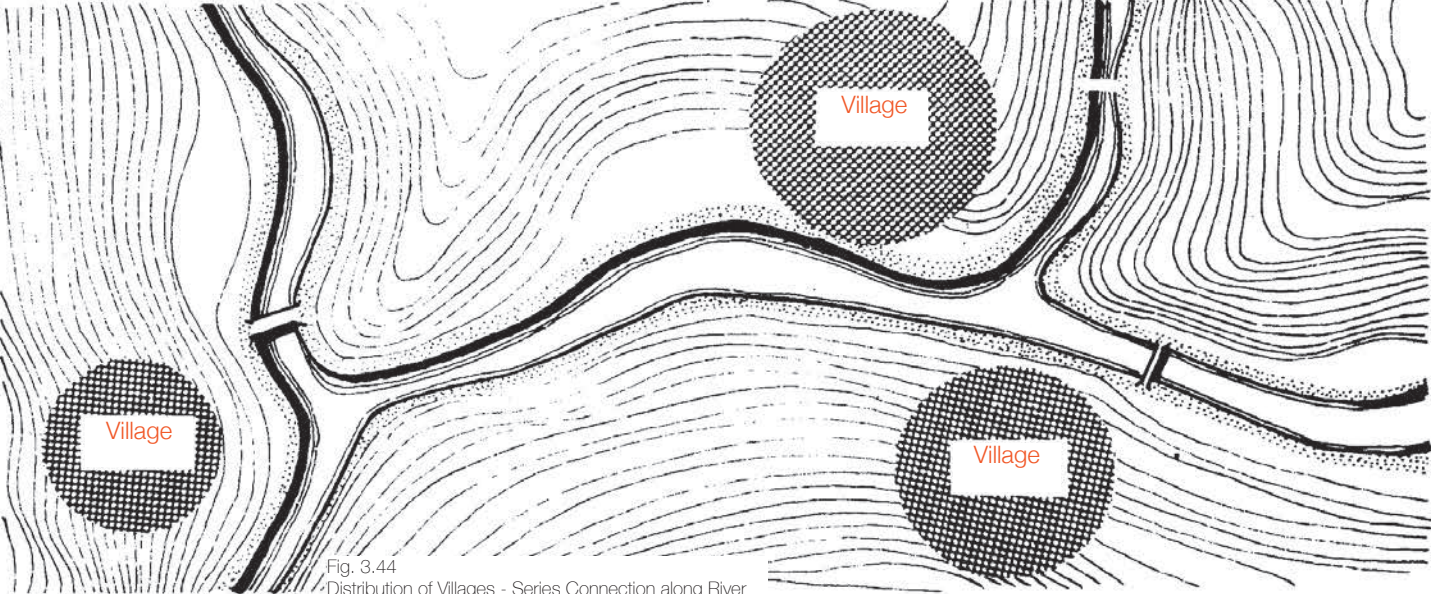


Fig. 3.44  
Distribution of Villages - Series Connection along River  
in North Guangxi  
Source: Li, Changjie, ed. Vernacular Architecture in North  
Guangxi. Compiled by Xiang Quan and Yuli Lu. Beijing:  
China Architecture & Building Press, 1990. Page 27.



Fig. 3.45  
View of Dudong Village  
Landscape and Road Space  
Source: Li, Changjie, ed. Vernacular Architecture in North  
Guangxi. Compiled by Xiang Quan and Yuli Lu. Beijing:  
China Architecture & Building Press, 1990. Page 45.



Fig. 3.46  
Plan of Ma'an Village  
Centrality to Single Drum Tower  
Source: Li, Changjie, ed. Vernacular Architecture in North Guangxi.  
Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture &  
Building Press, 1990. Page 32.



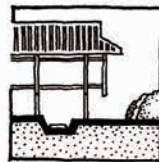
Col



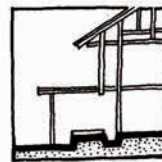
Riverside



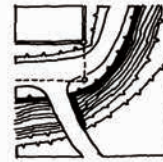
Ridge



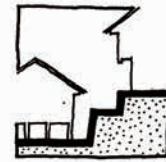
Cross the bottom  
of the house



Cross the  
cantilever platform  
of the house



Cross a corner  
of the house



On the terrain in  
different level  
between houses

Fig. 3.47  
Possible allocation of Villages  
Source: Li, Changjie, ed. Vernacular Architecture in North Guangxi. Compiled  
by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press,  
1990. Page 9.

Fig. 3.48  
4 Typy of Basic Relationship between Roads and Buildings  
Source: Li, Changjie, ed. Vernacular Architecture in North Guangxi. Compiled by  
Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 12.

or retracted by layers of terrain, resulting in a variety of shapes. The width of the village road is usually only about 1 meter, but the road space composed of the houses on both sides is very varied. The road often crosses the bottom of the building, or passes through the corner of the building, or passes between the buildings to form a completed road network makes the village traffic convenient. The combination of roads and buildings in village is very organic, forming an open, semi-open and closed interpenetrating space, which constitutes many wonderful landscapes.

All ethnic groups in the mountainous areas of northern Guangxi have their own religious ideas, worshiping ancestors and various natural gods. They are good at integrating the inherent religious beliefs of the nation into the Taoism that was introduced later. This kind of religious view directly affects the choice of building location and the layout of the interior. For example, the selection of the ground is based on the Fuxi Bagua, and the foundation, orientation, height, opening size, and gate position of the house are derived from the character of the person's birth. Religious concepts have a major impact on the residences of northern Guangxi and restrict civil

architecture in many ways. In the village, there are geographically linked links and tribal alliances. Therefore, the village leadership council has been created, that is, each village must have a drum tower. It is not only a place for meetings, but also a symbol of nationalities and villages. A place for public recreation and entertainment. They are good at stone and wood buildings, and the drum tower and wind and rain bridge are the crystallization of their architectural art.

### **Study from Chinese Traditional Public Open Space in Chinese Traditional Painting**

People living in cities, towns and villages not only have houses, public buildings and road systems, but public open spaces are also an important part. These places not only serve as places for human rest, work, and commercial activities, but also as carriers for the generation and inheritance of culture. In ancient China, the agricultural economy led the formation of a self-contained urban construction concept and urban development model because it has different forms of social and economic development with the West. At the same time, the city has the superiority of political economy and military, therefore, the evolution of the city.

There are significant features in development.

The emergence of word "public space" in the context of Western society was a profound and rapid reconstruction of Western urban space after World War II. A series of political cultures and ideology movements clearly defined public and private to protect individual rights. Produced at the time. The commonly understood "public space" does not exist in traditional Chinese literature. Because China has long been under feudal rule, land belongs to the ruler, and it has not developed and bred an early democratic political system which was similar to that of the ancient Greek city-states and the Roman Republic<sup>1</sup>. It requires a place where people can gather and conduct democratic political activities. So to enter these space for participating activities has shaped the area for public life of citizens. In ancient Chinese society, the emperor was the representative of the state. Therefore, the urban space did not completely form a platform for public participation. However, the urban public space emphasizes the sense of ritual, order, and the authority to formalize rules and demonstrate authority.

To understand the public space of

Chinese cities, it is necessary to explain from the generation, development and formation of cities. The prevailing concept of urban origin was that the production and lifestyle changed have emerged in cities dominated by commercial handicrafts, and the differences between urban and rural areas have been formed in rural-based rural areas.<sup>2</sup> In the earliest archaeological excavations, no residential ruins were found. Although these walls appeared, they were not realized in the city walls. For the ordinary people, there was not a city lifestyle different from the rural areas, which was only the management base of the rulers. This is completely different from the city-state life that the West has produced in the context of industrial and commercial prosperity, product exchange and monetary economic development.

China's urban development has gone through three stages, the period of the Qin Dynasty and the Han Dynasty, which was dominated by the palaces in the city, and the period of the Song Dynasty, which was marked by the divided blocks in the city, From the Qin Dynasty to the early Han Dynasty, the ideological concept was dominated by the Legalist, conforming to nature, and ancestors as the top. People believed that the stability

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1 Hao, Pengzhan. "The Public Space, Urban Communication and Social Control - Base on the Research of the Chang'an City of Sui and Tang Dynasties." Doctor's thesis, Shanxi Normal University, 2017. Page 18-19.

2 Hao, Pengzhan. "The Public Space, Urban Communication and Social Control - Base on the Research of the Chang'an City of Sui and Tang Dynasties." Doctor's thesis, Shanxi Normal University, 2017. Page 28.

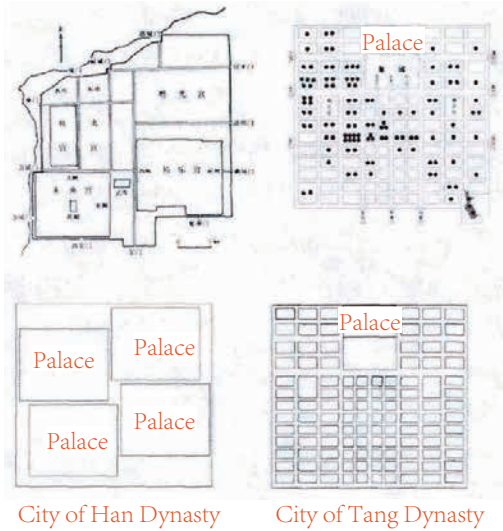


Fig. 3.49  
City Composition in History  
Source: Hao, Pengzhan. "The Public Space, Urban Communication and Social Control - Base on the Research of the Chang'an City of Sui and Tang Dynasties." Doctor's thesis, Shanxi Normal University, 2017. Page 20.

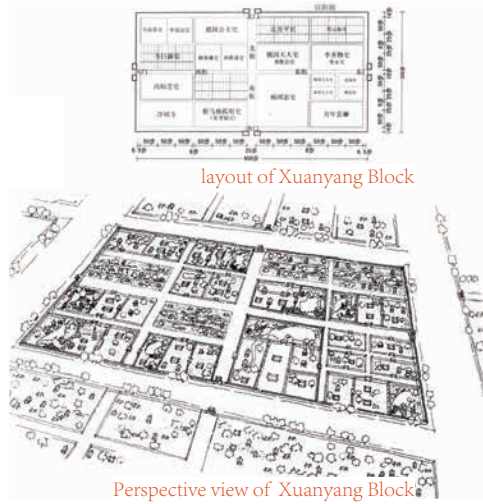


Fig. 3.50  
Xuan yang Block  
720-756 AC - Tang Dynasty  
Source: He, Congrong. *Ancient Capital City Xi'an*. Beijing: Tsinghua University Press, Jul. 2012. Page 282.

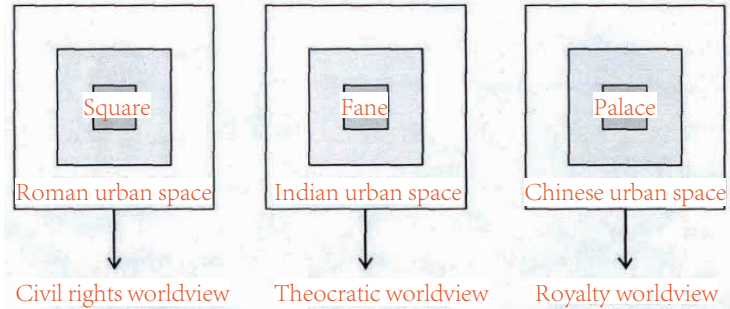


Fig. 3.51  
Comparison Between Different Ideology Cultural  
Source: Hao, Pengzhan. "The Public Space, Urban Communication and Social Control - Base on the Research of the Chang'an City of Sui and Tang Dynasties." Doctor's thesis, Shanxi Normal University, 2017. Page 22.

of the imperial power was the blessing of the ancestors, and the urban spatial layout was mostly palace-based, mainly reflecting using space for the upper ruler with the emperor as the core. Until the Emperor Wu of the Western Han Dynasty, with Confucianism as the core, the central axis of the city that later generations relished appeared, and the etiquette system became very important. Among

them, the < Book of Diverse Crafts > thought was the theory that most directly affects the concept of urban construction, so the Blocks system was produced under this ideological condition, all for the control of the residents.

The urban space structure of ancient China was integrated into the traditional ideas of that time, such as the

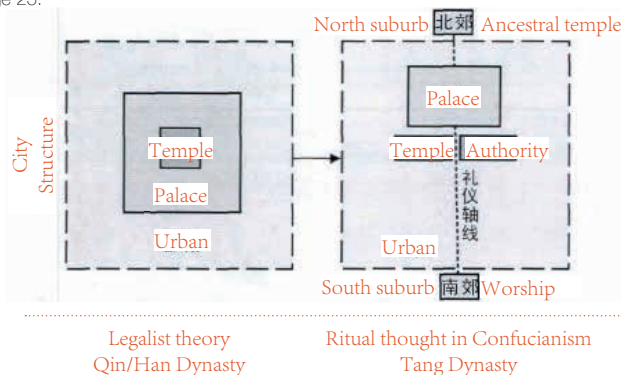
astronomical thoughts of the universe, the ceremonial thoughts of the royal court of the dynasty, the urban paradigm of <Book of Rites · Zhou etiquette>, the ideology of yin and yang, and the Feng-shui thoughts and so on. Therefore, the integration of various ideas affecting the spatial structure of Chang'an city was summarized in one sentence, that was, like the origin of Chinese cities, the city is basically a political center city, and the symbolic meaning of the ruler was everywhere.

Therefore, with the public square as the core, India was centered around the temple, and the religion represented by God became the core of the society (fig. 3.4). It is precisely because of this that the causes of urban space are completely different, and the public space of the city also presents a different pattern.

Under the mainstream ideology of Confucianism, China's commodity economy continued to prosper. From the Song Dynasty, the strict Block system did not adapt to social development, and was gradually replaced by the market. The formation of public space was a carrier of coexistence in different social life.

The prosperous scene mentioned above could be appreciated from the famous painting <Along the River During the Qingming Festival> which was painted in Song Dynasty (Emperor Huizong, ) by painter Zhang Zeduan. The painting presents the real scenery of the city view of capital city of Song Dynasty, Bianliang city, and every item inside are detailed restored how it looked like at that time, and even they can be taken as the material for historical academic research and architectural research. Some scenarios have been clapped from that painting are presented following. People

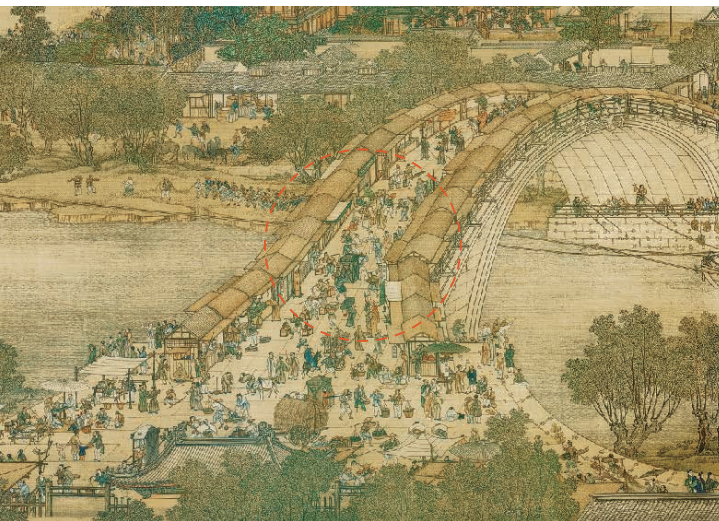
Fig. 3.52  
 Changing Ideology for Urban  
 Planning in Ancient China  
 Source: Hao, Pengzhan.  
 "The Public Space, Urban  
 Communication and Social  
 Control - Base on the  
 Research of the Chang'an  
 City of Sui and Tang  
 Dynasties." Doctor's thesis,  
 Shanxi Normal University,  
 2017. Page 25.



The Chinese-style plan shows the centrality of the emperor by showing the ruler and the central axis of the universe.

The city showed that the palace was the

core, and the city center of Rome, like its predecessor, the Greek square, symbolizes the interests of the citizens and the power of mass entertainment.



can walked freely on the street. And the walls of block had been eliminated when constructing the city which means that the stores can directly face to the street and conduct business activities. Some large open space formed by the houses arounded even become the "staying" space for citizen which we can see from the first picture and there a performance were on show. Some narrow roadways between houses also became a public

space for commercial or leisure not only as channel function. Moreover, the bridge also became anothe type of commercial area, where there many pavilions of shops were built along the sideway.

Following two chinese paintings are showing city view of different citie at different time, from which we can understand some common features of chinese traditional urban spatial structure.

Fig. 3.53  
Clap scenes from Panting  
《清明上河图》  
<Along the River During the  
Qingming Festival>  
Source: database website



mental information of life were the space in front of the houses and the commercial streets. Development of city mainly depending on economics activities with a relatively simple and boring life style. The special architectures were hosting the designated activities although where some people can gether and meet, such as the temples, official ceremony buildings and so on.



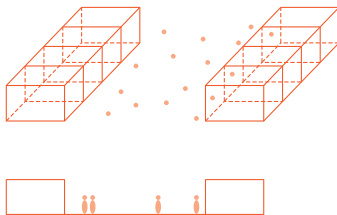
The painting described Beijing in Qing Dynasty also being in the same situation. Beijing was the capital city under the feudal rule, so there were more obvious differences of life between normal citizens and the government officers. The main street of city was a commercial area with public and open features, in front of the Forbidden City, and flat and open street space has a sense of extension.

The city view of Guangzhou in Qing Dynasty, it was in the period when it was the only trading port. There foreign trading house along the bank and many ships, but the public area with specific activities for business was not for all the citizens. There were still a city wall forming the shape of city and the citizen were still under relatively strict class ruling society environment. As a result, where people can share and exchange physical and

At the same time, the official activity of officers and emperor was controlled by a serious rules. They move neatly like a queue of soldiers and are not allowed to walk around at will. The size of the entire space has been stipulated, and the people inside were acting in an environment full of restrictions and atmosphere of nervous.



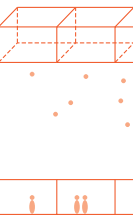
Street



City streets are one of the main places of activity for people, and shops along the street can be shops or ordinary houses.



Open space

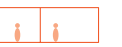
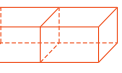


The open space area for activities





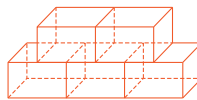
Fig. 3.54  
 «广州鸟瞰图»  
 Painting <View of Guangzhou (Canton)>  
 Qing Dynasty Emperor Qianlong, around 1770 AC  
 Source: <https://www.bl.uk/collection-items/view-of-guangzhou>



near house is a typical of citizens.

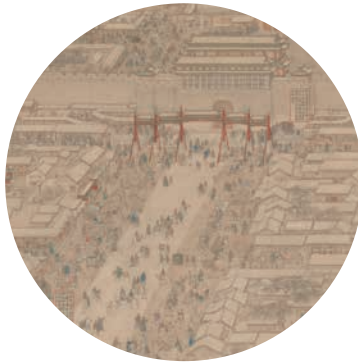


Special building

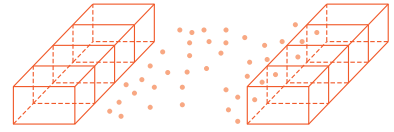


Some special buildings can have open space for people to gather because of the needs of the activities. Some are used only by special people. For example, the building is built by officials to celebrate the birthday of the emperor. The civilians can participate in the stage or temple.





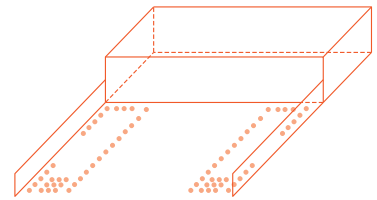
Street



Streets along the street are street-side shops, which are public places where people can freely move.



Square



This square belongs to the Imperial Palace area and is used for official political activities. The participants are all official and emperor.

Fig. 3.55  
《京师生春诗意图》  
Painting <Poetry of spring in Capital Beijing paintings>  
Painter: Xu Yang  
Qing Dynasty Emperor Qianlong 32nd year, 1767 AC  
Source: <https://www.dpm.org.cn/collection/paint/228649.html>



# 4

## Classification and Presentation of Ancient Chinese Architectures



# 1

## Chinese Palace

The official architectures and architectures for royal family in ancient China mostly located in Northern area. It was included palaces, tombs, temples, monasteries and other royal religious buildings. Every dynasty spent a lot of money and used the most advanced techniques and arts to build them. Meanwhile, these architectures were the representation of imperial authority and rule so that they were full of political meaning.

We are going to talk about the imperial architectures in ancient Chinese dynasties.

In western ancient times the single architecture gave the deep impression from its grandeur, elegance and luxury. The important buildings in ancient China were mostly characterized by the spatial arrangement of the group layout. The rules they followed were all in the environmental language and had been transformed. It reflects the creativity and the characteristics of Chinese ourselves. For example, when the base address is selected, the architectural environment will be shaped according to local conditions and then the space, scale and color processing will be carried out.



Fig. 4.01  
Northern Palace  
Geographical Distribution Map  
Source: produce by authors  
base on relevant material

In the history of China, the cities of northern China are mostly political centers and ruling centers. Therefore, the possibility of war was more turbulent, leading to more people fleeing to the south and raising the idea of sentimental landscapes, especially the long-term wars in the north after the Eastern Han Dynasty. The rule of different ethnic minorities led to

the migration of many paper intellectuals in the north to the south of the Yangtze River. This situation led to the castles and royal gardens, which were dominated by royal palaces in the north, and the gentle landscapes with garden architectures created by the purpose of enriching the living environment in the central and southern parts.



The interesting point is that Chinese palace buildings exist in the form of group buildings, so they were not only showing their grandeur in a single volume, but also in the layout of the group space and the arrangement of the buildings. The above mentioned southern garden architecture is because these two kinds of landscapes consider the layout of the buildings and the consideration of the surrounding environment. The palace buildings mostly adopt the layout of the central axis and the layout of the courtyard, which is quite stylized. Garden architectures are infinitely variable and not subject to any shape system, because the fundamental ideas are completely different.

For example, the plan of the Forbidden City shown in right below corner (Figure.4.02), it both has the royal garden and the palace buildings. In comparison, we can see that both the natural and serious methods are adapted to the requirements of different types of buildings, which is one of the traditional culture of our country. The big feature, the combination of the effects can make people get two different tastes at the same time, which reflects the need for spatial form when a person (here it means for the emperor) has two life roles.

Another example is the picture next page (Figure.4.03) which is the royal garden of the Qing Dynasty, Yuanmingyuan. In the Ming and Qing Dynasties, where the regime was stable, the emperor in the royal garden built by the north liked to look forward to the gardens that were considered desirable in the patrols of the south, and all of them tried to imitate the heroes, so that the royal courts in the north had absorbed many private gardens in the south of the Yangtze River. The handling method, so the important feature is to gather the famous gardens in the park. At the same time, we can see that the layout of the palace area has maintained its own neatness and momentum.

In order to understand how the palace buildings generated and by which the influence in ideology and theory, we need to start from its origin, which presenting as following article.

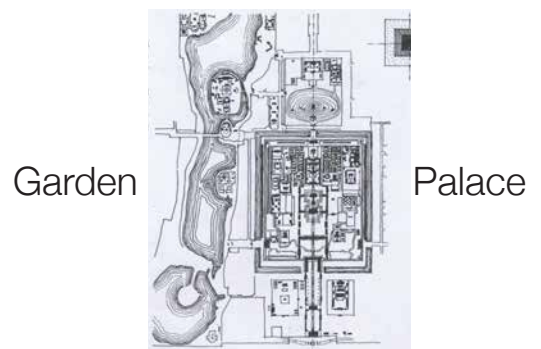


Fig. 4.02  
Two completely opposite layout of Palace and Garden. Source: Peng, Yigang. Analysis of the Traditional Chinese Garden. Page 66.

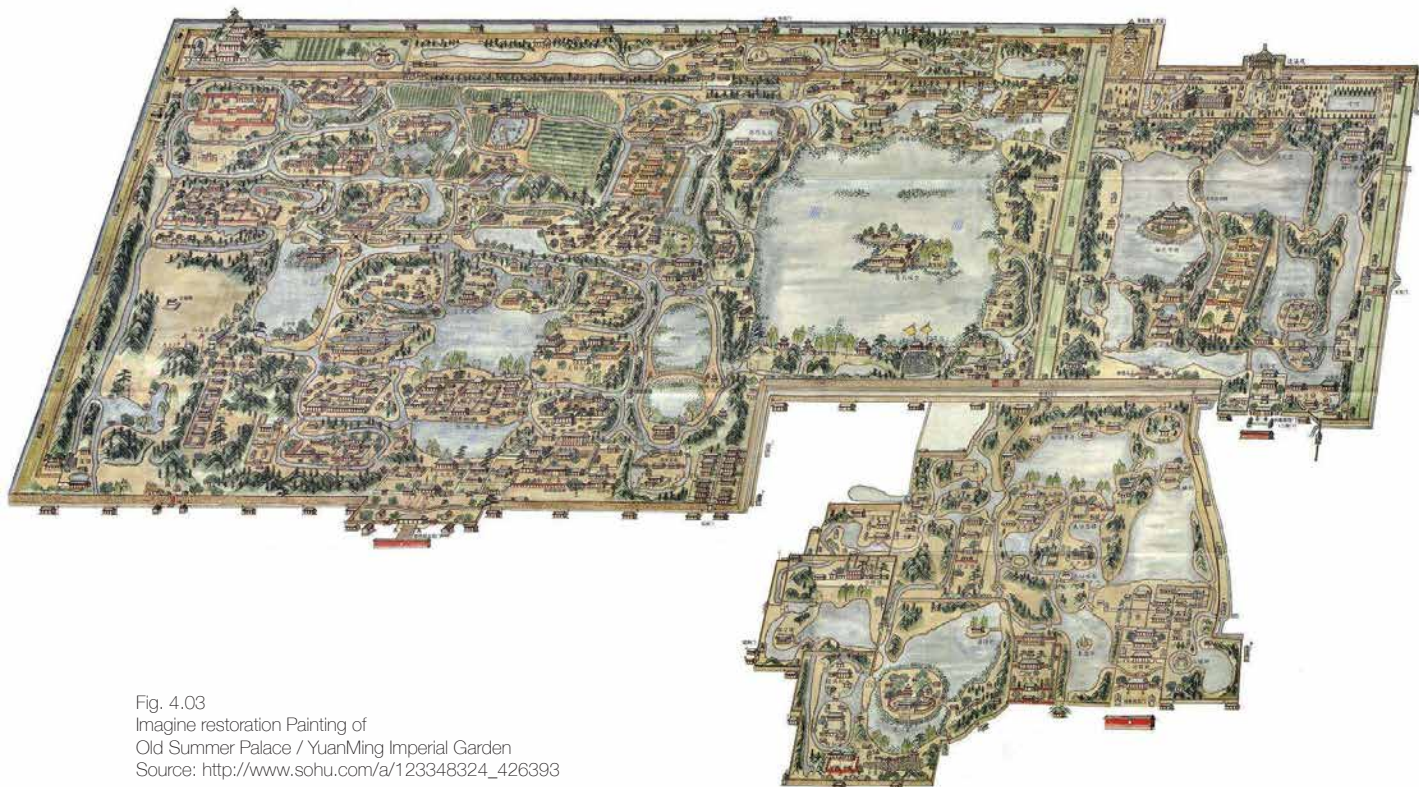


Fig. 4.03  
 Imagine restoration Painting of  
 Old Summer Palace / YuanMing Imperial Garden  
 Source: [http://www.sohu.com/a/123348324\\_426393](http://www.sohu.com/a/123348324_426393)

“上古穴居而野处，后世圣人易之以宫室，上栋下宇，以蔽风雨”<sup>1</sup>The earliest ancient books speculated that ancient humans experienced cave dwellings and were then transformed into palaces by saints. Because there was no specific time to record, they thought that the palace and the cave house may coexisted rather than replace each other. In the written record, Xia Dynasty (late 17th Century BC) has begun to have a palace concept. The palace architectures generally refers to tall and magnificent houses. Here it refers to the historical feudal emperors used in the dynasty, daily

listening to the government, negotiating with the courtiers, meeting foreign ambassadors, sometimes as a place for banquets, gatherings or elections. It can be said that it was the building for ruler to give orders and handles government affairs at that time. The palace, conceptually known as the general term for such a group of buildings, the hall, sometimes refers to the single building among them, was also the living room of the emperor and the heirs. Some religious temples are also called palaces, because they have a similar shape and scale to the imperial palace.

<sup>1</sup> Transcription of I Ching.

The Chinese architectural system based on wood structure has a simple and clear organization law in the layout of the plan. It was to form a single-story building in units of "bay", and then to form a courtyard with single-seat buildings, and then to form a group of various forms of courtyard in the complex. The earliest halls that can be found in archaeology belong to the early Shang Dynasty (around 16th Century BC), and there were already more regular corridor-style buildings complex. These palaces have formed a column network, and it may have produced the concept of "bay".<sup>1</sup>

As early as in the late primitive society, in order to improve the moisture-proof sanitary conditions of indoor living surfaces, the method of filling and ramming earth for construction was already invented. The increase in soil density of the rammed earth also increases the pressure resistance. After entering the class society, with the ideological needs of the slave-owner class, rammed earth platform of the halls were increasingly demanding, far exceeding the needs of the moisture-proof function, thus creating high-rise buildings. It can be seen from the archaeological site that the Shang Dynasty has already built the house on the top of the platform.

The larger the building area, the higher the base platform. The general height was about 1 meter, and the highest was more than 10 meters.<sup>2</sup> At the same time, the ancients were envious of the inability to spy on the poles between the heavens and the earth, so the metaphor of the high mountains for the mountain can be towering into the clouds, giving it a lofty meaning. The palace ruins of the Shang Dynasty are the earliest and largest palace buildings ever discovered. From the height of the platform and the size of the roof, the buildings were in different grades. The building of "高台榭，美宫室" (high platform base, gorgeous palace) was further developed in the late Qin Dynasty.

“天子以四海为家，非壮丽无以重危，且无令后世有以加也。” It was the idea of the ruler and the builder united together when the Chang'an Capital city was built in the Han Dynasty and the Weiyang Palace was built. It means that the land in the world belongs to the emperor. As a palace representing the imperial power, it should be expressed in a magnificent manner, and it needed to reach a high level in one time without the need to increase later. Therefore, this definition made the palaces built in the later generations the most magnificent buildings in the country.<sup>3</sup>

1 Liu, Dunzhen, ed. *The History of Ancient Chinese Architecture*. 2nd ed. Beijing, China: China Architecture & Building Press, 1984. Page 13.

2 The Insitute for History of Natural Sciences, Chinese Academy of Sciences, ed. *A History of Chinese Ancient Architectural Techniques*. Page 57.

3 "Under Heaven and upon Earth." In *Chinses Ancient Buildings*. March 5, 2014. [https://www.youtube.com/watch?v=-IHXP2h\\_wU&t=677s](https://www.youtube.com/watch?v=-IHXP2h_wU&t=677s).

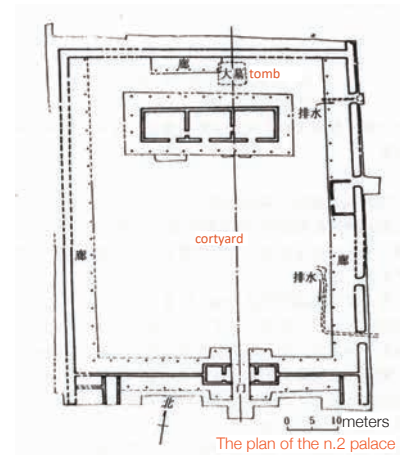
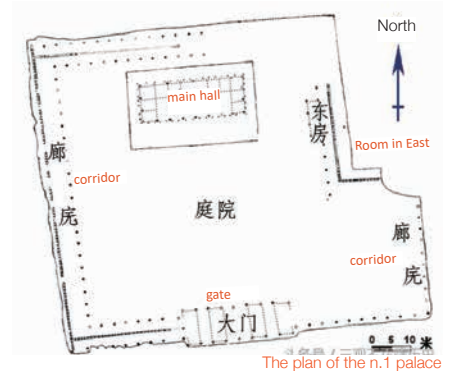
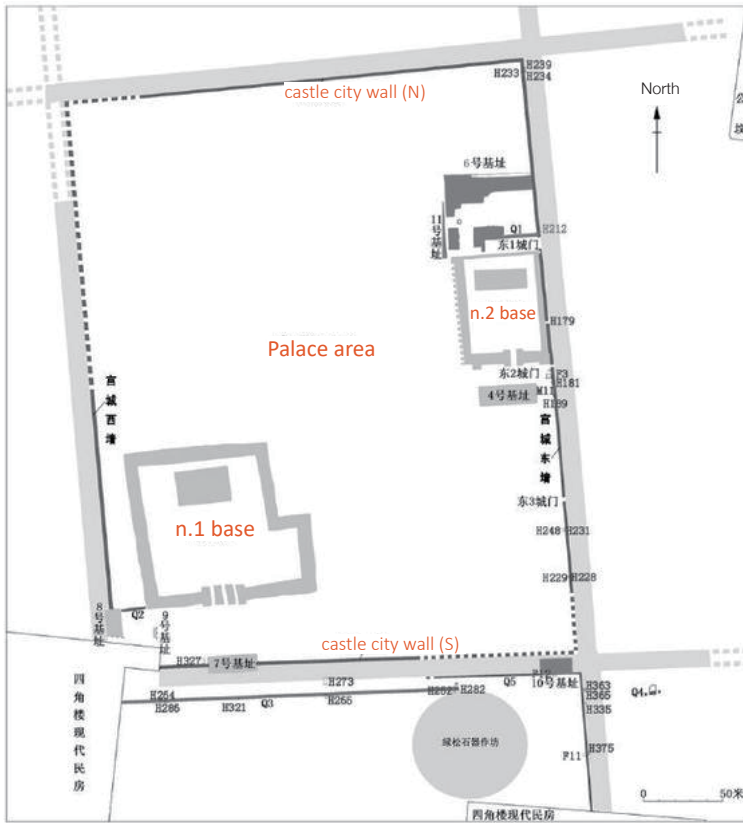
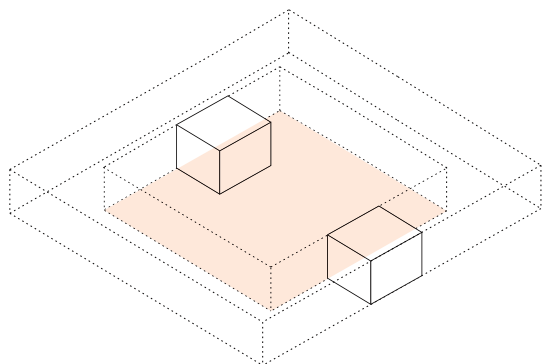
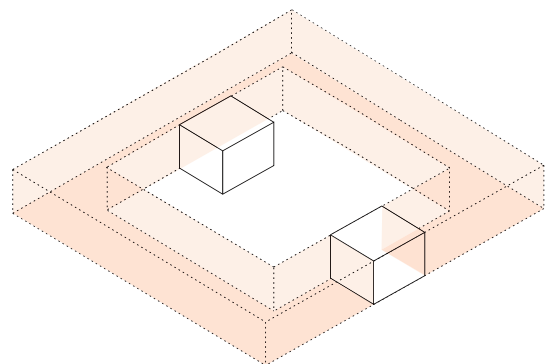


Fig. 4.04  
Plans of the palaces n.1 and n.2 of Erlitou, City of Shang Dynasty  
Between 1625-1450 BC  
Archaeological site, near Luoyang  
Source: <https://kknews.cc/zh-my/history/4v24vrv.html>



Cortyard



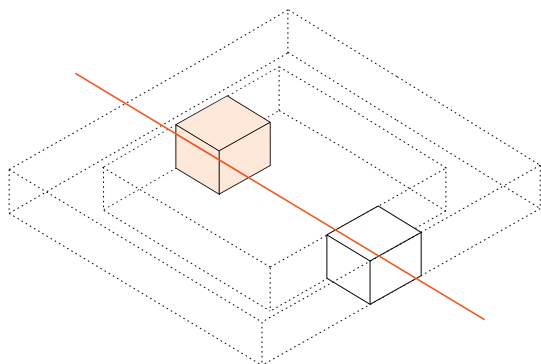
Corridor

Fig. 4.05  
The Features of Early Stage Palace in China  
Learning from relevant archaeological document  
Source: made by authors

It was found from the archaeological sites that there were not many residential ruins found in the earliest castles. The castle was like the palace city after the Spring and Autumn Period (770 BC - 221 BC), and only existed as a ruling stronghold without citizens until Qin and Han Dynasties (221 BC – 220 AC).

In ancient China, to show the authority of the kingship was in a symbolic way, so the etiquette rule of ceremonial space was the first thing in planning capital city spatial. When studying the characteristics of the king's power in the history of the Shang Dynasty, scholar Ito Daozhi said: "China has concentrated the concept of God on the ancestors."<sup>1</sup> Just as <Book of Rites> recorded the construction of the capital, that was, the construction process of the castle city in the Qin and

1 Hao, Pengzhan. "The Public Space, Urban Communication and Social Control - Base on the Research of the Chang'an City of Sui and Tang Dynasties." Doctor's thesis, Shanxi Normal University, 2017. Page 36.



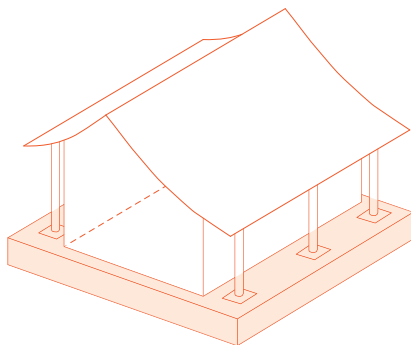
Axisymmetric

Han Dynasties (221 BC – 220 AC) was “宗庙为先，厩库为次，居室为后”，the ancestral temple was the first, the storehouse was the second, and the living rooms were the last. It was built considering temple as center from the inside to the outside, until the end of the Western Han Dynasty (25 AC).

As shown in the right picture (Figure.4.00), the Palace of early Shang Dynasty archaeological site in Erlitou Castle city was the earliest found in China. The n.1 palace located north and faced south and had a rammed earth base. There was a single-story building, corridor and the court with gate on the base. To the north of the central part was the Hall, with a flat and wide courtyard in front, an open door to the south, and a roofed corridor connected to each other around the central hall formed a magnificent palace architecture. The layout of the entire plane basically has the shape and scale of the palace building in China. The layout of the palace complex developed until the Western Zhou Dynasty (1046 BC – 770 BC), such as the Fengchu archaeological site is composed of three courtyards and a number of houses surrounded by it. The enclosed space formed by this group of buildings is very similar to the quadrangle courtyard popular in the north of China.



Fig. 4.06  
 Three Main Characteristics of Chinese Palace  
 Learning from ancient painting  
 Source: made by authors



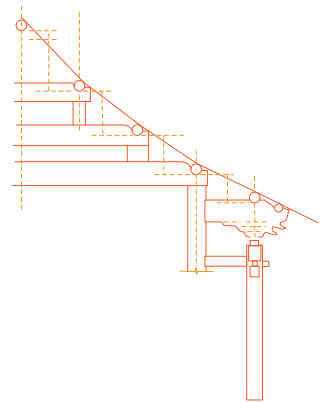
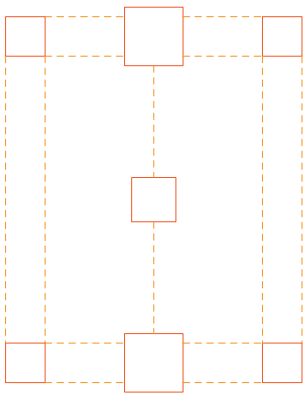
Platform



Layout of palace and corridor connection



Fig. 4.07  
 The conceptual drawing of the first great palace, EPang-Palace (not finished) in the recorded history (Qin Dynasty)  
 Painter: Yuan Jiang, Qing Dynasty  
 Source: <https://kknews.cc/zh-cn/culture/e89q4yr.html>



Timber structure and its constructural techniques

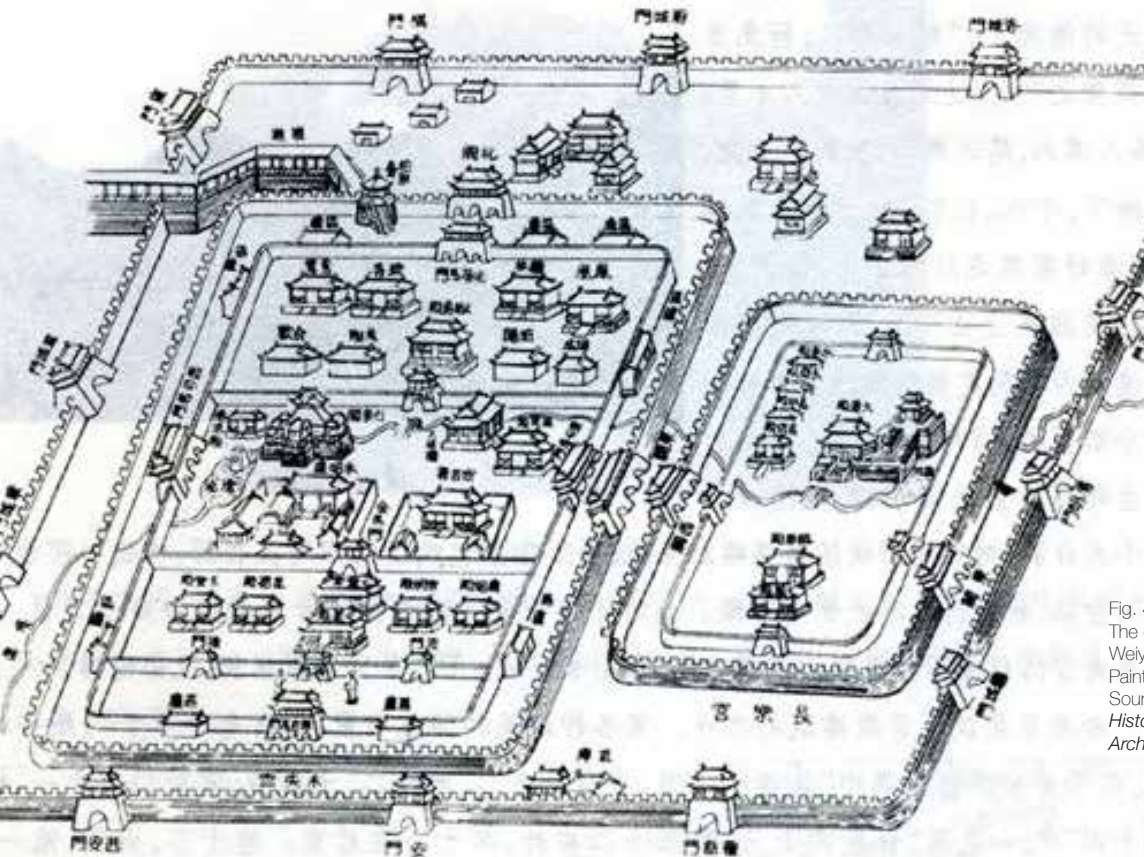


Fig. 4.08  
The conceptual drawing of Weiyang Palace  
Painter: Bi Huan, Qing Dynasty  
Source: Liu, Dunzhen, ed. *The History of Ancient Chinese Architecture*.

It is known from the origin that the palace is composed of several single houses, but what kind of grouping will be adopted is subject to a kind of ideology. The rule of "etiquette" has always been the central idea of ancient Chinese rulers. The ritual system was a set of rules for strictly regulating social behavior in ancient China, that is <Book of Rites> which was written in the Spring and Autumn Period. The specific content is the refinement and summarization of ruling behaviors of Xia, Shang and Zhou Dynasties and previous leader, so that the rules of social behavior in all aspects were formulated to facilitate the rulers' behavioral and ideological control of the nationals. Tracing back to



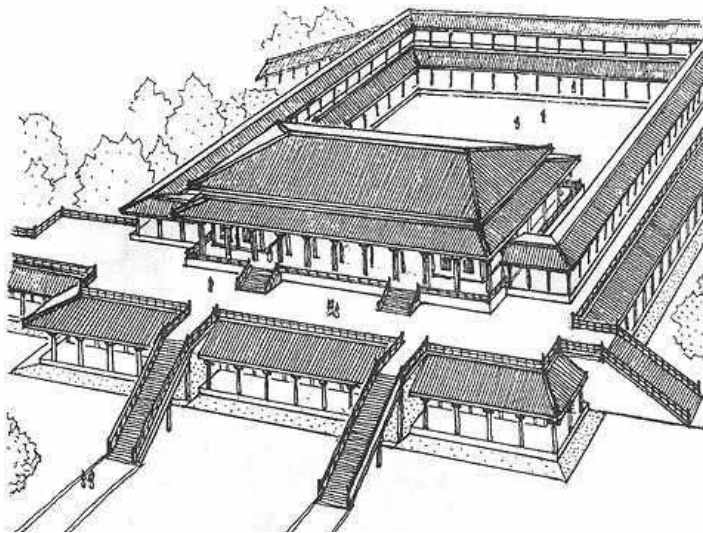
Fig. 4.09  
The conceptual Plan of Weiyang Palace  
Source: pic.baidu.com



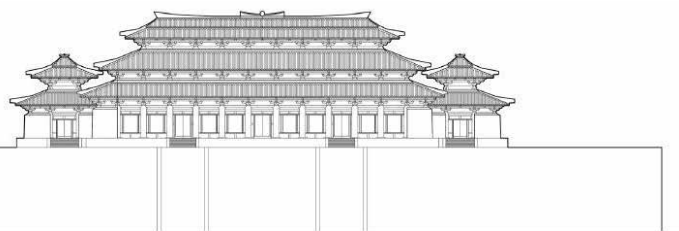
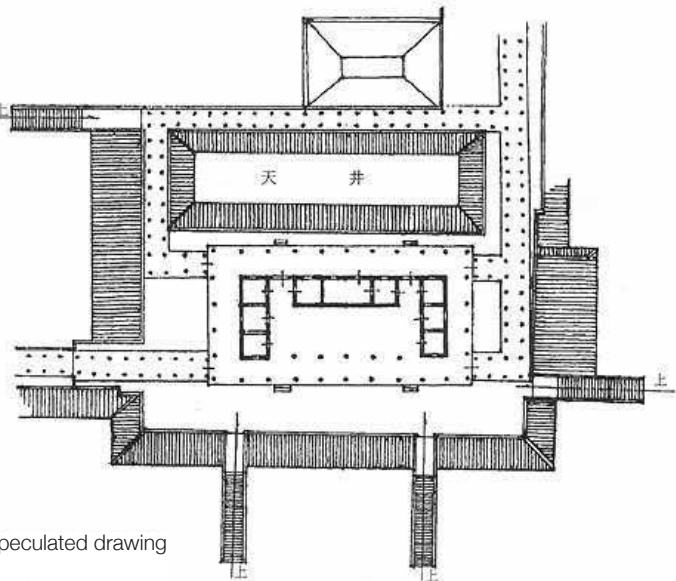
the source, after the second chapter on the understanding of ancient Chinese ideology, the predecessor's ruling thoughts were based on the fear and respect of nature. Under the combination of the ruler's consciousness at the same time, many rules seem to be blunt, but they were only the root cause. A kind of representational behavior of thought was to declare the power of ruler. The <Book of Rites> recorded the construction of the capital of Western Zhou Dynasty, but it was not used in the construction of the Changle Palace in the Han Dynasty. It is because the Confucianism with the book as the core was only mainstream in the late Western Han Dynasty. After the

origins shown above, the desire of the imperial power was strengthened. The palaces in the Spring and Autumn Period and the Qin State were towering, splendid and magnificent. The successful design and construction of these palaces have affected the construction of the Changle Palace. Changle Palace broke the habit of the palace layout that must extend along the central axis to the depth. Instead, the central axis was used as a passageway, and the palaces were divided into two groups. They were all located on the high platform, surrounded by cloisters and spectacular. It also shows that the palace construction was preferentially planned with the space of the ruler's using.

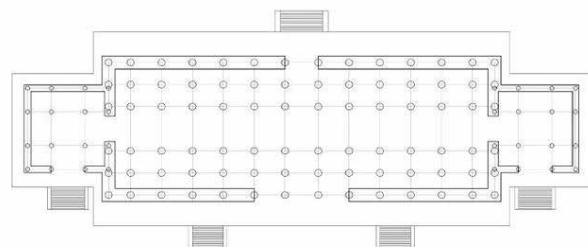
Fig. 4.10  
Jiaofang Hall and Changle Palace  
Source: cjdbjy.net



Jiaofang Hall of Weiyang Palace, speculated drawing



Changle Palace, speculated drawing



Front Hall of Changle Palace, speculated drawing

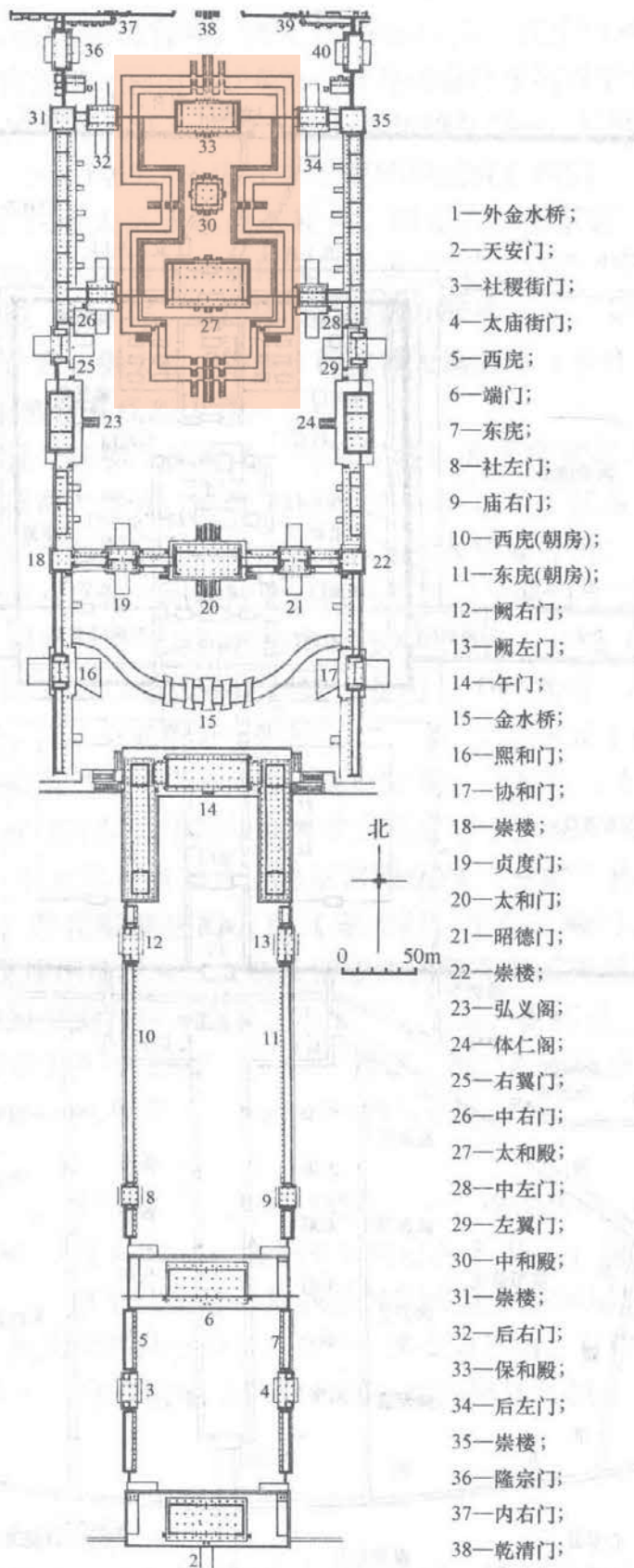


Fig. 4.11  
 Plan of Three Great Hall  
 in Forbidden City  
 Source: Pan, Guxi, ed.  
*The History of Chinese  
 Architecture.*



Fig. 4.12  
Aerial View of Three Great Halls  
Source: pic.baidu.com

The Forbidden City in Beijing is a masterpiece of the Chinese imperial palaces. It has developed into a palace building at its peak, and it is also the largest and most complete wooden structure complex in the world. It combines the ideology of Chinese for thousands of years, then refines and sublimates, and many ideological doctrines can be embodied here. It is well-designed, with a wide composition, spacious land, large group, diverse temples, and beautifully decorated carvings. It combines the highest achievements of Chinese ancient architectural theory, technology and artistic practice.

During the Ming dynasty the emperor began to create the Beijing Imperial

Palace. Most of the builder were Han dynasty craftsmen and it was only expanded and repaired after the Qing Dynasty occupation. In 1407, Emperor Chengzu Zhu Li collected 300,000 workers and spent 14 years of finishing imperial city and palaces, which is a huge complex of more than 9,000 houses. The three halls in the Forbidden City are the main building for the rulers to carry out their external office activities, and many important activities were carried out here. The layout of three halls formed a strict central axis arrangement, followed the ritual principles. The central axis extended strictly until the Meridian Gate by passing the Jinshui Bridge and several numbers of gates determined based on <Book of Rites>.

All in all, in the social economic modus of cultivation culture, the grain harvest affects the country's prosperity in ancient China, which meant the natural climate and weather are direct influences. Since human beings can not resist or scientific understanding the power of nature, they gradually produce traditional superstitions related to the nature of universe with fear and respect, which leading chinese ancestors contributed plentiful ideological theoris and philosophy to standardize people's behavior for every social activities, not surprisingly including architectural construction and urban planning. As far as the result, from examples of the construction of palace architectures we learned the rigorous layout and central axis can contribute a logical methods for master planning or layout rich in chinese traditional culture and vernacular characteristics.

## 2

### Chinese Garden

There is a long history of Chinese Garden Art. As early as the Zhou Dynasty, there was an activity to create garden of the palace. And after the Eastern Han dynasty, during 220-420 A.D, the ruling classes were struggling intensely, frequent wars led to the turbulent society. Thus, intellectuals had a preference for travelling in the landscape in this period. Under this ethos, the developing of culture and art brought a lot of poems and paintings which all present the topic of natural beauty and enjoying life. Before this stage, the aesthetics of nature from Chinese people were spontaneous. But different from the past, this new aesthetic had definitely outstood. Hereunder, those factors have all promoted the developing of Chinese Garden Art in Wei and Jin Dynasty.

At that time, the ethos of making Chinese Garden was quiet strong, so that the increasing number of private gardens has risen up. Additionally, according to the Luo Yang Qie Lan Nots <sup>1</sup>, the private garden houses of Zhang Zhao and Zhang Lun. Although these private gardens are not as large as the royal gardens in size, their natural scenery, the skill of stacking stones and the beauty of the rocks are

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<sup>1</sup> 《洛阳伽蓝记》 Yigang Peng. Analysis of the Tradition Chinese Garden. China Architectural Industry, 1986.

even more than the royal gardens of the past. At the same time, As Buddhism was introduced to China, at that time, the atmosphere of building temple garden architecture also reached its peak.

When the timeline came to the Tang Dynasty, the economy developed rapidly. The capital Chang'an City was the largest city in the world at that time. China in the Tang Dynasty, the state is unprecedentedly powerful. In such an environment, the royal garden has naturally been further developed. Large gardens and large pools had built in the north of the palace for emperors to visit. After the division of the Five Dynasties and Ten Countries, the southern city became the political, handicraft and commercial

centre of China at that time.<sup>1</sup> The ethos of building garden architecture entered a new peak in that moment. At this time, the garden began to flow into the natural landscape with water from the natural forest.

When China arrived in the Song Dynasty, the national capabilities was weaker than that of the Tang Dynasty, but it achieved great achievements in poetry and painting art. During the Song Dynasty, there was also a painting institute, and the excellent painters from all over the country were gathered together and communicated with each other. Which led to the great development of painting art in such a period. The literati painting group represented by Su Shi, and they were

Fig. 4.13  
"West Lake Qingqu", 《西湖清趣图》, Ming Dynasty  
Source:  
The Freer Gallery of Art, Washington, D.C. (<https://www.shuge.org/ebook/xi-hu-qing-qu-tu/>)

1 Yigang Peng, *Analysis of the Tradition Chinese Garden*. China Architectural Industry, 1986. Page 2.



were interested in pursuing freehand brushwork and imparting spirits, without sticking to the shape. That created a new style of landscape painting. The Northern Song Dynasty gardens are mostly concentrated in the capital of the east, Bianliang. Royal gardens are concentrated in this place. The most famous one is Jinming Chi. This garden layout is relatively regular and has a clear central axis. The main hall is built in the centre of the pool and connects all places through bridges. There are rich varieties of flowers and trees in the garden, and artificial hillsides have been built for the emperors to visit and relax. <sup>1</sup> In the Southern Song Dynasty, China's political center moved to the south, and officials and nobles

lived in Lin'an, which is now known as Hangzhou, Wuxing, and Suzhou. Lin'an is the capital of the Southern Song Dynasty. The nobles and officers built huge amounts of countless gardens in the West Lake and around it, both imperial and private gardens, see the painting from below (Figure 01). There are more than a dozen royal gardens, and private gardens are too numerous to be retired officials. During this period, the development of private gardens reached a peak.

In the later Yuan, Ming and Qing Dynasties, gardens have always had this relative development, and the achievements of private gardens have become more and more excellent. From the diversity of plants and the delicacy of

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1 Li Gefei. A litterateur from Northern Song Dynasty. 《洛阳名园记》. 1105.



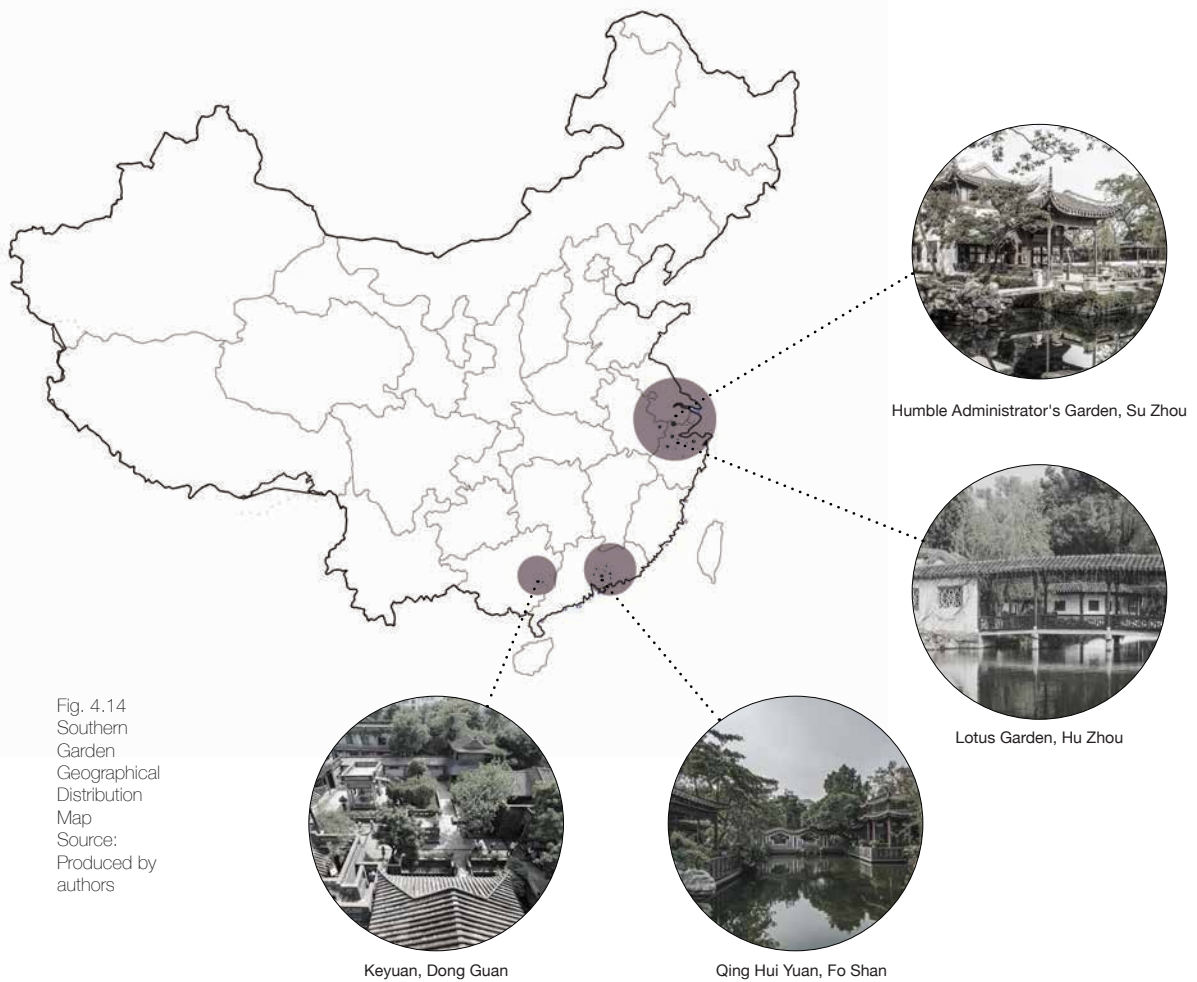


Fig. 4.14  
Southern  
Garden  
Geographical  
Distribution  
Map  
Source:  
Produced by  
authors

hand-made stone styling, the private gardens of the South are more ingenious than the royal gardens after their development in these dynasties. Meanwhile, in this phase, even through there was no systematic garden working theory publications, but a rich theoretical work on landscape painting. However, the theory of garden working was systematically organized and there were

some corresponding standard writings appeared during this period. Until the end of the Qing Dynasty to the beginning of the Republic of China, the continuity of the historic traditional garden working began to break because the social environment and the Chinese ideology have changed under the impact of Western civilization.<sup>1</sup>

1 Yigang Peng, *Analysis of the Tradition Chinese Garden*. China Architectural Industry, 1986. Page 4.





Fig. 4.15  
Sketch of  
Traditional  
Chinese Garden  
Source:  
[https://  
zhangrenzhi.  
artron.net/works](https://zhangrenzhi.artron.net/works)

About the geographical distribution of Chinese gardens, we could start from the classification to different users of Chinese gardens. Preliminarily, the art of garden was an outcome for meeting the requirements from feudal ruling class. Therefore, the massive gardens adjoin to the imperial palace that concentrated in the capital of the emperor or other economically and culture developed areas. Then private gardens are generally concentrated in urban areas with excellent conditions. Others, such as temple gardens, are mostly distributed in religious shrines in order to serve specific users

and special needs. In addition, some gardens for government office distributed in marketplaces.

Because of the long history and lineage, the areas where the traditional Chinese garden is distributed are actually very extensive. But most of them stay in Guan Zhong area centred on Xi'an, Zhe Jiang and Jiang Su provinces in the Yangtze River Delta, capital Beijing and southern Linnan area. In summary, the gardens before the Northern Song Dynasty were mainly concentrated in Chang'an, Luoyang and Kaifeng. The garden after



Fig. 4.16 Dwelling in the Fuchun Mountains, painter Huang Gongwang, Painted between 1348 and 1350. Source: National Palace Museum in Taipei, <https://upload.wikimedia.org/wikipedia/File:富春山居圖（無用師卷）>



Typology A

The house is hidden in nature, and the group of buildings consisting of multiple single buildings fluctuate according to the terrain.

見茲初欣  
富之貌  
原閣比美  
登幸亦早  
有可相資  
寅暮之初  
後

不見富春山  
色已十五載  
春過雲栖山  
徑江充空  
遠映層崖  
如子久筆端  
神韻  
展閱善洽我  
心矣  
庚子冬日  
泚

世傳富春山圖  
為黃公望生平

傑作此卷富山  
居風景巖壑手  
遠瞻若千里未  
識與富春圖孰

為先後董香光  
稱其規撫董巨

天真爛熳皆為  
為子久家得意

筆耶清河畫  
舫謂大癡畫格

渴真言大佛寺  
五其富春卷澄  
翠一而二而一也  
初後於白雲之行  
後



Fig. 4.17 Architectural Typology Analysis from Painting. Source: Produced by authors



Typology B



The house is adjacent to the water system and plants.



the Southern Song Dynasty were concentrated in the Yangtze River Delta and the Pearl River Delta. Since the gardens in the three regions have different styles, we often divide the Chinese gardens into northern gardens, Jiangnan gardens and Lingnan gardens.

As far as our concerned, the Chinese garden concentrated in Jiang Su and Zhe Jiang Province are much more interesting to do a study and research. Afterwards, we will do some selective analysis of Jiangnan gardens according to famous Chinese landscape paintings and our diagrams.

It is a quiet famous Chinese landscape painting, "Dwelling in the Fuchun Mountains". Painted by Huang Gongwang during 1348 to 1350. This painting now is collected in National Palace Museum in Taipei.<sup>1</sup>

Huang Gongwang portrayed a natural landscape view near Fuchun River, Hang Zhou. As we can see the Fuchun mountains are drawing elegant outline on in the sky, and below the picture is the beautiful Fuchun River. Then some vernacular dwellings are hidden among the nature, some of them are located

in the valley, others are built adjoin to Fuchun River. You can see there are two highlighted area with circle dash line on this painting, emphasizing two different situations of local residential area.

There are two different typologies of settlement we found from painting, and then we imitated master's brushwork to extract vernacular drawings area out of picture, for clear analysing. According to the final sectional drawings, the first type of local people's preference is built housing in valley and behind woods. Trees provided hood insulation for extra sun light and became natural shelters during the raining days as well. The proper dimension of housings generated such a harmony scene that demonstrating an idea relationship between architecture and natural environment. Have the same effect, another type is that local residences built up their vernacular housing next to the Fuchun River. Of course, it is evident to find that each site selection is close to trees. That is also due to the traditional habit for Chinese people, that people like to sitting or playing under trees' covering. We have an old saying that is widely spread: under the tree is good for the cooling. This is a good interpretation of the above phenomenon

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1 From online resource: [https://upload.wikimedia.org/wikipedia/File: 富春山居圖（無用師卷）](https://upload.wikimedia.org/wikipedia/File:富春山居圖（無用師卷）)

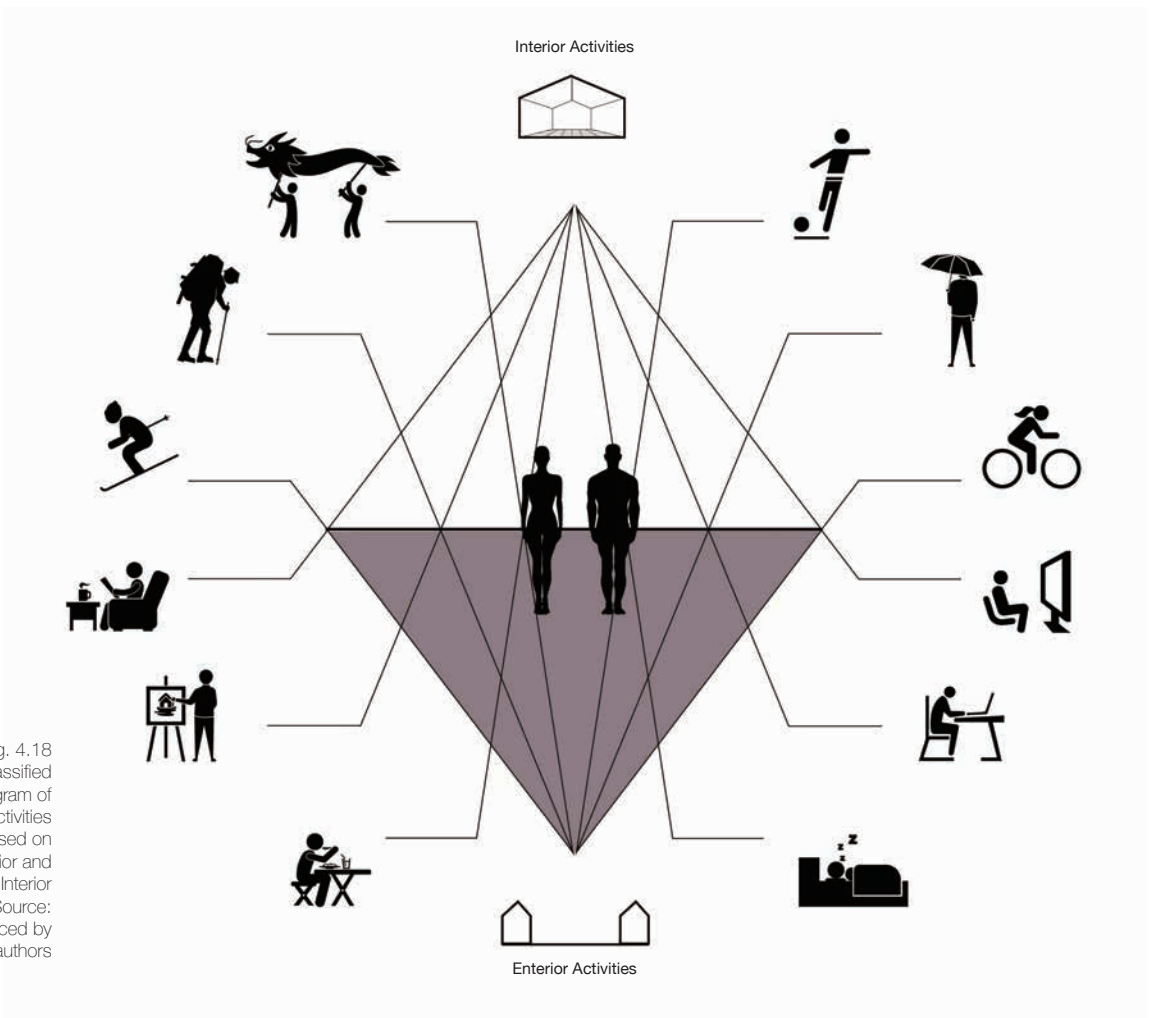


Fig. 4.18  
The Classified  
Diagram of  
Human Activities  
Based on  
Exterior and  
Interior  
Source:  
Produced by  
authors

sections by authors are illustrating two various relationships between architecture and nature. Although due to the different human demands, there are different managements deal with natural environment. However, the mentality of Chinese people is still insisting the significance of the balance between architecture and nature. Hence, the pursuit of the beauty of nature

has become the driving force for the continuous development of the Chinese garden in our history.

Then establish on our understanding from researches, we try to explain Chinese garden in the perspective of human activities through this diagram (Figure.3.13). Human activities are extremely complex and diverse, but in

Ideology A

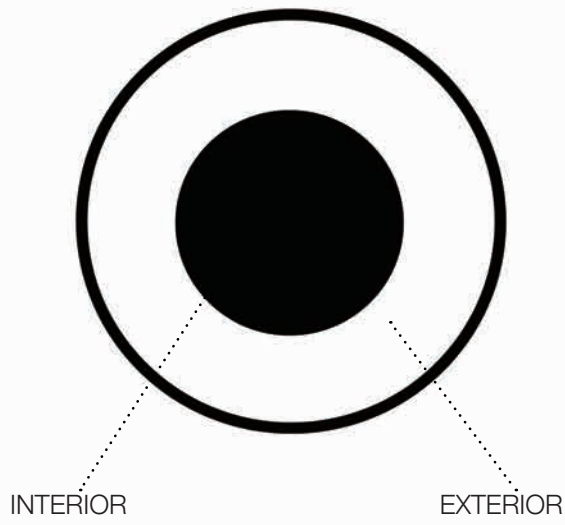


Fig. 4.19  
Analytic Diagram  
of Typology A  
Source:  
Produced by  
authors

Centralized layout  
Geometrical open space  
Manicured plants  
Massive volume

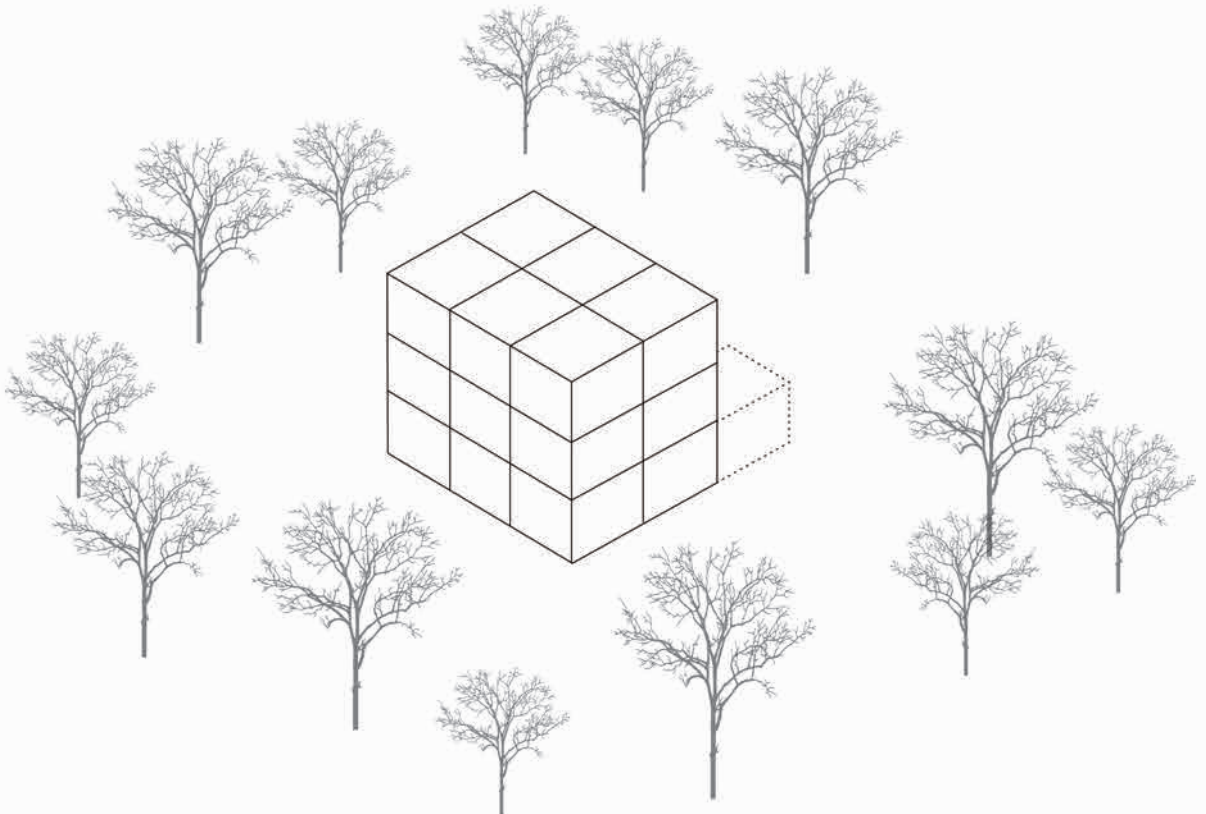
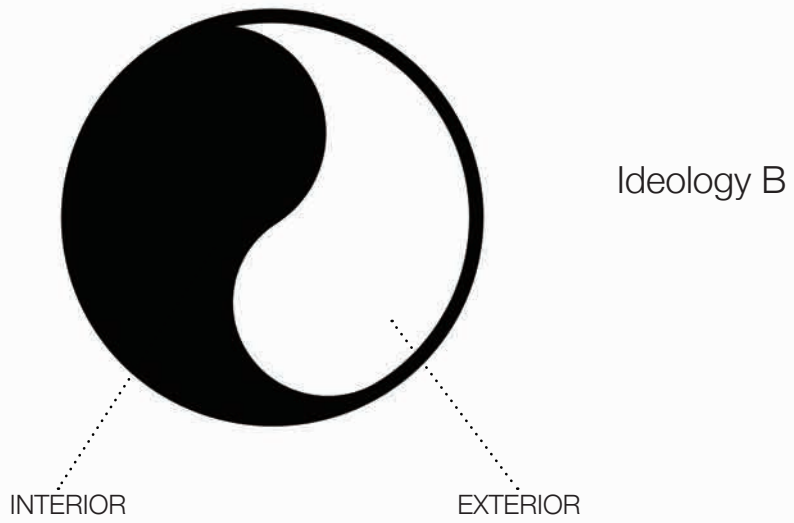
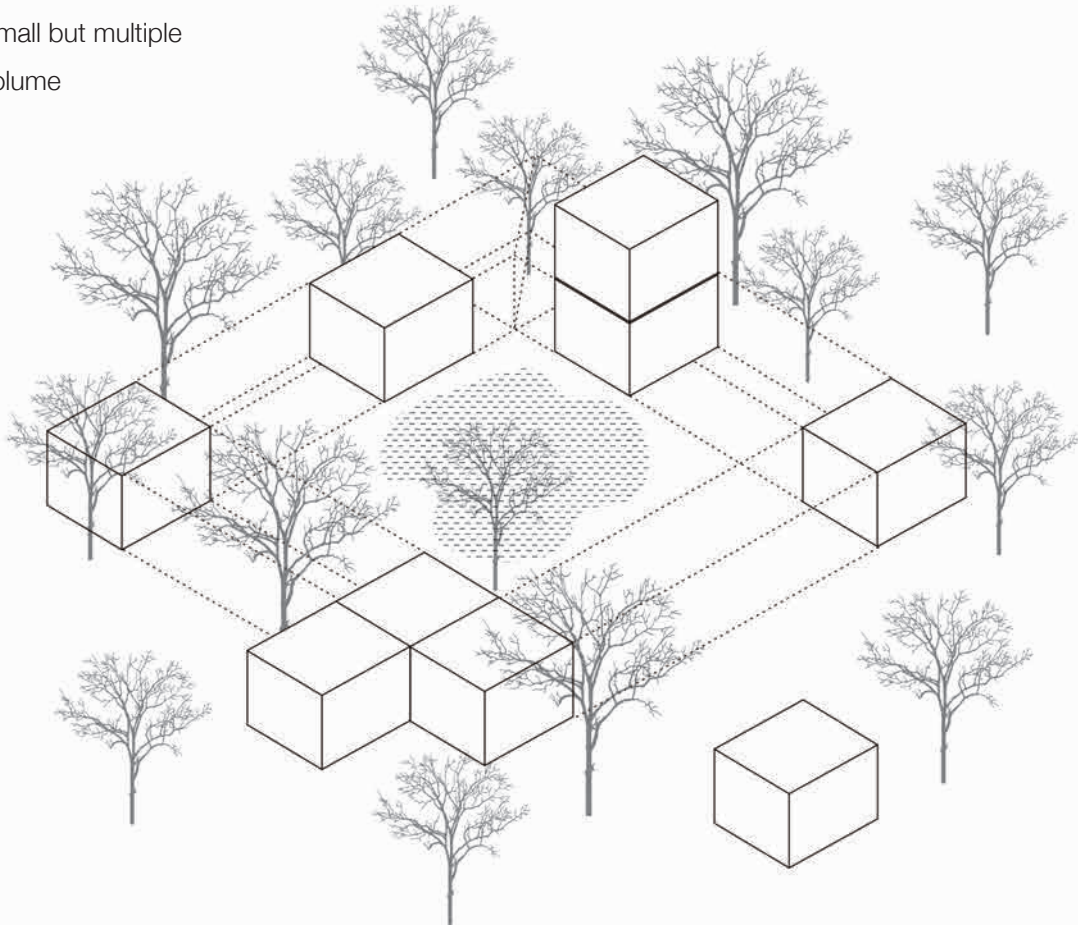


Fig. 4.20  
Analytic Diagram  
of Typology B  
Source:  
Produced by  
authors



Free combined layout  
Dynamic open space  
Natural Plants  
Small but multiple  
volume

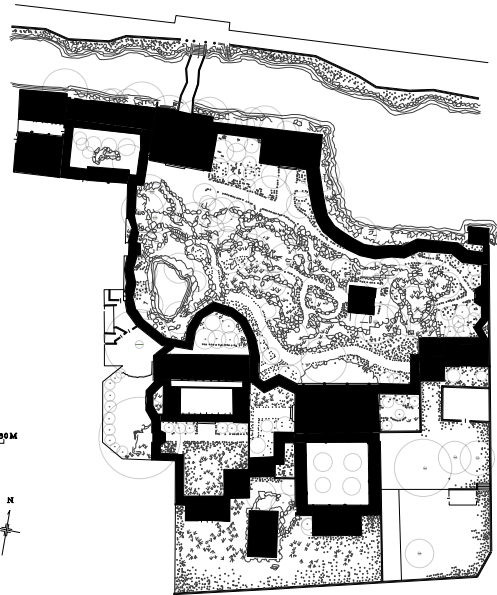


# Nolimap of 3 Chinese Gardens in Suzhou

## Canglang Pavilion Garden, Song dynasty, 1044

The Canglang Pavilion was built in 1044 CE by the Song dynasty poet Su Shunqin (1008–1048), on the site of a pre-existing imperial flower garden c 960 CE. It is the oldest of the UNESCO gardens in Suzhou, keeping its original Song dynasty layout.

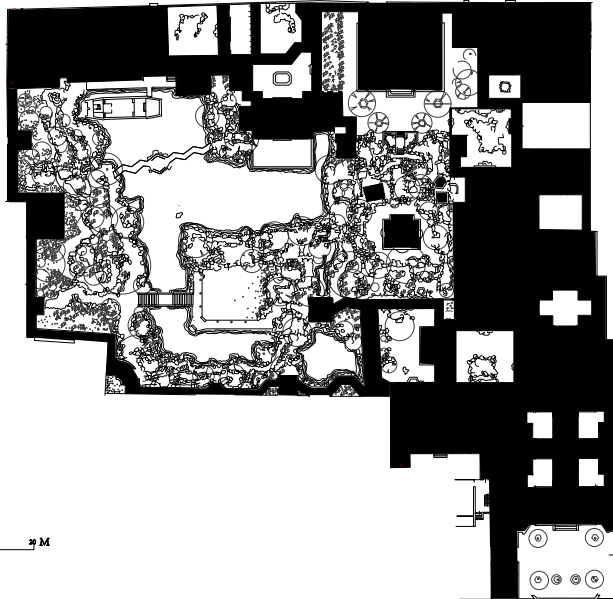
0 1 5 10 20 30 M



## Lion Grove Garden, in Yuan dynasty, 1342

"Of all the famous rock-gardens in history, only one has survived. This is the so-called 'Lion Garden' in Suzhou." The Lion Grove Garden was built in 1342 during the Yuan Dynasty by a Zen Buddhist monk, Wen Tianru, in memory of his teacher Abbot Zhongfeng.

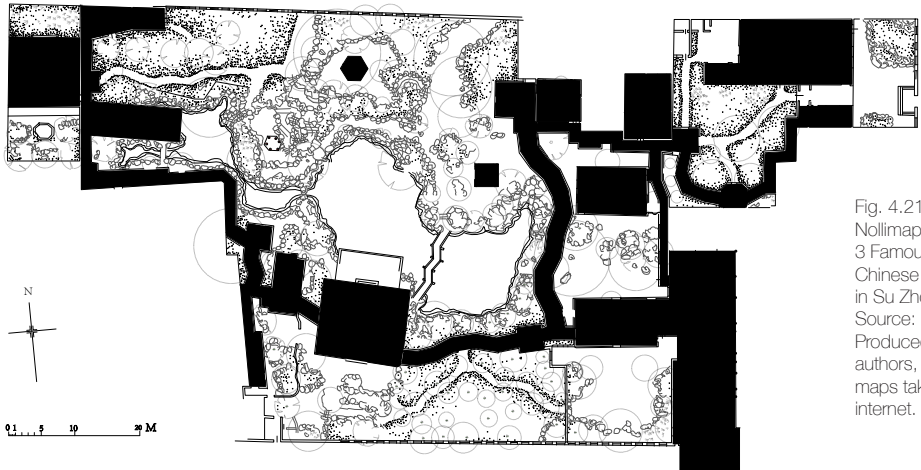
The 1.1 ha garden is divided into two main parts, a housing complex and rockery around a central pond. In addition to the 22 buildings the garden also houses 25 tablets, 71 steles, 5 carved wooden screens, and 13 ancient specimen trees, some dating back to the Yuan Dynasty. The garden is most famous for its elaborate grotto of taihu rocks.



0 1 5 10 20 M

## The Garden of Pleasance, in late 19th century

The garden was originally a private garden built by Go Wenbin, an official of the early years of the Guangxu Reign of the late Qing Dynasty. It has been described as one of the most representative Suzhou gardens, comprising a garden, a lotus pond, residences, artificial villages and ancestral halls. Because the garden incorporates all the elements of the various Suzhou gardens, it is sometimes regarded as an agglomeration of Suzhou's garden culture.



0 1 5 10 20 M

Fig. 4.21  
Nollimap of  
3 Famous  
Chinese Garden  
in Su Zhou  
Source:  
Produced by  
authors, base  
maps taken from  
internet.





typical building is usually as shown in the above scheme we made. The ideology A describes the interior space is located in the centre and it is always surrounded by open space out ring. The layout generated by ideology A has these features: 1. Centralized layout; 2. Geometrical open space; 3. Manicured plants and last is Massive volume. Different from ideology A, ideology B reflects the balance in Chinese traditional thought. And this balance is not equal to half of each. It emphasizes the dynamic integration between interior space and open space. As you can see from our diagram, the feature of layout coming from ideology B are listing as following: 1. Free combined layout; 2. Dynamic open space; 3. Natural plants 4. Small but multiple volumes. We think that is quiet clear to distinguish the different architectural philosophy of Chines Garden from the common architectural ideology.

Originated from traditional Chinese material, but use western method to deconstruct the architectural information in this painting helped us improve our analysis became much more relevant. We would continue to use this integrated method to go further study deeply. Because in our opinion, eastern architectures are complicated for the people who does not understand Chinese

Fig. 4.22  
Sketch of the garden by Wen Zhengming  
Source:  
Scanned from Wen Zhengming, An Old Chinese Garden : A Three-fold Masterpiece of Poetry, Calligraphy and Painting, by Wen Chen Ming, 1922.

general they can be divided into two broad categories. One is done indoors and the other is outdoors. In order to adapt to different needs, human beings not only need to build houses, but must also create suitable external space. The Chinese emphasize the coexistence of homes and gardens, and there must be a courtyard for the family. This shows that the external space is indispensable as an extension and supplement of the indoor space.

In our lives, the relationship between indoor space and outdoor space of a



Fig. 4.23  
Bird View  
Drawing of the  
Garden  
Source:  
<http://www.ylw0813.com>.

tradition and culture. But they are all architecture, so we can use the geomatical methods which we use in the whole world to interpret our typical architecture in a common language. That method is good for people to understand traditional Chinese architectures.

### The Humble Administrator's Garden

Now we are showing several interesting and representative cases to introduce

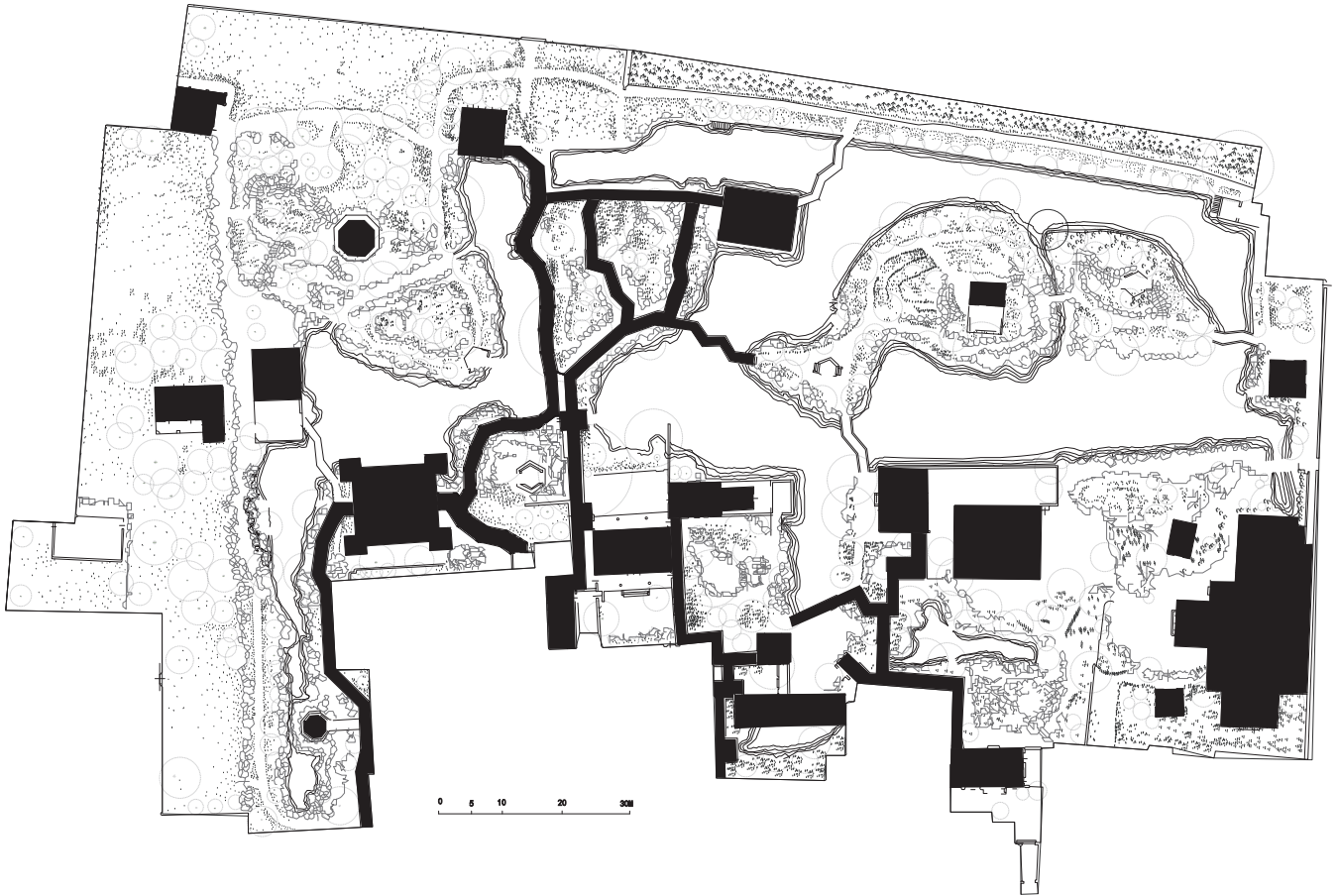
the specific spatial treatments in Chinese garden. First is the Humble Administrator's Garden, is a Chinese garden in Suzhou, a UNESCO World Heritage Site and one of the most famous of the gardens of Suzhou. The Humble Administrator's Garden is Covering an area of about seventy two acres,<sup>1</sup> it is the largest classical garden in Suzhou. The entire garden can be roughly divided into three areas: eastern yard, central yard and western yard.

<sup>1</sup> Congzhou Chen. *Chinese Garden Appreciation Dictionary*. East China Normal University Press, Shanghai. December, 2000.

Yuanyang Pavilion  
Listen to the music  
and entertain the  
guests



Jian Shan Pavilion  
Viewing the lotus  
and goldfish



Masterplan of Humble Administrator's Garden

Fig. 4.24  
Mapping of  
Architectural  
space and open  
space  
Source:  
Produced by  
authors, base  
maps taken from  
internet.

Fei Hong Gallery Bridge  
Eastern Park





The main hall of eastern yard is Lan Xuetang hall and Han Qing pavilion, et cetera. This area is more opened. The central part is the essence of the Humble Administrator's Garden, and the scenery here is dominated by natural scenery. The open and semi-open small yards are lined up one by one, and each staying space corresponds to a natural beauty. The western part of the Humble Administrator's Garden is dominated by

pools, then the winding bridges provide interesting streamlines for people while they are strolling. This kind of layout describes an integration between leisure atmosphere and exciting circulation scene for people. Every staying space is not randomly distributed, they are followed the Chinese traditional artistic conception to plan. All of them have their specific perspectives to the natural landscape scene.

Fig. 4.25  
Masterplan  
of Linger  
Garden, Suzhou.  
Source:  
<http://photo.blog.sina.com.cn/category/u/1268424895/s/401116/page2>. Chinese Classical Garden.

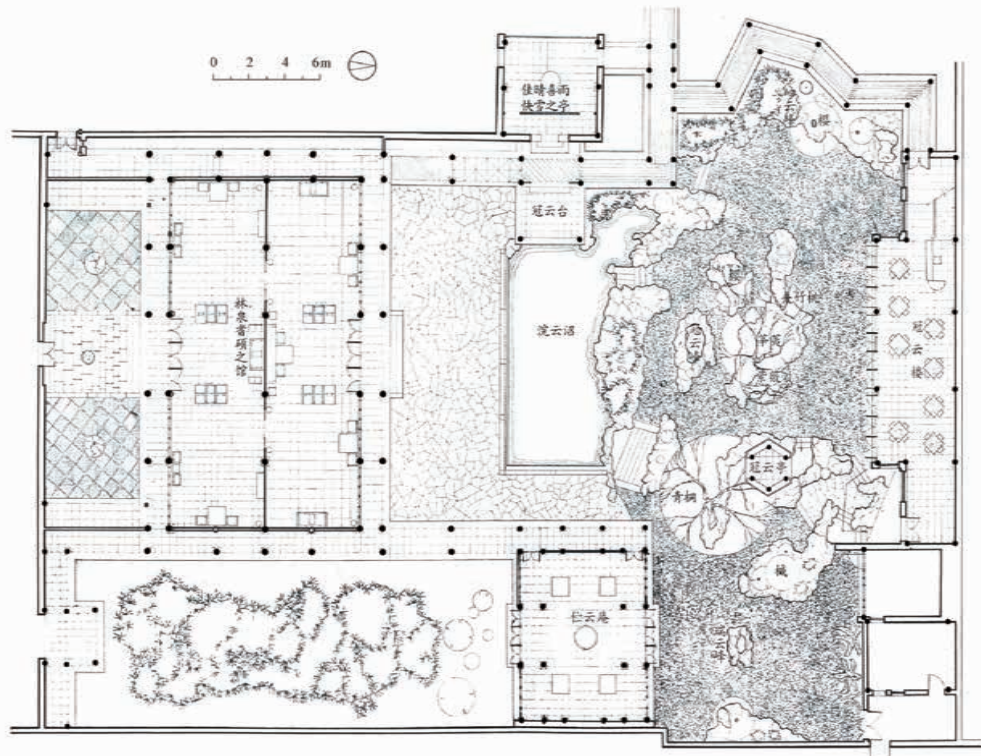


Fig. 4.26  
General Plan of  
Guan Yunfeng  
Courtyard in  
Lingering Garden  
Source:  
<http://photo.blog.sina.com.cn/category/u/1268424895/s/401116/page2>. Chinese  
Classical  
Garden.

## Lingering Garden

Lingering Garden is a renowned classical Chinese garden. It is located at 338 Liu Yuan Rd. Suzhou, Jiangsu province, China. It is recognized with other classical Suzhou gardens as a UNESCO World Heritage Site. In 1997, the garden, along with other classical gardens in Suzhou, was recorded by UNESCO as a World Heritage Site.<sup>1</sup> The masterplan of Lingering Garden is showed above (Figure.3.14), we try to underline principle visiting route of Lingering Garden as the

Nolimap process to present how richness of moving it is. The Lingering Garden combines the art of Jiangnan garden art, especially the division of architectural courtyards and the combination of garden spaces. It is divided into natural landscape in the central area, northern area is mainly about the countryside style. The western area focuses on diversity of plants, but eastern area shows its exquisite work of stone stacking. In Lingering Garden, most of buildings in the southeast are built adjoin to pool. pavilions, halls and multi storied buildings which are producing

<sup>1</sup> Congzhou Chen. *Chinese Garden Appreciation Dictionary*. East China Normal University Press, Shanghai. December, 2000. Page 22.



Fig. 4.27  
 Section A-A'(up)  
 Section  
 B-B'(down) of  
 Guan Yunfeng  
 Courtyard in  
 Linger Garden,  
 Su Zhou  
 Source: [https://  
 zhangrenzhi.  
 arttron.net/works](https://zhangrenzhi.arttron.net/works)  
 and Modified by  
 authors

amazing inverted image on the pool nearby. Elegant corridors are going to invite you shuttle in various pavilions with fresh air and gentle sun light.

Afterwards, when you pass through the Linquan Shuo Shuo Pavilion, then you arrive at the northeast corner of the garden. The plan of this area is shown above (Figure.3.16). The Huan Yun pool is surrounded by two pavilions and two multi-storeyed buildings which are Guan Yun building and Jiaqing pavilion. Through the sections we presented (Figure.3.17),

it is obvious that the courtyard planning provides diversiform natural scenes no matter which building you are looking at from the opened gallery. Exquisite rockery is communicating with organic shape pool, alternation of green plants and water create a fascinating courtyard.

All in all, classical Chinese garden has deduced a dynamic relationship between internal space and open space, that could inspire us there is a possibility to realize a distinctive Chinese open space applied on modern cities nowadays on this land.

### 3

## Chinese Pagoda and Tower

In this section, our main research goal is focusing on the storeyed buildings, Lou Ge, between AD. 25 and 220. This study is concerned with towers in an effort to articulate relationships between the early towers and multi-storeyed pagodas that flourished in China after introducing of the Buddhism from India. Towers had existed in China for a long period before any Buddhist pagodas were constructed. The Multi-storeyed buildings in late Eastern Han are the earliest tower in the history of Chinese architecture. We can also indicate that Lou Ge is a prototype that has influenced Chinese Pagoda during the late time.

At the very beginning of ancient China, multi-storeyed buildings came out just because the needs from emperors.

《论衡·道虚》曰：“为道学仙之人，能先生数寸之毛羽，从地自奋，升楼台之陞，乃可谓升天。”<sup>1</sup>

It means immortals are willing to live in tall buildings. And after this background, emperors ordered the construction of tall buildings to satisfy their lusts. Gradually, the atmosphere of building multi-storeyed buildings became popular in public. According to the records of the literature, a large number of funerary objects of the

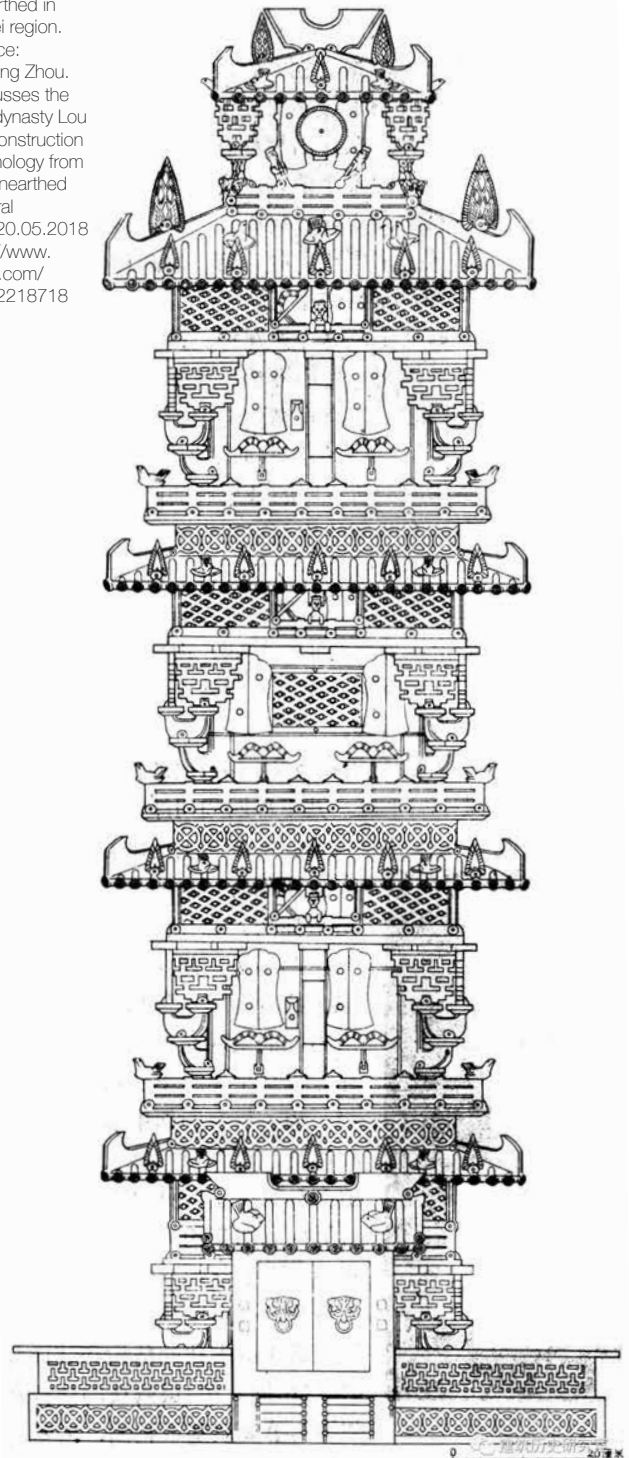
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<sup>1</sup> Chong Wang. *Lun Heng*. A.D 86. Chong Wang is an ideologist from Eastern Han Dynasty.

Han Dynasty were earthenware buildings including pottery towers. Checking the image on the right side (Figure 4.1) is a pottery tower unearthed in Hebei region. Most of those discovered so far have been excavated in Luoyang, the region of the Eastern Han capital and its adjacent areas. The pottery towers are dated to the period from the late Western Han to the end of the Eastern Han Dynasty. Although not being real buildings, they reveal various building practices of the day, with a surprising degree of details.

An early example of pottery multi-storeyed buildings is remarkable, excavated from a tomb at Weihe near Zhengzhou.<sup>1</sup> The building is grandiose with five roofs. It consists of two parts: the lower part is a double-storeyed base, and the upper part a five-storeyed building. The front and rear of the base are designed differently. There is a double-storeyed veranda in front and two stairways at the rear, and only the first storey has lattice windows suggested by parallelograms with holes.<sup>2</sup> A very important feature is that the sizes and heights of the storeys decrease towards the top gradually. The pottery towers together with other unearthed

Fig. 4.28  
Pottery tower  
unearthed in  
Hebei region.  
Source:  
Xueying Zhou.  
Discusses the  
han dynasty Lou  
Ge construction  
technology from  
the unearthed  
cultural  
relic.20.05.2018  
<http://www.sohu.com/a/232218718>



1 Qinghua Guo. *Chinese Architecture and Planning Ideas, Methods, Techniques*. Edition Axel Menges, Stuttgart/London, 2005.

2 Qinghua Guo. *Chinese Architecture and Planning Ideas, Methods, Techniques*. Edition Axel Menges, Stuttgart/London, 2005. Page 46.



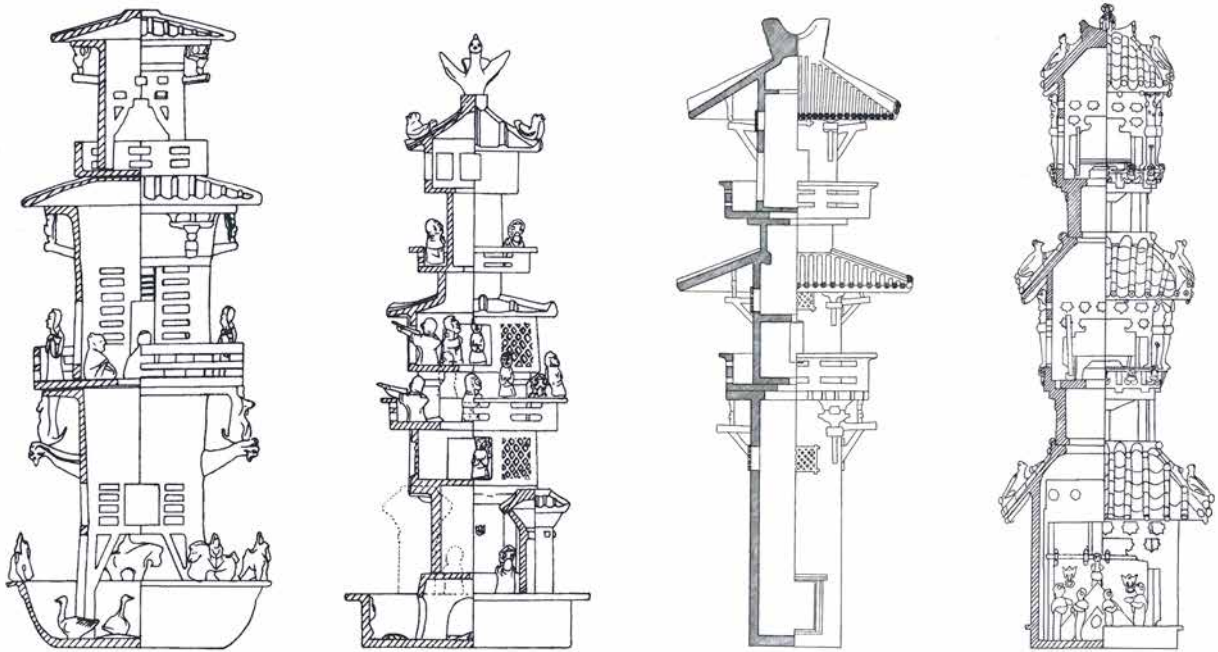


Fig. 4.29  
Four distinct structural types exhibited by pottery towers of the Han dynasty. Source: Qinghua Guo. Chinese Architecture and Planning Ideas, Methods, Techniques. Edition Axel Menges, Stuttgart/London, 2005. Page 51.

architectural representations reveal that building materials used in the Han Dynasty were earth, timber and masonry including tiles. This fact was corroborated by archaeological excavations which took place in many historical building site.

Among these unearthed pottery tower, they have different typology as shown the drawings above (Figure.4.2). Combined with research documents and our hypothesis, except from the storeyed building which is mainly serve as residential building. Others are watchtower, gate-tower and pavilion tower in respectively. As the sections

illustrates that the storeyed building has the function of living, so there is a underground level dedicated to raising poultry such as chickens and ducks. Above the ground level, there is living area with balcony around.

The second one is watchtower, also called multi-functional building. The watchtower was built to afford a wide view and high position for security. It shared basic architectural features and construction techniques with the gate-tower. The main difference were that the watchtower was a freestanding building within a compound, and was elevated by



Fig. 4.30  
Different types  
exhibited by  
pottery towers of  
the Han dynasty.  
Source: [http://  
www.jzsbwg.cn/  
index.asp](http://www.jzsbwg.cn/index.asp).

a substructure, such as an earth-timber structure, a group of wooden piles, and was elevated by a substructure, such as an earth-timber structure, a group of wooden piles, and a masonry structure. The third is gate-tower, we can also call it (que). It was erected on either side of a gateway to a walled city, or an enclosed domain of the royal, or nobility, or the officials.<sup>1</sup> History exhibits that the

gate-tower was treated as a type of Li architecture. Before the Qin dynasty, it was only used by the royal military. The last one is pavilion tower. The architectural appearance and setting of the pavilion tower are entirely different from any of the previous types, as demonstrated by the discovery from a Han tomb at Songwanhe, Henan Province. Towers had existed in China for a long period before

<sup>1</sup> Qinghua Guo. *Chinese Architecture and Planning Ideas, Methods, Techniques*. Edition Axel Menges, Stuttgart/London, 2005. Page 48.

any Buddhist pagodas were constructed. The Buddhism was adopted by Chinese at large by means of worshipping the Buddha.<sup>1</sup> When the Chinese immortal soul joined the Buddhist spirit, the tower, most likely pavilion tower, as an imposing architecture was transplanted to pagoda in late Eastern Han. Following we would like to introduce some typical and significant cases about different type of Chinese towers in different periods and represent different construction techniques in their period respectively.

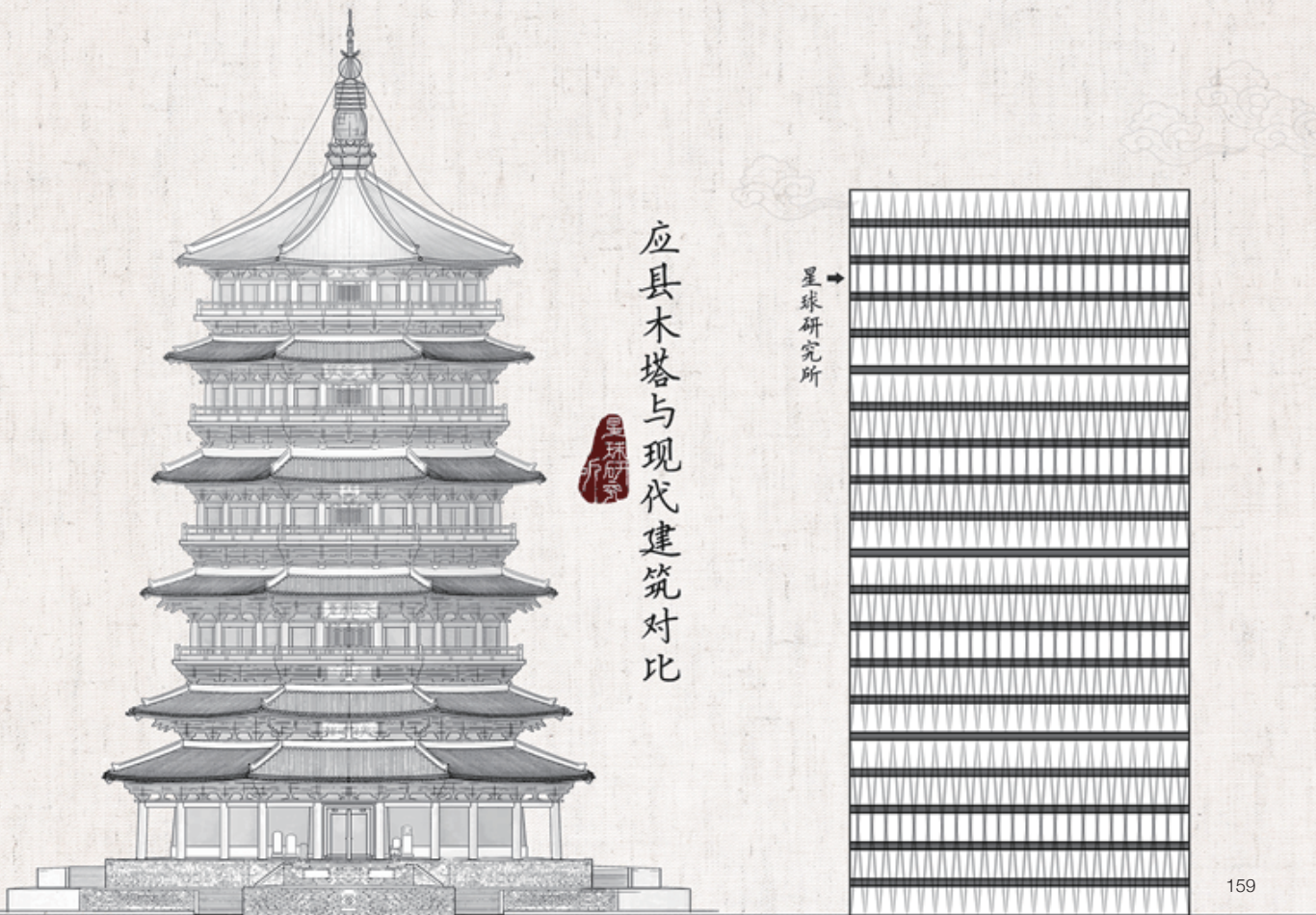
Fig. 4.31  
Comparison of  
Hsien Wooden  
Pagoda with  
Modern Tower  
Source: <https://zhuanlan.zhihu.com/p/38201366>

1 Qinghua Guo. *Chinese Architecture and Planning Ideas, Methods, Techniques*. Edition Axel Menges, Stuttgart/London, 2005. Page 50.

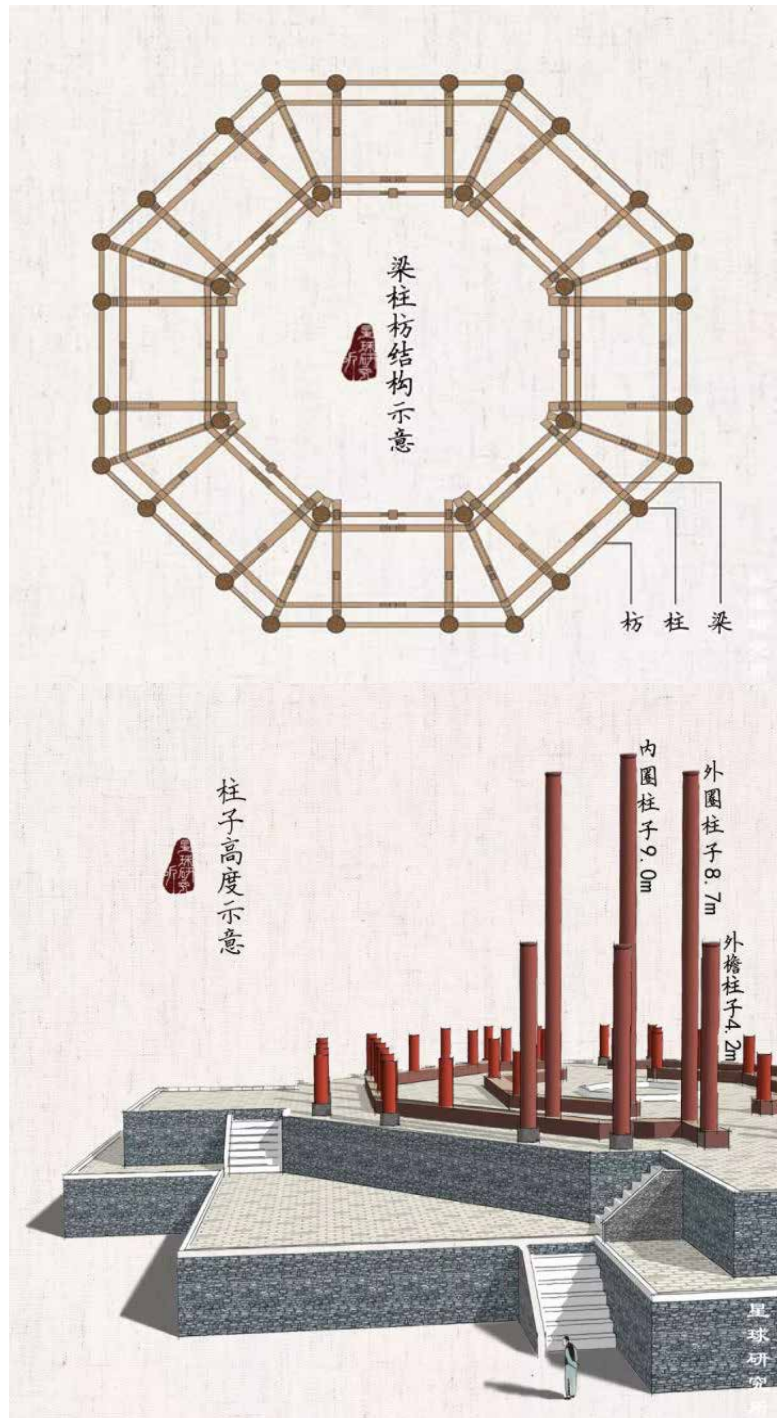
## Ying Hsien Wooden Pagoda

A poverty-stricken Shanxi town, Ying Hsien, boasts the only wooden pagoda known to exist in China, built in 1056 A.D. The only wooden pagoda existing in China today dates from the Song period. It stands about fifty miles south of Da Tong, Shan Xi Province.

The pagoda's eaves and stories are supported by a system of brackets. It is octagonal in plan (Figure 4.15) and it is



constructed entirely of wood, its structure is essentially the super imposition, in five tiers, of single-storied Chinese buildings. The first story has double-decked eaves, supported by huge brackets, stylistically identical with those of the Kuan-yin Ge. Each of the four upper stories has a surrounding balcony and an overhanging eave, supported by its own system of brackets. On each story, doors are opened on the four sides facing the central points, the other four sides being walled-in with plaster on lath, decorated with paintings of Arhats and Bodhisattvas.<sup>1</sup> On the ground floor, seated in the centre of the octagonal sanctuary, is a colossal clay stature of Sakyamuni, while on the upper floors are different Buddhas, usually attended by Arhats and Bodhisattvas. The top of the pagoda is finished with an elaborate spire of wrought iron, secured to the corners of the uppermost roof by eight iron chains. Sicheng Liang was up on that spire while he was surveying and mapping. That was one sunny, clear afternoon, absorbed in measuring and photographing, when clouds closed in rapidly but unnoticed. This pagoda, generously spared by nature, is entering its last century of a thousand-year cycle. This is the treasure that history has left for us in our opinion.



1 Sicheng Liang. *Chinese Architecture: Art and Artifacts*. Foreign language teaching and research press, Beijing. March, 2011.

Fig. 4.32  
Structural Plan of  
Hsien Wooden  
Pagoda(right up)  
Source: [https://  
zhuanlan.zhihu.  
com](https://zhuanlan.zhihu.com)

A tower of the height of 65.84 meters is completely constructed by wooden structure, and this pagoda is equivalent to a twenty-storey modern tower. The scheme we provide here (Figure.4.xx). What is surprised us is that our ancestors built this pagoda with completely wooden structure without an iron nail. By using traditional Sun Mao technology<sup>1</sup> to make wooden component bite with each other and then form this exquisite wooden art body. One thousand and five hundred people can climb the wooden tower at the same time.<sup>2</sup> The average weight of each wooden pillar on the first floor is up

to hundred and ten tons. Moreover, this weight of structure has been built since 1056, and it has been nearly a thousand years.<sup>3</sup> . In spite of that, in the millennium, other similar wooden towers were destroyed by natural disasters or lost in man-made disasters. Only the Ying Hsien Wooden Pagoda is preserved in the world. More than 40 earthquakes, more than 200 shots and bombardments, numerous lightning strikes, and strong earthquakes. Additionally, the pagoda is not destroyed by shelling, and it is not burned by lightning. It is not too much to call it "the first wooden tower in China".

Fig. 4.33  
Illustration of the  
Height of Columns  
(right down)  
Source: [https://  
zhuanlan.zhihu.  
com](https://zhuanlan.zhihu.com)

Fig. 4.34  
Base of Ying Hsien  
Wooden Pagoda  
(below)  
Source: [https://  
zhuanlan.zhihu.  
com](https://zhuanlan.zhihu.com)



According to historical archive's documents, the purpose of the construction of Ying Hsien Wooden Pagoda was to collect precious treasures of Buddhism. Originally, the ancient craftsmen in that period built a huge foundation for this pagoda with stone, and the underground part is two meters high. The general thickness is more than 6.4 meters, which is equivalent to the total height of three or four people. You can understand from the scheme below (Figure.4.xx) The above-ground part of the tower base is divided into upper and lower layers. The upper layer is octagonal and the lower layer is square. Corresponding to the

1 Sicheng Liang. *A History of Chinese Architecture*. SDX Joint Publishing Company, Beijing. 2001.

2 Xingqiu Research Team. *How much do you know about China's first wooden pagoda?* June 19th, 2018

3 Sicheng Liang. *Chinese Architecture: Art and Artifacts*. Foreign language teaching and research press, Beijing. March, 2011.

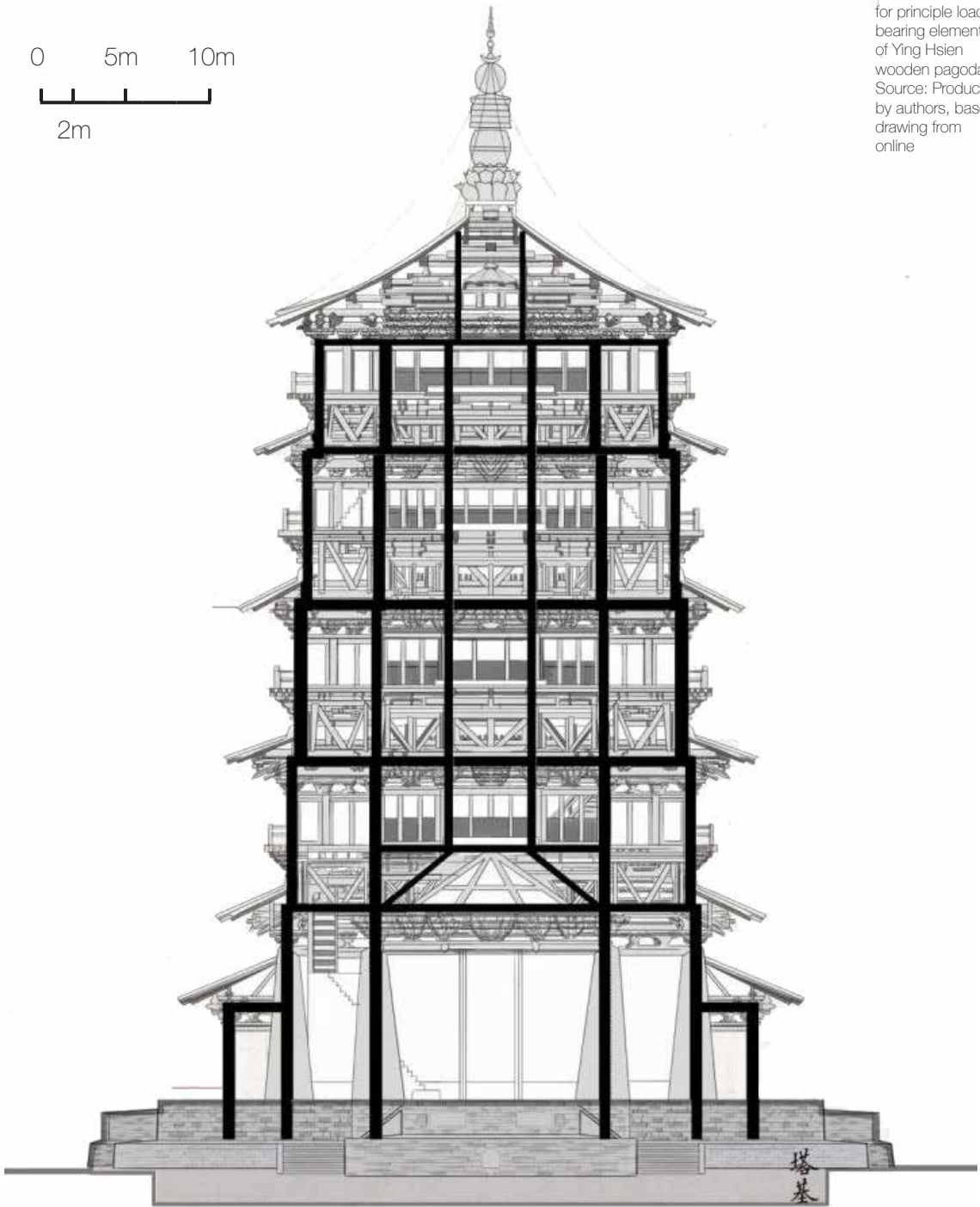


Fig. 4.35  
 Section scheme  
 for principle load-  
 bearing elements  
 of Ying Hsien  
 wooden pagoda  
 Source: Produced  
 by authors, base  
 drawing from  
 online

Fig. 4.36  
 Perspective  
 Section of Ying  
 Hsien Wooden  
 Pagoda  
 Source: Qianlang  
 Li, *Cutaway of  
 Chinese Classic  
 Architecture*.  
 Guangxi Normal  
 University Press,  
 October, 2009.



"round sky and square land", the four sides are extended to form a stable large cross structure. And the surface of pagoda base has reserved foundations for receiving wooden columns. Next, the thirty-two wooden columns were divided into three rings and placed on top of the column to form an octagonal

column network with columns up to nine meters. The columns and columns are laterally interconnected by "Fang" and "beams". From the top of the building, they form a "cylinder", which greatly improves the stability of the building. After that, a unique component of Chinese architecture appeared: the fight. It is made up of multiple small wooden blocks. It can be connected, connected to various columns, beams, rafts, or cantilevered eaves. Ying Hsien Wooden Pagoda uses a total of fifty-four species and four hundred and eighty buckets. It is the most ancient building in China and is called the "Brackets Museum". When the wind and earthquake come, the bracket is like a flexible spring that absorbs kinetic energy and protects the main structure from damage. Looking up from the bottom, the blossoming scorpion is like a cluster of lotus blossoms, which shines on the tower. The ancients call it "the hundred feet of lotus blossom." The structure is obscured by the eaves. So it is hard to observe dark layer from outside. The beams, columns, rafts and brackets are laid on the dark layer, then the integration between bright layers and dark layers. This is the first floor of the Ying Hsien Wooden Pagoda. And the layers are also duplicated in this way, eventually forming a wooden pagoda which has both bright layers and dark layers.

## The Sung-Yueh Brick Ssu Pagoda

The second case we would like to introduce you about the Sung-Yueh Brick Pagoda. It is the oldest brick work pagoda in China, and this pagoda is in the compound of the ancient Buddhist temple of Sung-Yueh Ssu at Sung Shan, Honan. The pagoda, built in 523 AD, is very unusual in style having, as it does (Figure.4.xx), you can see from its ground level plan below, as it shows, the twelve sides and fifteen stories bring its special envelope from others. In China, architects

who work for historical buildings called this kind of pagoda model as Multi-Eaved Pagoda. The fifteen stories of the pagoda also constitute an uncommon feature. On a very high base is the tall first-story, above which are fifteen decks of cornices of roof-eaves. Though regarded as fifteen-stories, a pagoda with such arrangement may perhaps be more appropriately described as one-storied, but with the characteristic of fifteen-deck-roofed and multi-eaved pagoda. The first story is embellished at the corners with polygonal engaged columns with lotus-blossom

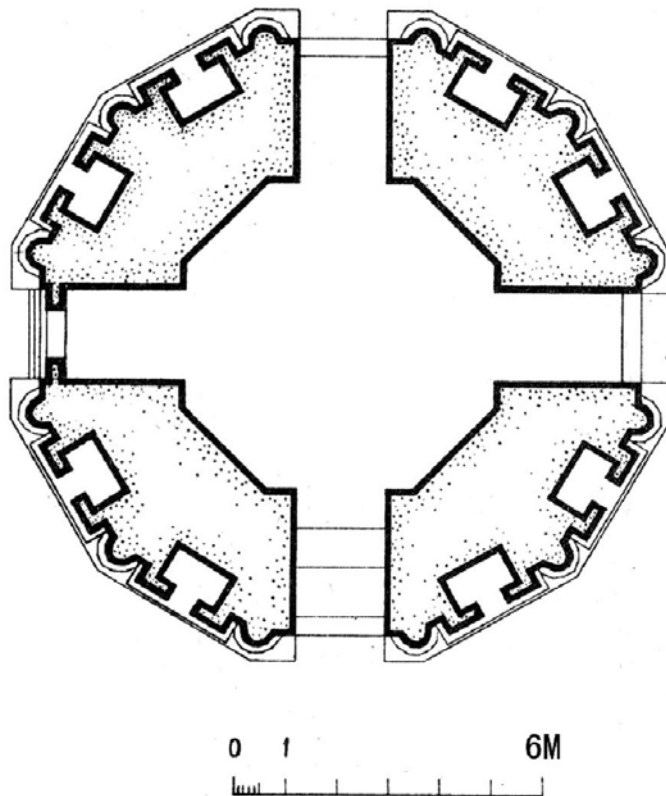
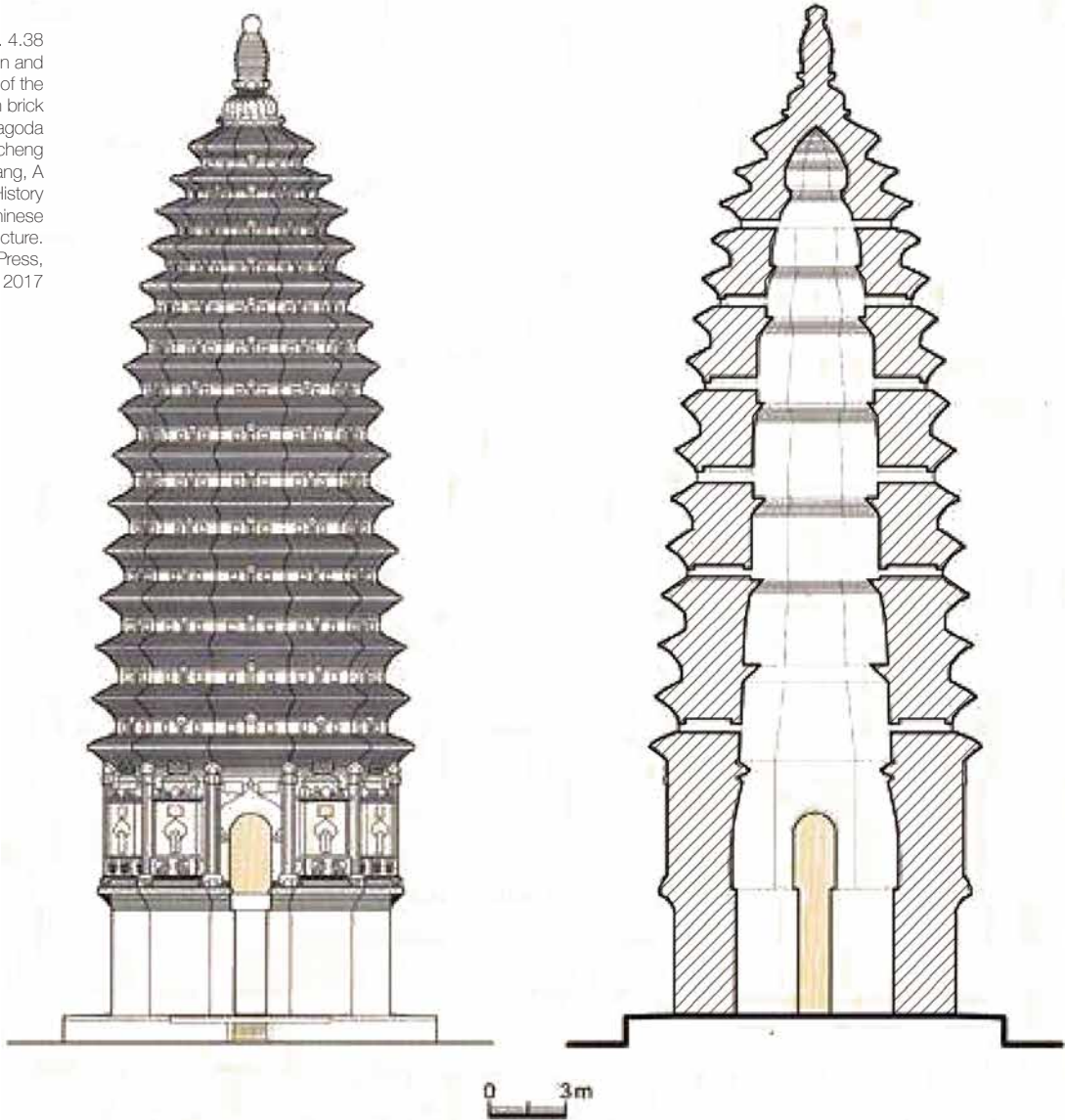


Fig. 4.37  
Plan of the  
Sung-yueh brick  
Ssu pagoda  
Source: Sicheng  
Liang, A  
Pictorial History  
of Chinese  
Architecture.  
New Star Press,  
June, 2017

河南登封县嵩岳寺塔平面图



Fig. 4.38  
 Elevation and  
 Section of the  
 Sung-yueh brick  
 Ssu pagoda  
 Source: Sicheng  
 Liang, A  
 Pictorial History  
 of Chinese  
 Architecture.  
 New Star Press,  
 June, 2017



capitals. Each of the doorways on the four sides facing the cardinal points is arched, the extrados of the arch being shaped like a lotus petal and ending in volutes at the spring-line.<sup>1</sup> Since then, let us discuss about its façade and the feature of architectural elements. Firstly,

this orphans of the existing twelve-deformation towers in China are made of densely populated, constructed with blue bricks and yellow mud from the local mountains. And pagoda's façade was decorated by fake windows and doors that do not have real functions

<sup>1</sup> Sicheng Liang. *Chinese Architecture: Art and Artifacts*. Foreign language teaching and research press, Beijing, March, 2011. Page 274.

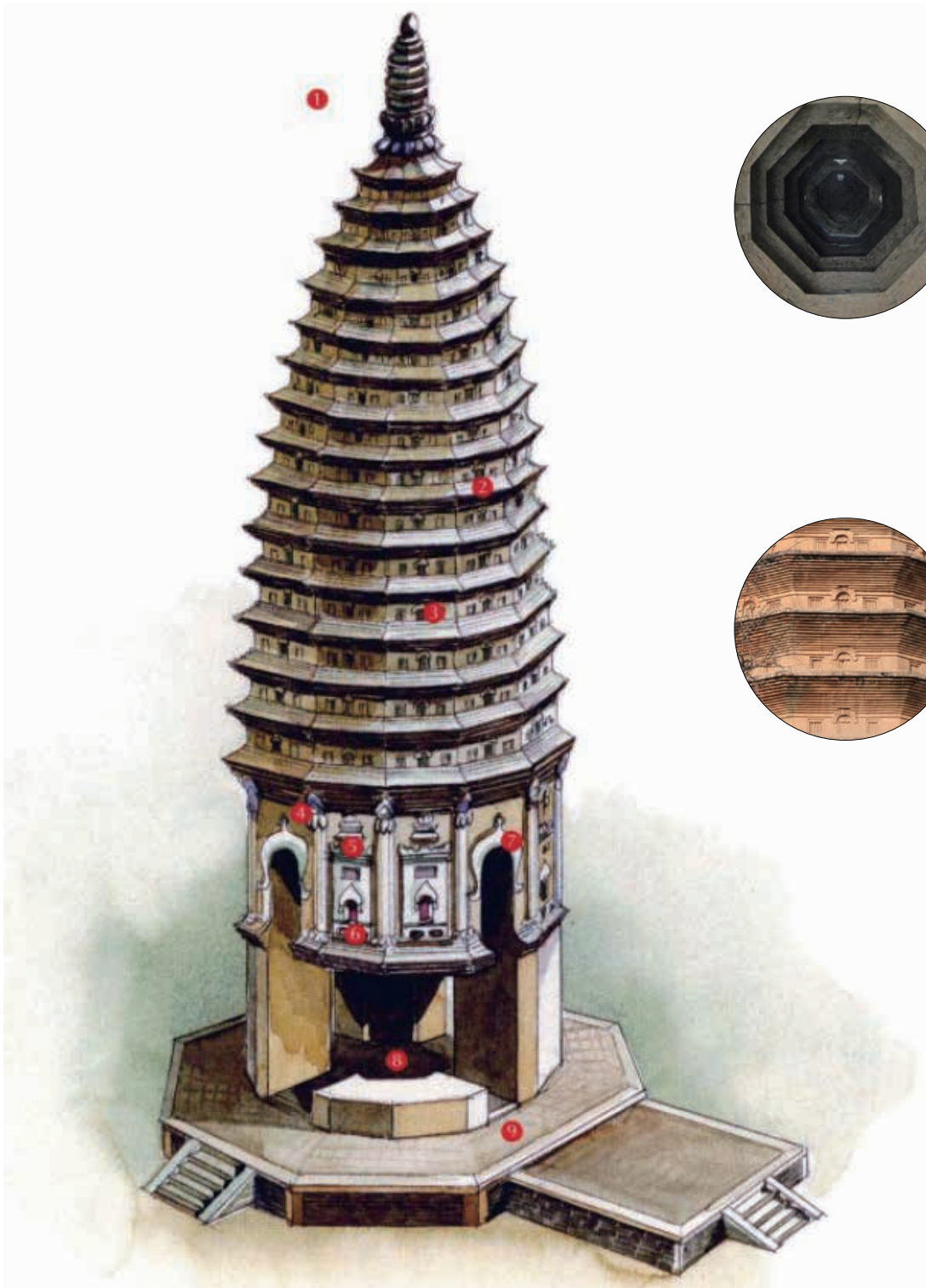


Fig. 4.39  
Perspective  
Section of the  
Sung-yueh brick  
Ssu pagoda  
Source: Qianlang  
Li, *Cutaway of  
Chinese Classic  
Architecture*.  
Guangxi Normal  
University Press,  
October, 2009

of ventilation instead of expression. The second is the inside of the tower is empty, and the bottom four sides are all surrounded by doors. The last one is its recognisable octagonal pedestal. Undoubtedly these niches were once occupied by statues which were lost long ago. The architectural motifs show unmistakable Indian influences. The general parti of the edifice is the primogenitor of a pagoda-form that later became very popular in China.

### CHIN-KANG-PAO-TSO T'A

The name CHIN-KANG-PAO-TSO T'A refers to several temples in China that were constructed following the

architectural design of a Diamond Throne Pagoda inspired by the Indian Mahabodhi Temple. This instanced temple is located in PI-YUN SSU, western hills, Beijing. And it was built in Qing Dynasty, constructed in 1748.

The height of CHIN-KANG-PAO-TSO T'A is thirty-four meters in general. Mainly divided into base platform, throne and tower body. The base has two floors. The first floor is climbed straight up. The second floor is divided into two sides and then straight up to the throne arch. The throne is divided into two parts, and the tens of steps are taken to the top of the throne. The path of division and combination implies the realm of Dharma.

Fig. 4.40  
Front Elevation  
of Chin-Kang-  
Pao-Tso T'a  
Source:  
Sicheng Liang,  
A Pictorial  
History of  
Chinese  
Architecture.  
New Star  
Press, June,  
2017

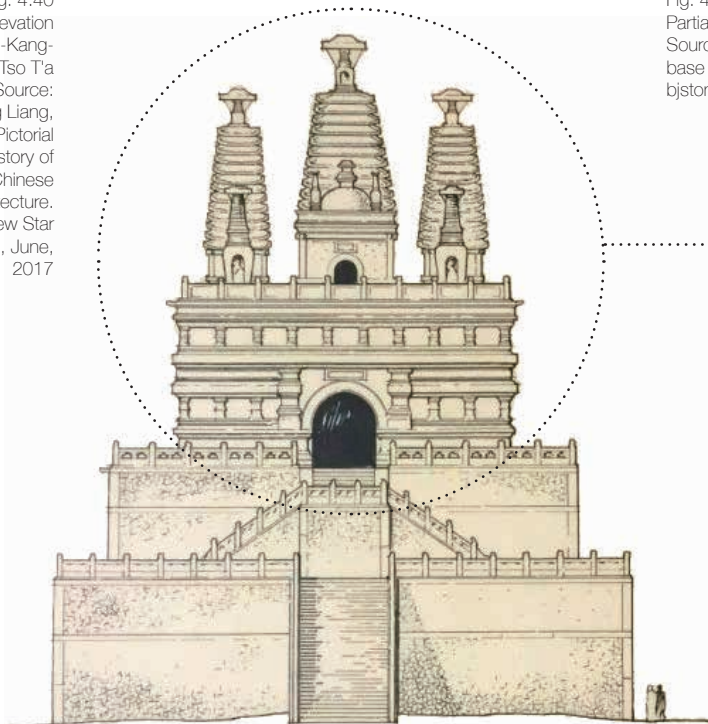
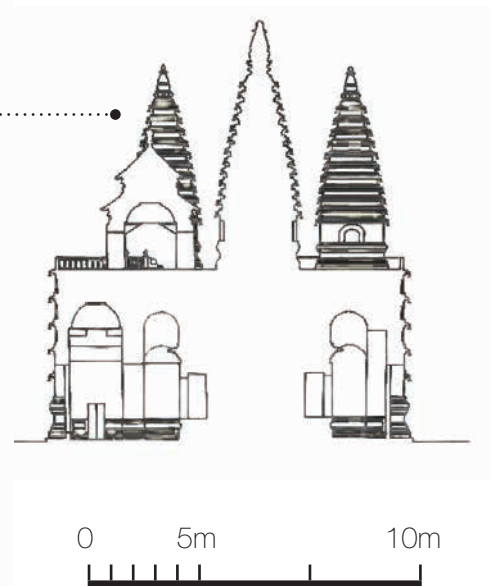


Fig. 4.41  
Partial Section of Chin-Kang-Pao-Tso T'a  
Source: Modified by authors, drawing  
base from internet(<http://www.bjstoneartmuseum.org.cn/>)



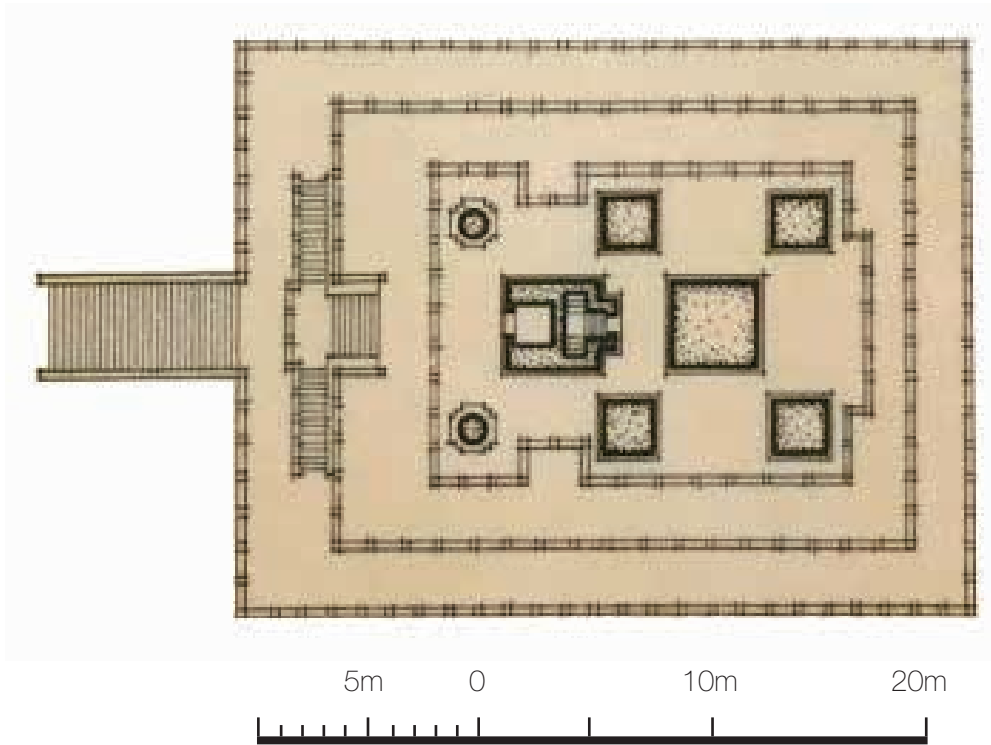


Fig. 4.42  
Plan of Chin-  
Kang-Pao-Tso T'a  
Source: Sicheng  
Liang, A  
Pictorial History  
of Chinese  
Architecture. New  
Star Press, June,  
2017

The image above (Figure.4.xx) presents my description through its drawing of section. The solemn staircases lead the visitors from ground land to the top of base platform. Afterwards, coming with the throne of the temple. Sacred entrance in the centre of axis. And there are thousands of exquisite decorations and Buddha statues reflect the privilege and luxury of the throne.

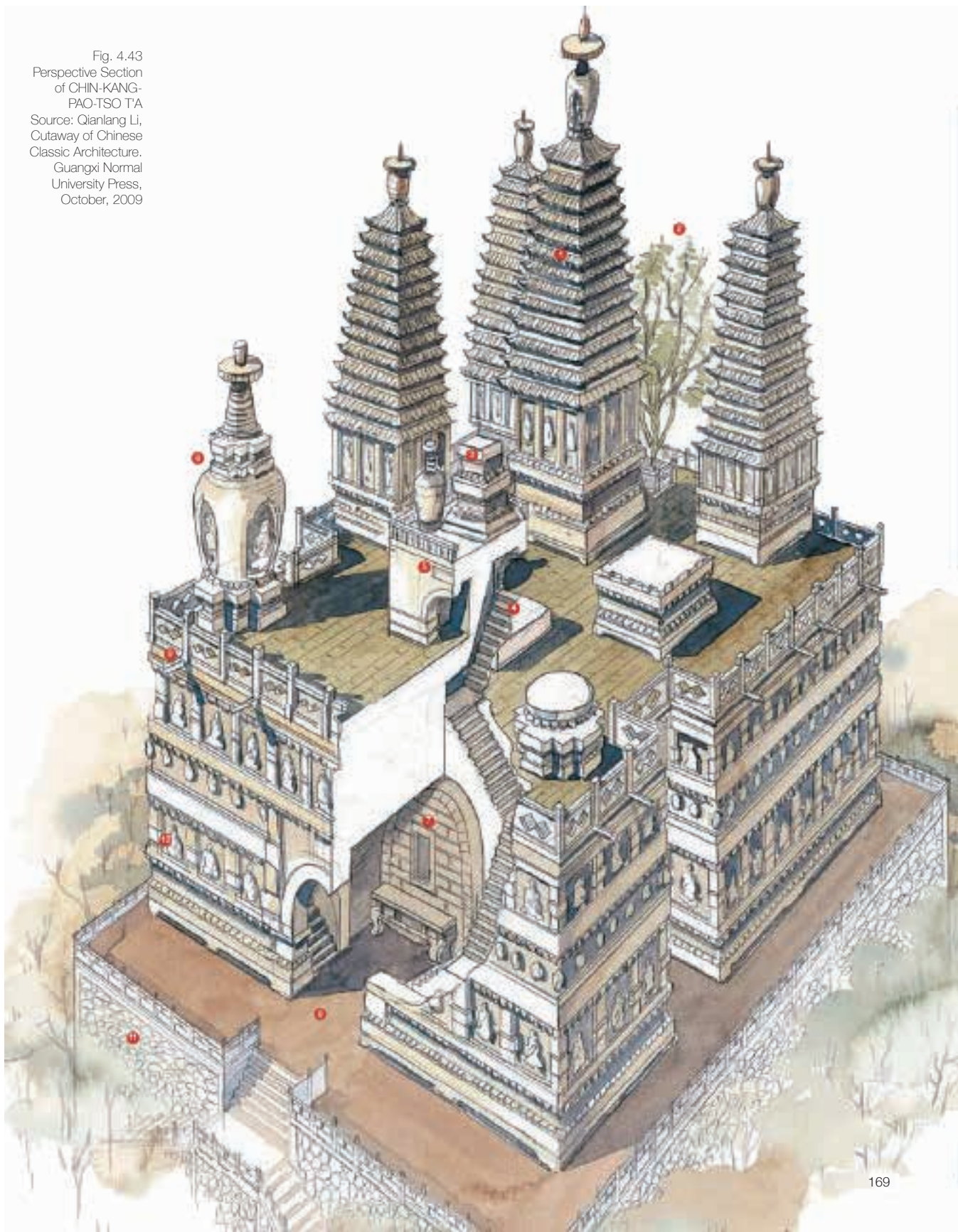
Besides, the high-rise platform is artificially built, and the Lama Tower<sup>1</sup>, the square

platform and the multi-eaved pagoda are placed in turn on the high platform. The walls are covered with white marble<sup>2</sup>, the walls are covered with Buddhist reliefs, and the stone levels can be used for the top (Figure.4.xx). The tower originates from India. But integrated into Chinese architectural features. Then move to the various characteristics that CHIN-KANG-PAO-TSO T'A has in architectural aspects. The first feature is there are five multi-eaved pagodas located on the pedestal are all made from white stone.

1 Sicheng Liang. *A History of Chinese Architecture*. SDX Joint Publishing Company, Beijing, 2001. Page 297

2 Qianlang Li. *Cutaway of Chinese Classic Architecture*. Guangxi Normal University Press, October 2009. Page 15.

Fig. 4.43  
Perspective Section  
of CHIN-KANG-  
PAO-TSO T'A  
Source: Qianlang Li,  
Cutaway of Chinese  
Classic Architecture.  
Guangxi Normal  
University Press,  
October, 2009



Secondly, when you enter in the throne, stone steps are going up and through the small CHIN-KANG-PAO-TSO T'A that built on the square pedestal. Then, the entrance to the throne is a semi-circular arch, and there are stone staircases on the left and right sides of the throne. The platform can be climbed through the two stone staircases. Fourthly, there are lots of stone relief buddha statue on the facades of the throne. Last but not least, the large bases are made of stone completely. Compared with the previous case, it embodies the blending of Indian Buddhist architectural culture and Chinese architectural culture.

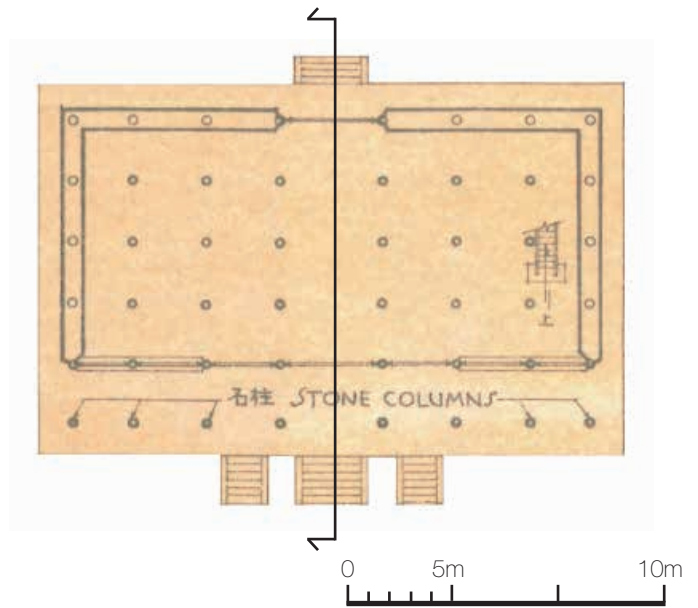


Fig. 4.44  
Plan of Kui Wen Pavilion (Library Building)  
Source: Sicheng Liang, A Pictorial History of Chinese Architecture. New Star Press, June, 2017

## Kui Wen Pavilion

The last case we are willing to introduce is the Library Building, Temple of Confucius. It is located in Qu Fu, Shan Dong. Originally it was built in Ming dynasty and constructed in 1540 A. D. Kui Wen Pavilion is the name of this library building. It is a quite important building on the central axis of the Confucius Temple. It is located in front of the Dacheng Hall and is taller than the Dacheng Hall. At the time of the initial construction, it was a library building that collecting important books and documents for scholars to refer and borrow.



Fig. 4.45  
Section of Kui Wen Pavilion (Library Building)  
Source: Sicheng Liang, A Pictorial History of Chinese Architecture. New Star Press, June, 2017

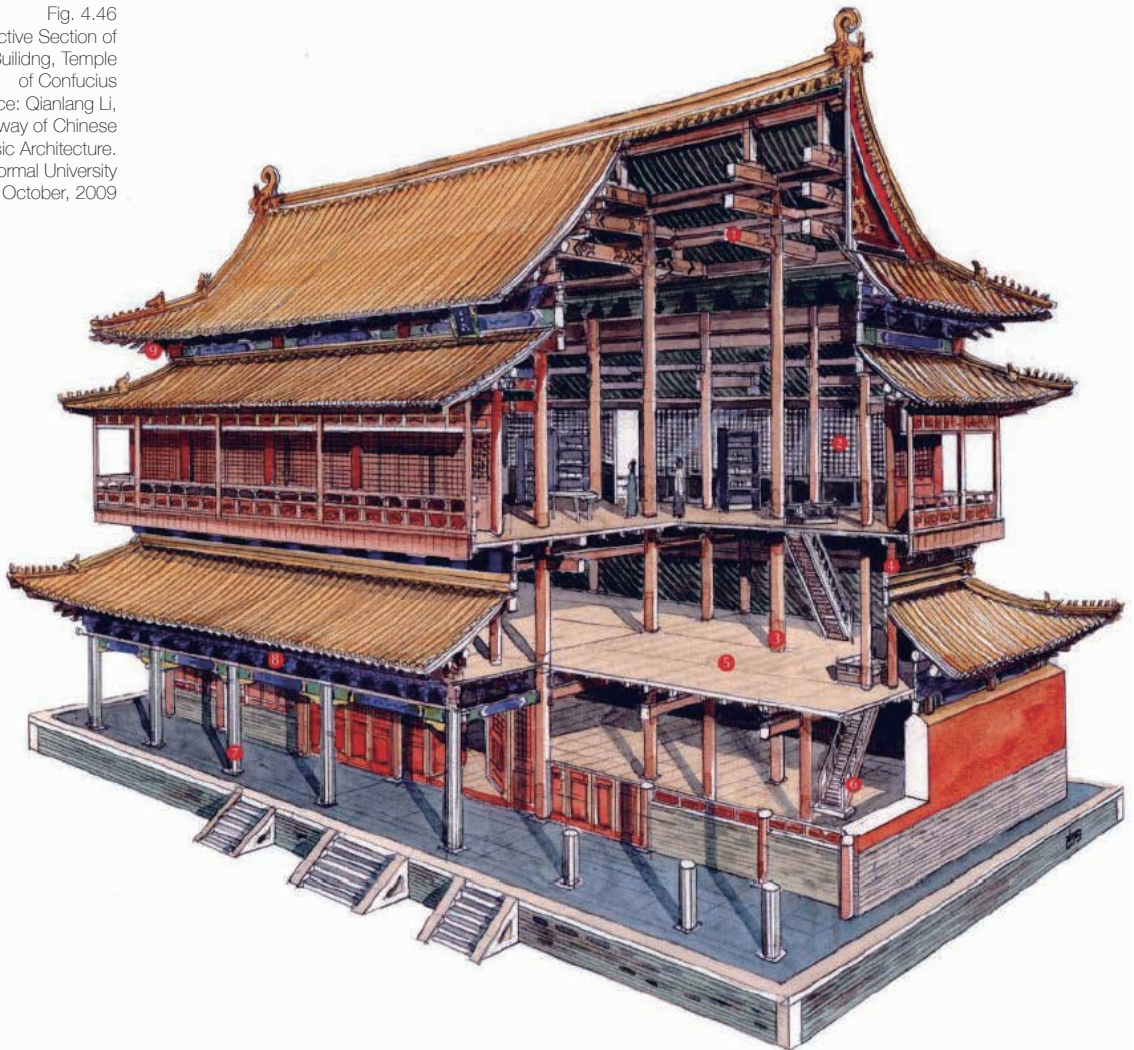
The second floor is spacious and surrounded by a cloister<sup>1</sup> with good ventilation and lighting. It is supposed to be used as a reading room. The collection of books is open for students to read and has the function of a public library. It is typical of ancient Chinese collections. The ancients were very careful about the protection of books and documents.

Different from previous examples, this building is a developed result from the prototype of multi-storeyed building. So you will find numerous characteristics which can really present the Chinese classical building. Initially, the different innovation of this building is that on the roof, there is no ceiling at all, it is clear to observe roof structure and a spacious

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1 Qianlang Li. *Cutaway of Chinese Classic Architecture*. Guangxi Normal University Press, October 2009. Page 276.

Fig. 4.46  
Perspective Section of  
Library Building, Temple  
of Confucius  
Source: Qianlang Li,  
*Cutaway of Chinese  
Classic Architecture*.  
Guangxi Normal University  
Press, October, 2009



space for reading. More specifically, these floor uses light-frame windows and doors to achieve the interior environment with good ventilation and natural lighting. In fact, that is due to the function of collecting books, that facing the users' demands while they were using the space. Third point is the first floor is the blindstorey, which were supported by the same columns that support the second floor. It makes the whole building more stable. Then the cantilever cloister is supported by Ping Zuo<sup>1</sup> structural system. The fifth feather is the floor system that for the blindstorey plays the important role of ceiling for the ground floor at the same time. The wooden staircases connect ground floor to the second floor in vertical direction. Lastly, Dou Gong system supports roof in a good performance.

All in all, even through the various classical towers in China have different representation but still there are common characteristics inspired us to design modern high-rise in nowadays.

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1 Sicheng Liang. *A History of Chinese Architecture*. SDX Joint Publishing Company, Beijing. 2001.



4  
Chinese  
Vernacular  
Dwelling

Among the many types of architectures in China, residential buildings can be said to be the earliest types of buildings that came with the appearance of human beings. According to research, the primitive society mainly has two major building categories, namely nesting and burrowing, which are residential buildings, which means that the two major architectural categories of the primitive society belong to the residential building type.<sup>1</sup>

After the primitive society, starting from the slave society, with the class, the building gradually produced different new types, and the residential buildings were gradually named as “residential houses”, which became different from other building types in ancient Chinese architecture. The residential building is almost a type of building that comes with the emergence of human beings. But relatively speaking, it is the most simple one among the various architectural types in ancient China. The materials are simple, the volume is small, and the construction is not arbitrary. When the palaces, mausoleums, temples and other types of buildings have developed to a magnificent stage, most of the dwellings are still Mouth Cottages.

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<sup>1</sup> Wang, Qijun. Vernacular Dwellings, in Chinese Ancient Architecture. Beijing: China Electric Power Press, 2008. Page 10.

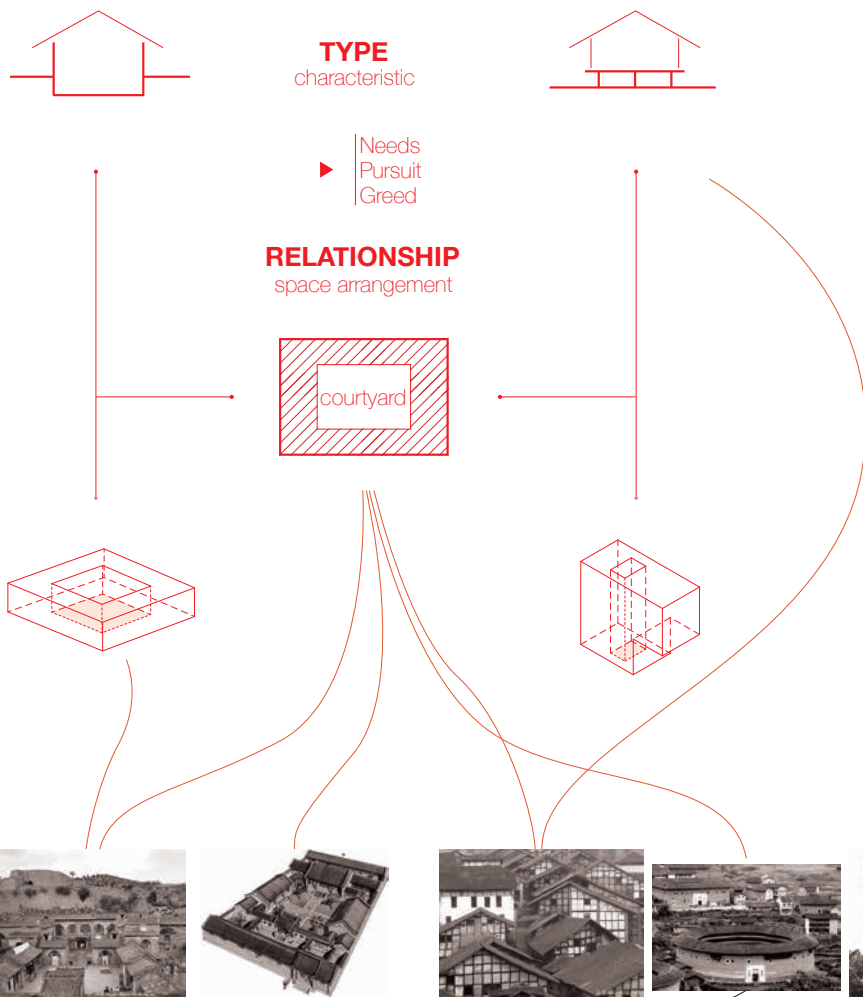


Fig. 4.47  
The Origin and  
Differences Development  
of Chinese Dwellings  
Source: Made by authors

The courtyard combination is the biggest feature of Chinese residence. The main purpose of the construction of residential houses is to meet the actual needs of people's daily living. On this basis, they also appropriately pursue comfort, and with the continuous improvement of living standards, people's comfort and other spiritual aspects of housing. The requirements are also getting higher and higher. Every house is the home of everyone who lives in it. The home is a place full of affection, warmth and introversion for the people living in. Especially in ancient China, this introverted feature is the most obvious, and this introvert is prominent in the residential architecture about the form of the courtyard enclosed<sup>1</sup>, which is a common feature of most residential buildings in ancient China.

Chinese dwellings show significant locality, which is different subdivisions due to differences in geography, climate, customs, etc. Such as: courtyard-style dwellings, water town dwellings, cave dwellings, stilt style dwellings, defensive dwellings, and felt-style dwellings. Among them mostly are in courtyard style, but their appearance and layout are different because of the local culture.

In the enclosed courtyard, each building has a central axis that is symmetric or balanced. That is, in the whole dwelling house, there is a significant central axis, and the main volume is built along the central axis, and other auxiliary rooms or volumes are built on both sides of the axis building, and should be built in a bilaterally symmetrical form, even if it is not in the image which exactly the same, they must achieve a balanced situation.

From the spiritual point of view, this kind of central axis symmetry and balance, courtyard enclosure and so on, in line with and adapt to the patriarchal system and ethics and hierarchy rules of ancient Chinese society. China's ancient system emphasizes the centre is in great dignity status, people are different in hierarchy. Therefore, the houses on the central axis of the residential courtyards are always the most important houses in the entire residential area. The central dignity and hierarchy rules, respectful to order, shows the feudal level is emphasized. The centripetality of the four sides enclosure is the distinct expression of the ancient Chinese people's distinction between inside and outside, closed or distant.

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1 Wang, Qijun. Vernacular Dwellings, in Chinese Ancient Architecture. Beijing: China Electric Power Press, 2008. Page 11.



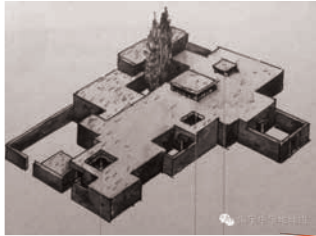
Zhuangkuo Yard  
Qinghai Province



Cave dwelling  
Gansu Province, Shanxi Province,  
Shanxi Province, Henan Province,  
Hebei Province, Ningxia Province



Felt-style dwellings  
the Mongol nationality folk house  
Mongolia



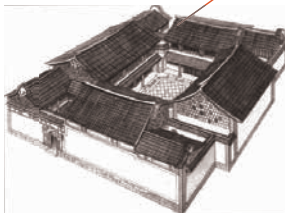
Ayiwang  
Uyghur nationality folk house  
Xinjiang Province



Defensive House made by Stone  
Tibet, Qinghai Province, Sichuan  
Province



Villages in Mountains  
Stilt Style Transformed  
Sichuan Province



Ethnic Han Style House  
in Minority Area  
Room in Three Sides  
Southwest Minority Area



Stilt House  
Yunnan Province



Stone House  
Guangzhou Province



Stilt House  
Guangxi Province



The Koreans Folk House  
Tile house  
Jilin Province, North in  
Heilongjiang Province

Quadrangle  
Dwelling  
Beijing, Hebei  
Province,  
Shandong Province

Dwelling in Watertown  
Stilt Style  
Jiangsu Province,  
Zhejiang Province

Dwelling south  
Anhui province  
Anhui province

Tulou  
Defensive Unit Dwelling  
Guangdong Province,  
Fujian Province, Jiangxi  
Province

Fig. 4.48  
Territorial Distribution  
of Chinese Traditional  
Dwelling  
Source: Made by authors

Dialou Tower  
Defensive  
Dwelling  
Guangdong  
Province

The hakka gathered around house  
Eastern coastal area

A Quadrangle building is a historical type of residence that was commonly found throughout China, most famously in Beijing and rural Shanxi. Throughout Chinese history, the Chinese Quadrangle composition was the basic pattern mainly used for residences, but also there are palaces, temples, monasteries, family businesses, and government offices apply the Quadrangle composition to build their building. In ancient times, a spacious Chinese Quadrangle would be occupied by a single, usually large and extended family, signifying wealth and prosperity. Today, remaining classical Quadrangles are often still used as subdivided housing complexes, although many lack modern amenities. Chinese Quadrangle dates back as early as the Western Zhou period<sup>1</sup>, and has a history of over two thousand years. They exhibit outstanding and fundamental characteristics of Chinese architecture. They exist all across China and are the template for most Chinese architectural styles.

More specifically, if we retrospect the origin of traditional Chinese Quadrangle, we could find that the appearance of this typology of architecture was due to the traditional mentality from Chinese people. Generally, Chinese people attach great

<sup>1</sup> From online resource: <https://zh.wikipedia.org/wiki/四合院>



importance to the concept of family and we emphasize the solidarity of whole community, instead of the individualism, we are educated as collectivism. This kind of mentality is also reflected in the layout of our architecture. The enclosed courtyard is a good interpretation of this

Chinese concept. Reading the Chinese famous painting 'Along the River During the Qingming Festival', which was painted by Zhang Zeduan during 1085 and 1145, Song Dynasty.<sup>1</sup> As we said before, this painting depicts the situation of the capital city of Bianjing, nowadays is Kaifeng,

Fig. 4.49  
Along the River During the Qingming Festival, painter Zhang Zeduan (1085–1145), Source: Palace Museum(<https://commons.wikimedia.org/wiki/>)

<sup>1</sup> People's Network - Art Collection Channel. *Appreciation of the Northern Song Dynasty painter Zhang Zeduan's "Along the River During the Qingming Festival"*. August 27th, 2013. <http://art.people.com.cn>



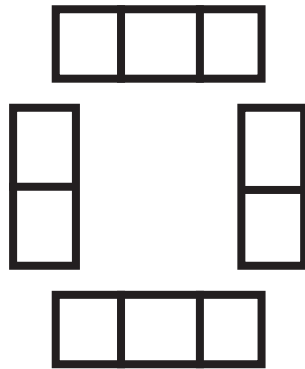
Henan. It illustrates mainly the natural scenery and prosperity of the banks which were belong to Bianhe River in the Northern Song Dynasty. In the form of long scrolls, the author used the composition method of scatter-point perspective to incorporate the

complicated scenes into a unified and Richly varied painting.<sup>1</sup>

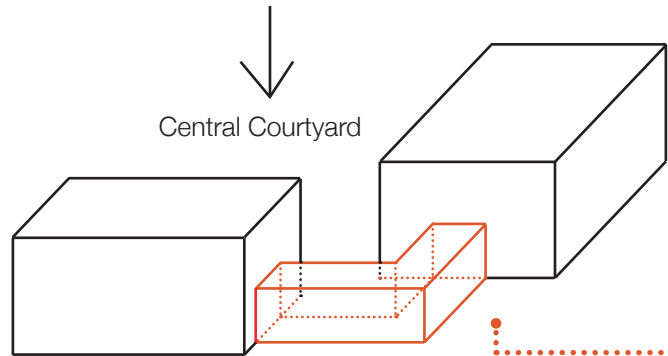
Centered on a tall city tower, the houses on both sides are lined up with tea houses, wine cellars, foot shops, butcher shops, temples, public spaces and so on.

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1 People's Network - Art Collection Channel. *Appreciation of the Northern Song Dynasty painter Zhang Zeduan's "Along the River During the Qingming Festival"*. August 27th, 2013. <http://art.people.com.cn>



Generic Layout of Quadrangle Dwelling



Spatial Connection between Different Halls

Fig. 4.50 Analytic Diagram Source: Produced by authors.

In the store, there are special operations such as silk satin, jewellery and spices, and incense paper horses. In addition, there are medical clinics, cart repairs, fortune-telling, face-lifting, all works of life. The big store heads are still garnished "Welcoming entrance", hanging the city to attract flags, soliciting business, market pedestrians, crowded street, continuous flow, street vendors, horse-riding bureaucrats, hawkers, and sedan chairmen. There is a scene about a rich diversity of different social activities they have in Northern Song Dynasty.

Besides, behind the bustling street scene are the typical Chinese traditional Quadrangle Dwelling (Figure.4.xx), we call them Siheyuan in Chinese. It is not difficult to find this typology building even at that early time, the courtyard house became

the most popular and suitable residential type in this area. In spite of that this famous painting is describing the scenery of Kai Feng city which is the capital in Northern Song dynasty, during 960 A. D to 1127 A. D, the Chinese Quadrangle dwellings have developed in a very mature phase. Not only a single enclosed courtyard that common quadrangle has, but also multiple courtyards appeared with the massive Chinese Quadrangle that built from rich family.

Since then, we zoomed into this painting, and we plan to gain some historical information from this historical painting. Thus, we selected a circular area marked by orange dash line, by extracting architectural plan from perspective drawing. The layout of enclosed shows very clear by our plan. Then, based on



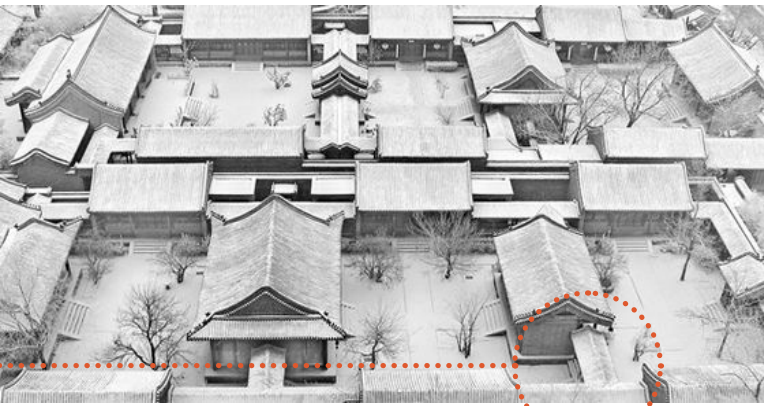


Fig. 4.51 Bird View of Beijing Quadrangle Model Source: <http://www.ecns.cn>.



Fig. 4.52 Drawing of tradition quadrangle dwelling in Beijing Source: By Xichen Zheng(1938-?). Painted from 2002.

analysing the relationship between courtyard and surrounded house, we find out there are various connection between different surrounded house as shows from our diagram (Figure.4.xx). The diagram we presented above is illustrating one of the various connections, this type of spatial connection (Figure.4.xx) is mainly

referring to a gallery or corridor that provide the functions of promenade and whistle stop.

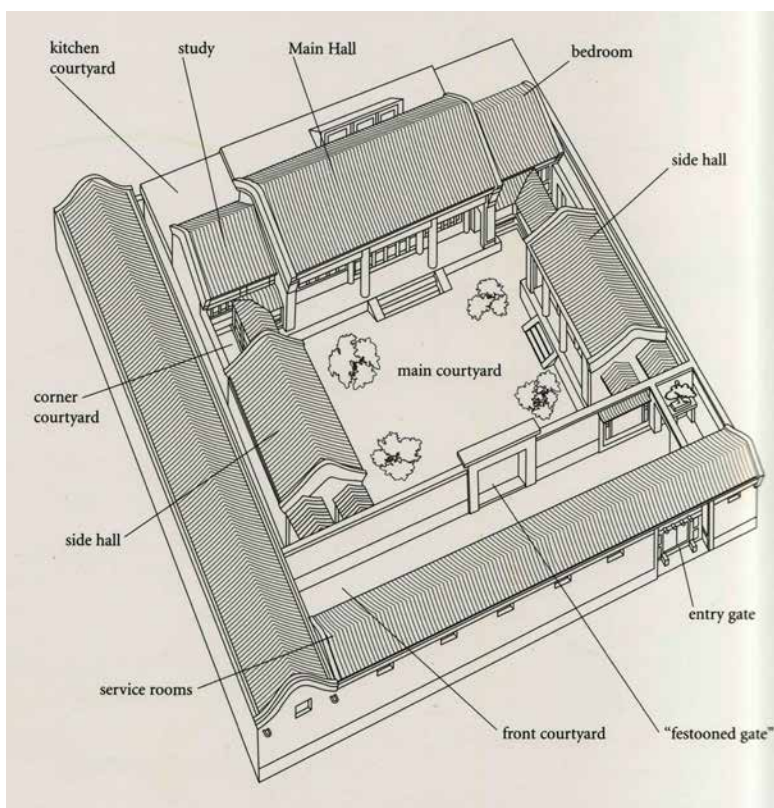
All in all, the reason why we introducing Chinese Quadrangle dwelling by the typology of Beijing Quadrangle as following is because that many of the traditional dwellings in our country are famous in the form of courtyards, and most of them are quadrangles. Among the many quadrangle houses, the quadrangle house in Beijing is a kind of typical and voltage.<sup>1</sup> The principle courtyard is not only spacious, but also more square. It is often planted with trees and flowers in the courtyard, for creating a quiet and introverted space. The decoration of the Beijing Quadrangle Dwelling is also more elegant and exquisite than other ordinary courtyards. According to the number of courtyards, Beijing Quadrangle has different sizes, from small single courtyards to the multiple courtyards such as horizontal and vertical courtyards. However, having three halls and two enclosed open courtyards<sup>2</sup> is the standard form of Beijing Quadrangle.

Beijing Quadrangle is a typical form of traditional courtyard-style dwellings in China, and it is also the representative of the residential houses in the northern

1 Wang Qijun. *Vernacular dwellings, in Chinese Ancient Architecture*. China Electric Power Press, 2008. Page 43.

2 Ping Chen, Shiren Wang. *Dong Hua Tu Zhi*. Tianjin ancient books publishing house, Tianjin. September 2005.

courtyard of China. Although Beijing Quadrangle is a typical and representative of the Chinese Quadrangle houses, but it can be divided into multiple modes. There are certain changes between multifarious models. Frankly speaking, the biggest distinction is the number of courtyards. Generally, there are three halls and two enclosed courtyards. However, large family may has frontside, backside, left side and right side courtyards and connected to a large group of courtyards. Then let us introduce you the function layout of traditional Beijing quadrangle. In the beginning is the front gate that invite you enter in the house. Then the front courtyard keeps the privacy of living rooms which locates more inside. Commonly, this courtyard has less decoration and is mainly focused on storage and circulation. But there are some decorated windows on the wall. Afterwards, moving through the festooned gate you will arrive at the principle courtyard finally. The main house in the Beijing Quadrangle is the most important house in the courtyard, both in terms of its location and the size of the building. The main body of the main house is a tall house with a width of three open rooms, and one or two side rooms are built on each side of it. Regardless of whether it is from the entire courtyard or from the



central main courtyard, the introverted characteristics of the traditional Beijing Quadrangle are very obvious. The overall feeling is simple and restrained, and the friendly layout is rigorous. The courtyard hall, bedroom, kitchen, study, veranda, car and horse room are all available. At the same time, ah, I have green plants that are reflected in the courtyard because of their love for nature. The embodiment of the unitedness united the family together. It also clearly reflects the traditional ethical concepts of our country.

Fig. 4.52  
Standard  
Composition  
of Beijing  
Quadrangle  
Dwelling  
Source: Chinese  
Traditional House  
Plan and Beijing  
Notebook Beijing  
Courtyard House  
Mei Lanfang S  
Published by  
Diana Carroll on  
July 31, 2018.

Fig. 4.53  
 General Section of Beijing  
 Quadrangle Dwelling  
 Source: Beijing Siheyuan  
 Architectural Elements, 2006.

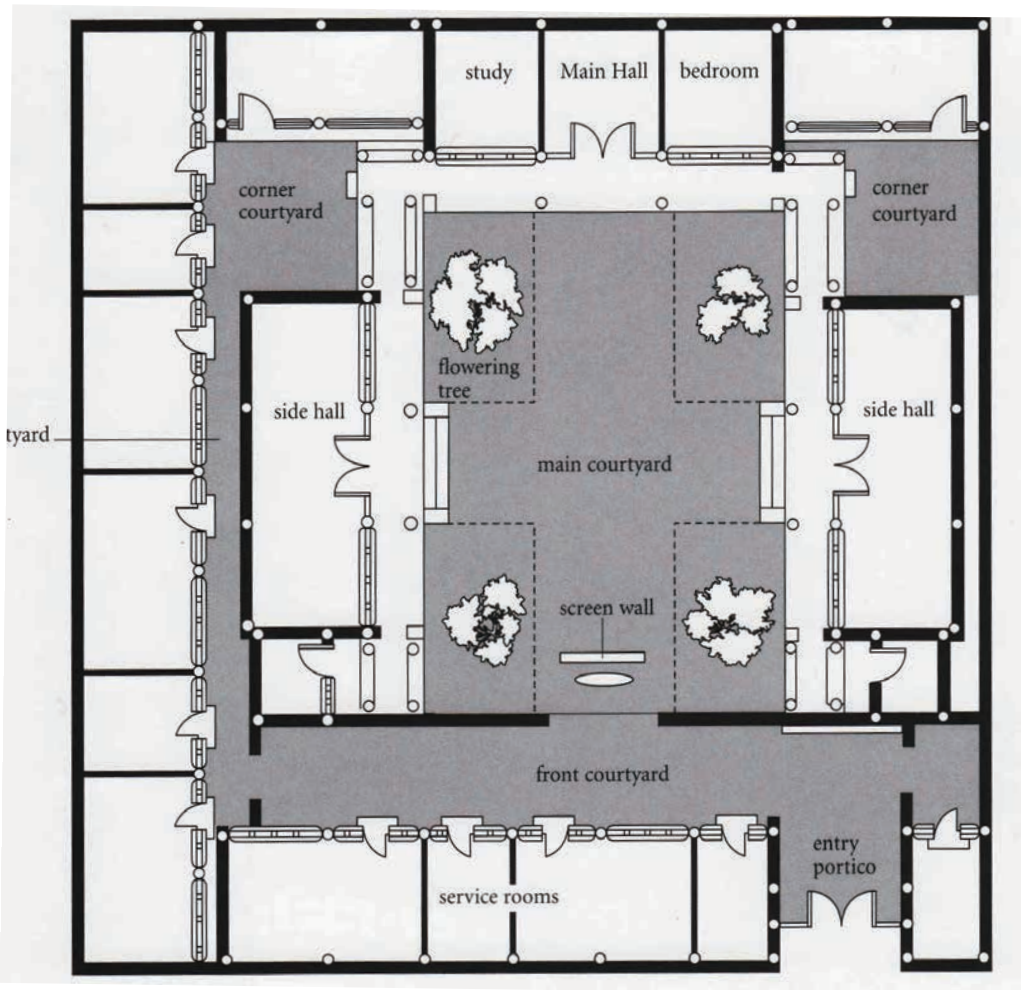


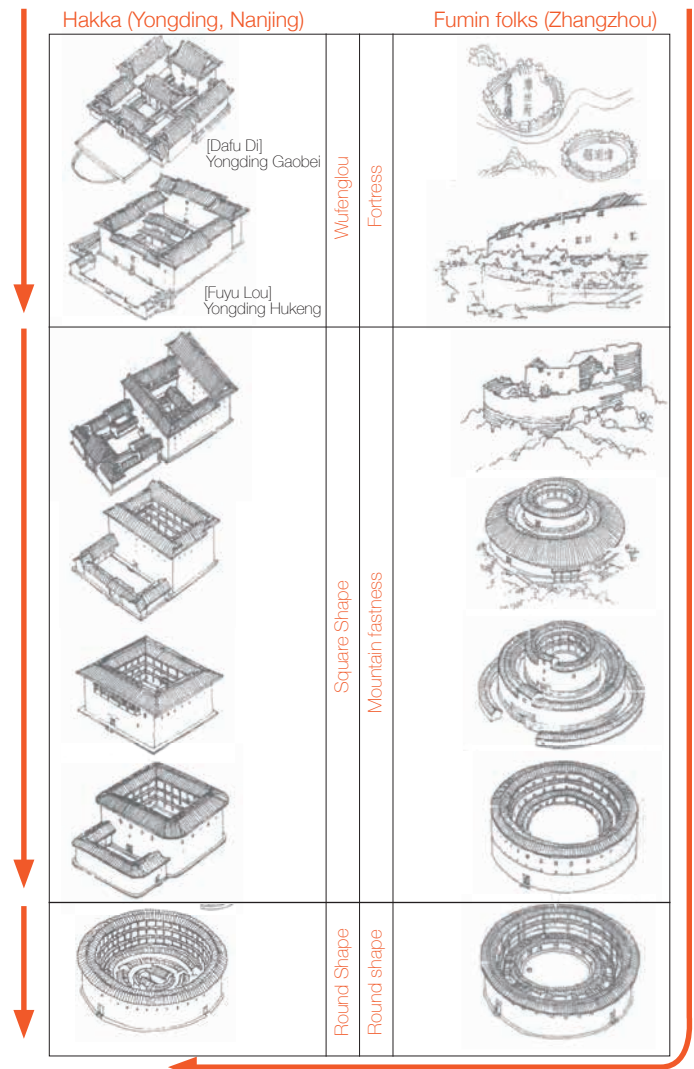
Fig. 4.54  
 General Plan of Beijing  
 Quadrangle Dwelling  
 Source: Beijing Siheyuan  
 Architectural Elements, 2006.  
 Page 31.

## Hakka Tulou

Tulou that appeared in the early stage was a rectangular building that was directly born out of the quadrangle dwellings which was popular in central plains region, but the rooms on both sides gradually heightened, and the levels were raised from front to back. It was made of bauxite, the wall was extremely thick, and the defensive performance was effective. The Wufenglou was the earliest, and those round shape Tulou is the latest and most mature. However, compared with the quadrangle dwellings, Wufenglou has a larger courtyard and more rooms, which can accommodate more residents. The family members allocate rooms according to the seniority and hierarchy, the elders are in the highest position of the back hall, and the middle hall is the place for family gatherings and hospitality. The Fumin on the coast took the lead in creating the round shape. The Hakkas followed up and built more round shape Tulou, which were completely enclosed and closed, and no corner making it easier to defend. And the area of the round building under the same perimeter was 1.273 times that of the square building,<sup>1</sup> which meant that the same amount of building materials can be used to get more spacious in-house space, fewer land but more

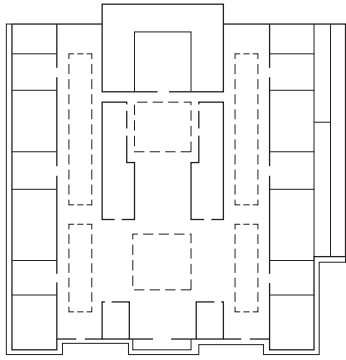
residents and no longer allocate rooms according to their social status. Tulou are not only in round and rectangular shape but also oval, octagon or round-rectangular-combined. The smallest diameter can be 13 - 14 meters, even the diameter of central courtyard is only 4 - 5 meters.<sup>2</sup>

Fig. 4.55  
Type and Development  
of Tulou  
Source: Remade by  
authors base on relevant  
material  
Reference: Huang,  
Hanmin. "福建土楼  
探秘 Exploring Tulou  
in Fujian." 中国文化  
遗产 Chinese Cultural  
Heritage, 2005, 10-30.

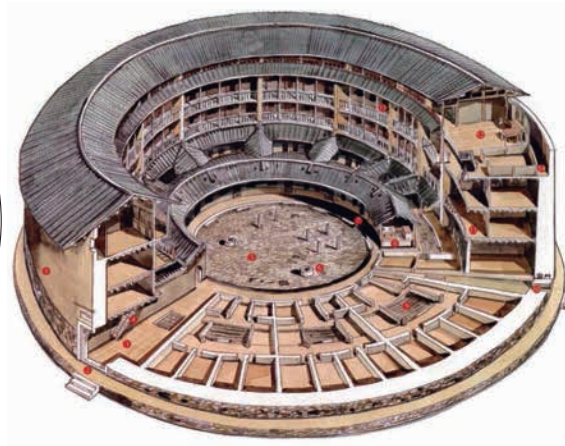
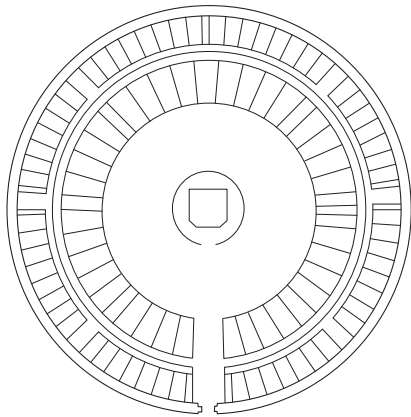
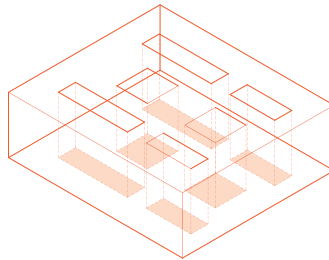
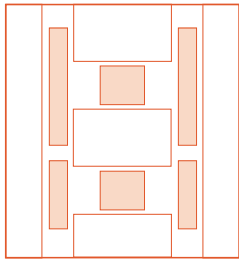


1 Institute For Planets. "土楼从何而来? *Where Does the Tulou Come From?*" Weibo Sina (blog), July 22, 2018. [https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#\\_0](https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#_0).

2 Institute For Planets. "土楼从何而来? *Where Does the Tulou Come From?*" Weibo Sina (blog), July 22, 2018. [https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#\\_0](https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#_0).



Dafu Di  
Gaobei  
Qing Dynasty  
Emperor Daoguang  
year 8th  
(1828 AC)



Eryi Lou  
Qing Dynasty  
Emperor Qianlong  
year 35th  
(1770 AC)

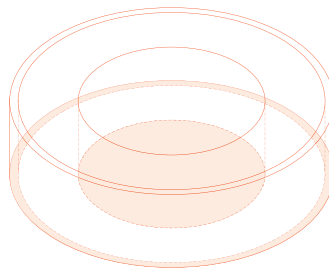
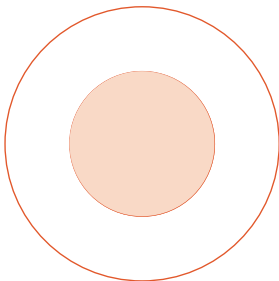


Fig. 4.56  
Analysis of Hakka Tulou  
Source: Made by authors

## Cave dwelling

Cave dwellings is a housing based on geographical environment, which are a unique form of dwellings in the Loess Plateau of China, and also a mature form of primitive burrowing in China. It is a form of residence that has evolved over a long period of time since ancient cave dwellings.

The cave dwellings in China are mainly distributed in the relatively cold and dry loess areas of Shanxi, Henan, Shaanxi, Gansu, Ningxia and Xinjiang provinces. There is relatively little rainwater in the Loess Plateau, the climate is dry, and the verticality of loessWell, the excavation of the cave dwelling is also good, so local people use it according to local conditions.

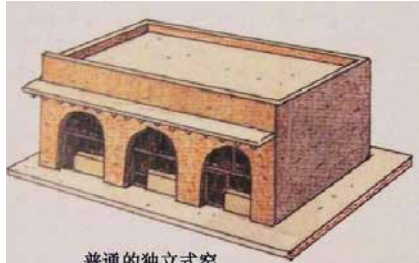
The thickness of the upper layer of the kiln roof is usually more than 3 meters. Because the soil layer is thick, the insulation performance is good, and it is warm in winter and cool in summer. The material of the cave dwellings is mainly loess. It is a form of dwelling that uses loess as a support system. There is no pillar support in the house. It is a living space that is artificially excavated in the yellow earth belt. The ceiling is dug into an

arch and the exterior is covered with soil. The vault door hole is basically the biggest appearance feature of the cave dwelling. The characteristics of cave dwellings in all parts of China have outstanding commonalities and exist in specific forms. There are quite a few differences. There are three main types of cave dwellings in China: One is a cliff-style cave, the other is a free-standing cave, and the third is a sinking cave. These three forms are used in the distribution areas of various caves in China, but they are slightly different due to the different distribution. This is determined by the topographical conditions of each distribution area.

It can be said that the independent cave dwellings are the form of overburden buildings in ordinary bungalow houses. According to the same construction techniques and materials, the layout of the independent cave dwellings or the arrangement of the courtyards is not limited by the cliff potential. The sinking cave dwelling is a cave dwelling below the ground. It is a courtyard that is excavated underground on a relatively flat and open loess, and then several cave dwellings are drilled across the walls of the courtyard. Basically, each The sinking courtyard is a family, independent.

### Independent type

It can be said that the independent cave dwellings are the form of overburden buildings in ordinary bungalow houses. According to the same construction techniques and materials, the layout of the independent cave dwellings or the arrangement of the courtyards is not limited by the cliff potential.

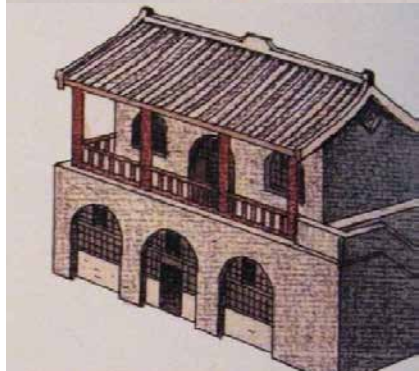


普通的独立式窑洞



半依靠黄土坡的独立式窑洞

几口窑



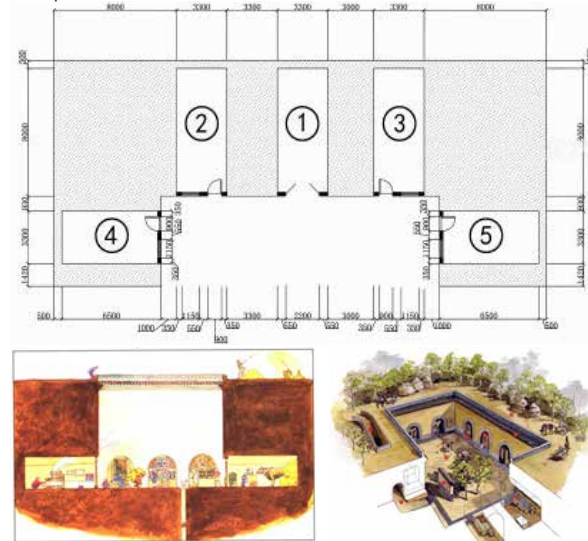
两层楼并带屋顶的独立式窑洞（窑上窑）



窑并列，并带屋顶的独立式窑洞

### Sunken type

The sinking cave dwelling is a cave dwelling below the ground. It is a courtyard that is excavated underground on a relatively flat and open loess, and then several cave dwellings are drilled across the walls of the courtyard. Basically, each The sinking courtyard is a family, independent.



### Cliff type

Cliff-style caves are caves that rely on natural cliffs or slopes. The excavation is carried out in parallel on the façade of the natural cliff slope. According to the height and slope of the slope, one layer, two layers or more layers of cave dwellings can be dug. After the cave dwelling is completed, the front side is an open space in front of the cliff slope, which is convenient for people to go out and usually activities.

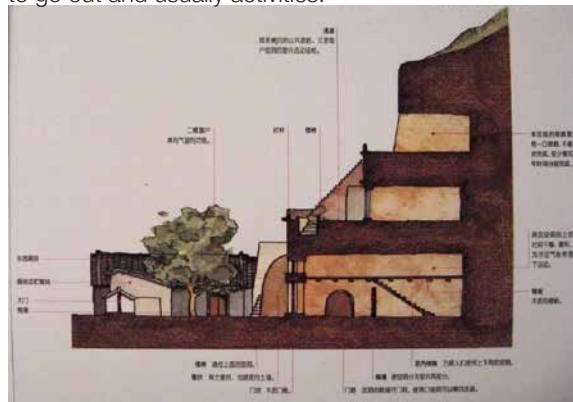
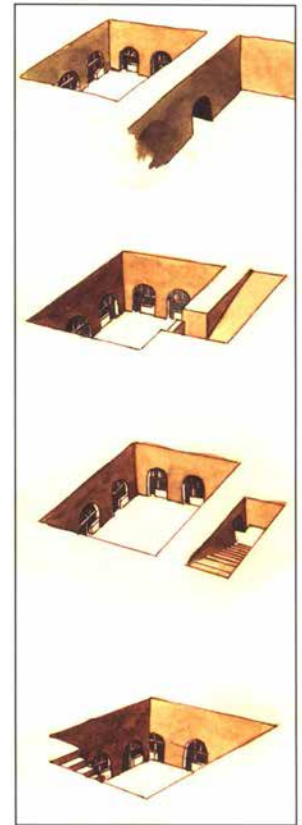
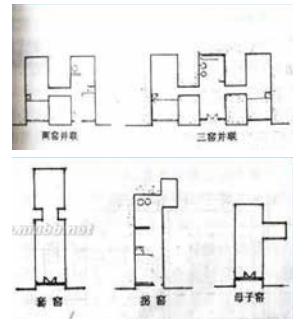


Fig. 4.57  
Analysis of Yao Dong  
Source: Made by authors based on relevant materials



## Defensive Residence - Diaolou in Guangdong region

The oldest Diaolou was constructed during the Ming Dynasty. Due to Kaiping's low-lying topography, local people used to build diaolou to serve as a refuge against summer monsoonal floods and chaotic social problems. As the amount of overseas Chinese bringing the remittances from abroad increased, so the number of the banditry in the area was also grew, thus contributing to the popularity of the construction of diaolou.

The traditional defensive architecture appeared more than 2,000 years ago, the Diaolou in this region has been influenced by them. The special point is the method for design and the construction materials used absorbed considerable experience from Western architecture. For example, the roof is the most distinguishing feature of each building, and it also has the best decorative effect on the building. Apart from roof, there always be an antium on the top floor of the Diaolou, which is usually cantilever.<sup>1</sup> The purpose of antium is for defensive, especially the cantilever is advantage to keep a lookout, because people can get better sight than standing behind the windows. And the appearance

is special in combination of western antium and arch, which is the main manifestation of western style on Diaolou. Besides, the use of reinforced cement or concrete gives Diaolou a strong modern architectural character.

There are three different form of dwellings in Kaiping village, three-bay-two corridor, Lu and Diaolou<sup>2</sup>, because this is the lingnan region and style belongs to it. When the overseas Chinese began to be back in their hometown and start to build the house in traditional form, but later they had to design the houses based on actual needs. Diaolou in Kaiping was functionally categorized into three types: the watchtower, communal tower and residential tower. The residential towers still followed the traditional three-bay-two-corridor floor plan.<sup>3</sup> The treatment of detail decoration is particular. The grass decoration on the top wall of the building is elegant, the composition is symmetrical, and it is rich in traditional Chinese architectural decoration.

Because the function of Diaolou included both defense and residence, there is no eaves in the building, and the whole body is smooth, preventing the enemy from climbing.

1 Wang, Qijun. Vernacular Dwellings, in Chinese Ancient Architecture. Beijing: China Electric Power Press, 2008. Page 147.

2 Kaiping Diaolou Traveling. " 侨乡建筑与村落 *Architecture built by overseas Chinese*". <http://www.kptour.com/culture/read1.aspx?cls=3&id=18>

3 Kaiping Diaolou Traveling. " 侨乡建筑与村落 *Architecture built by overseas Chinese*". <http://www.kptour.com/culture/read1.aspx?cls=3&id=18>



Picture

Elevation

Ground Floor Plan

Typical characteristic

Watchtower  
Family Fang's Light House

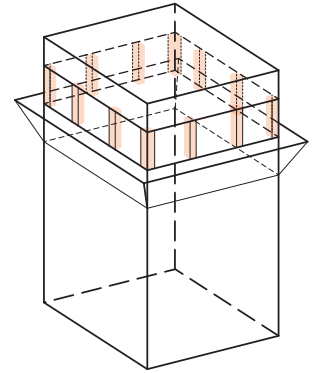
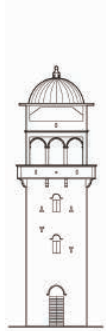


Fig. 4.65  
Typical Characteristic of  
watchtower Diaolou  
Source: Made by authors

Communal Tower  
Tianlu Building  
in Yongan village

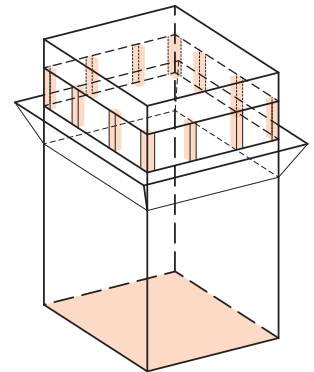
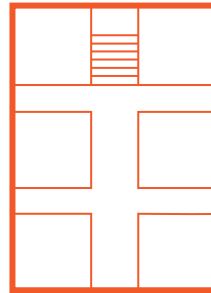
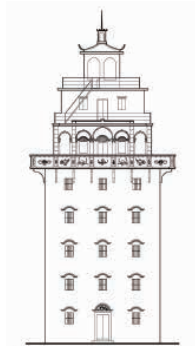


Fig. 4.66  
Typical Characteristic of  
Communal Tower and  
Residential Tower  
Source: Made by authors

Residential Tower  
Mingshi Building  
in Zili village

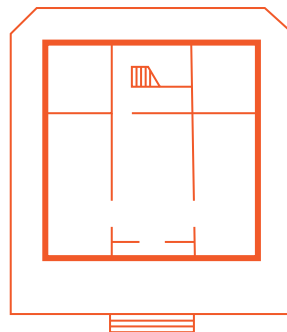
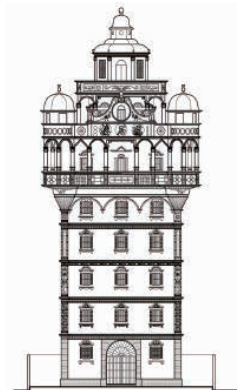


Fig. 4.58  
Watchtower Diaolou  
Communal Tower  
Residential Tower  
Source: <http://www.kptour.com/culture/read1.aspx?cls=3&id=18>

Fig. 4.59  
Elevation of Watchtower Diaolou  
Fig. 4.60  
Elevation of Communal Tower  
Fig. 4.61  
Elevation of Residential Tower  
Source: <http://www.kptour.com/culture/read1.aspx?cls=3&id=18>

Fig. 4.62  
Plan of Watchtower Diaolou  
Fig. 4.63  
Plan of Communal Tower  
Fig. 4.64  
Plan of Residential Tower  
Source: Remade by authors  
base on relevant material.

## Bamboo house and Arcade building

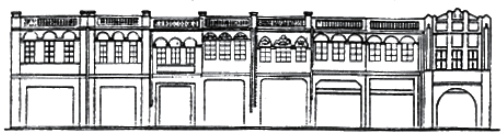
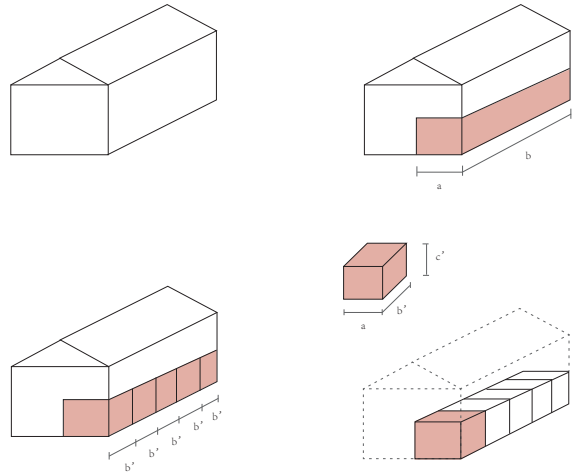
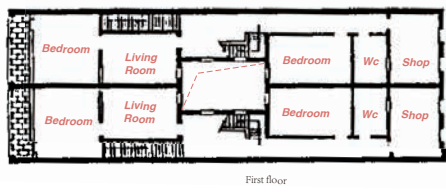
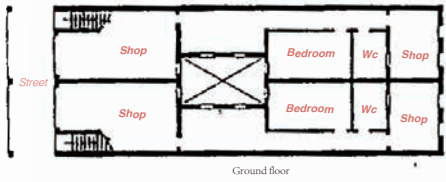
There are two types of residential houses in Guangdong. One is ordinary villages, fishing villages and other villages, and the other is market towns including regional market towns and neighbourhood market towns. The vast rural areas of China are based on the self-sufficient small-scale peasant economy. Therefore, most of the buildings seen in the villages are small houses. Small houses are usually in the form of courtyards with rooms in three sides and larger courtyards with rooms in four sides. The choice of rural villages in Guangdong has a common law. It requires near water, near fields, near mountains, and near traffic. The ideal is that several are available. There are four types of rural village layouts in Guangdong: First, the comb pattern layout system, which is found in most parts of Guangdong, is the most typical village layout in the plains of the province; the second is the dense layout system, and the third is the surrounding group. The layout is the representative form of the villages in the Hakka area; the fourth is the free-scattering or arranging layout, which is generally used in ethnic minority areas.<sup>1</sup> The layout of the city and market towns is different from the layout of the villages. The market town is the exchange

and sale of rural products and goods. It is mainly based on commodity economy. Therefore, the town houses are in the form of line layout. First, it is completely different from the block layout of the ordinary rural areas. As for the stores, there are two types, one is the shops in the market town: small, single-storey, single-open, and the other is the county or city (the political and economic center) and the shops in the town (the economy). Most of them are buildings of 2 to 3 floors: the front is the shop, and the back and upstairs are the home. The shop is in the form of an arcade, which can shelter from the rain and facilitate people to shop. This is a special form of construction in Guangdong towns. Because the land in the city is tense, in the layout, the depth is deepened to save land. However, it will bring problems such as ventilation, lighting, etc. Therefore, the inner patio, the open hall and the corridor are used to solve these difficulties. These houses in the town are made up of bamboo houses or Ming-shaped houses as the basic unit. The bamboo houses in the commercial area are basically in the form of arcades. They flourished in the 1920s – 1930s when Guangzhou demolished city wall and built the road. Therefore, the small width and deep depth are the basic characteristics of the building.

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<sup>1</sup> Lu, Yuanding, and Yanjun Wei. *Traditional Dwelling in Guangdong*. Beijing: China Architecture & Building Press, 1990. Page 18.

Fig. 4.67  
 Analysis of the  
 Bamboo House  
 Source: Made  
 by authors  
 based on  
 relevant  
 materials



Facade rule from street view (general)



## Stilt Style Architecture

The stilt style dwellings are the mature form of the primitive society in China, that is, they are opposite to the cave-style dwellings, which use soil materials, while the stilt houses basically use wood. This is the traditional residence of ethnic minority areas such as Yunnan Province, Guangxi Province, and Guizhou Province. These areas located in tropical rainforest areas, and the stilt style house can adapt very well to this climate.

The stilt houses are mainly simple small-scale buildings made of wooden columns and wooden beams, and in some place the people use bamboo materials instead of wood. 《旧唐书》“人并楼居，登梯而上，号为干栏” The upper level of the stilt style dwellings if for living, while the lower level is the livestock circle or the storage room. The bottom level of a house is vacated as a form for his use without living, which is the biggest feature of stilt house.<sup>1</sup> Apart from this, its roof is far-reaching, it can shield the radiation of the sun, and at the same time prevent the rain from drenching the wooden material structure of the house, which is very beneficial for the local rainy and hot climate. In addition, the subtropical rainforest area is relatively sparsely

populated, and there are more poisonous insects and beasts. The overhead bottom level of the building can better prevent insects and beasts from invading indoors and injuring people.

This kind of dwelling has a long history, but the construction method is relatively simple, and it is suitable for the local climate environment, so it is still used by people in some areas. There are many ethnic minorities using this type of house. According to the height of level of the ground floor space, these dry-column houses can be divided into high and short, which is distinguished by whether the height of the bottom layer can make people walk and move normally. The number of short dry bars is generally three, while the higher ones are mostly four floors.

In the early stage, first there a lot of wood was used to form a platform, after setting up, the house was placed on the top, the upper house and the lower wooden frame were not connected, and the fixed connection was tied with a rope. Most of the existing houses nowadays are in a bucket-type structure, and the joints of the members of the frame are connected by a shackle, so that the houses are naturally connected.

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<sup>1</sup> Wang, Qijun. Vernacular Dwellings, in Chinese Ancient Architecture. Beijing: China Electric Power Press, 2008. Page 100.

Wooden or Bamboo structure 这是吊

脚楼在建筑用材上的特点,与其多分布于竹、木丰富的山林地区有关。

Livingroom 堂屋相当于客厅,却又有厨房的作用,是生火做饭、会客之所。

Bedroom

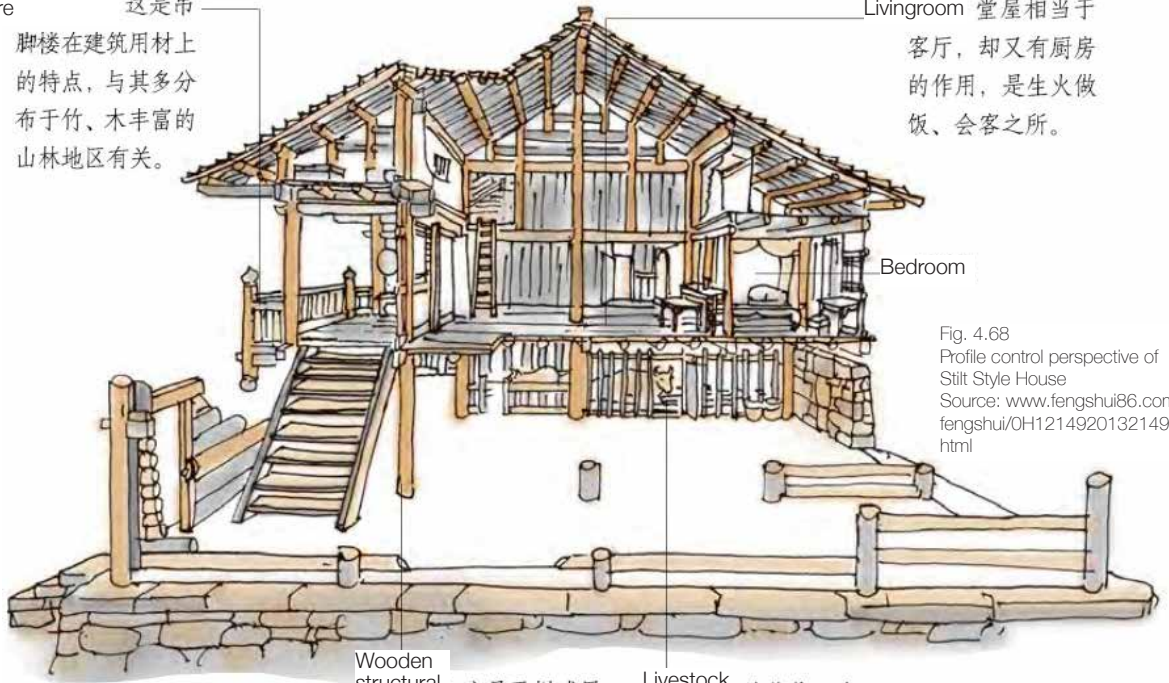


Fig. 4.68  
Profile control perspective of Stilt Style House  
Source: www.fengshui86.com/fengshui/OH1214920132149.html

Wooden structural column 这是干栏式民居的重要特征,可隔绝潮湿,利于通风。

Livestock circle 关养猪、牛的地方,也可用以堆放杂物。

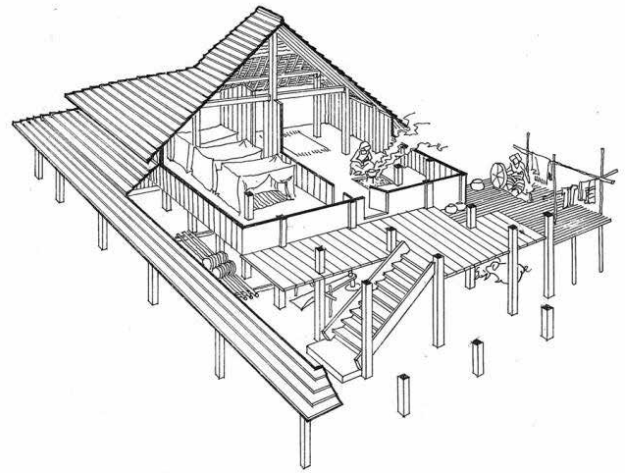


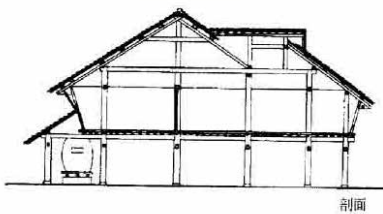
Fig. 4.69  
Stilt-House of Dai minority  
Source: kjbl.ypszk.com.cn/JSFMS/2jianzhu/minju/ZGCTMJ.html

Fig. 4.70  
Perspective View of Stilt-House of Banna Region

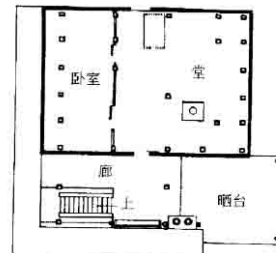
Fig. 4.71  
Section of Stilt-House

Fig. 4.72  
Plan of Stilt-House

Source: http://kjbl.ypszk.com.cn/JSFMS/2jianzhu/minju/ZGCTMJ.html



剖面



平面



# 5

## Abstraction from Chinese Traditional Urban Fabric and Architecture





1

## Abstraction from Chinese Traditional Urban Fabric

The fabrication of urban influences the architectures and the architectures influence back to urban fabric, which indicates that it is essential step to analyse the space in urban scale first in order to get a clear understanding of what are factors having impact on the generation of the vernacular characteristics of the architecture.

As the entering section to abstract and define the parameters of each construction elements, the urban scale can provide a fundamental frame to build up the whole system. Further more, to express a characterised architecture will be nonsense if there no the certain background materials to reflect.

From the previous chapters, we already well-prepared the knowledge in the whole for the information of the appearance aspects such as the culture, history, climate, geography and other relevant information. Then it is the process to summarize and then absorb the quintessence by simulating based on our understanding, among that there would be the significant intrinsic qualities which is appropriate elements for our study.

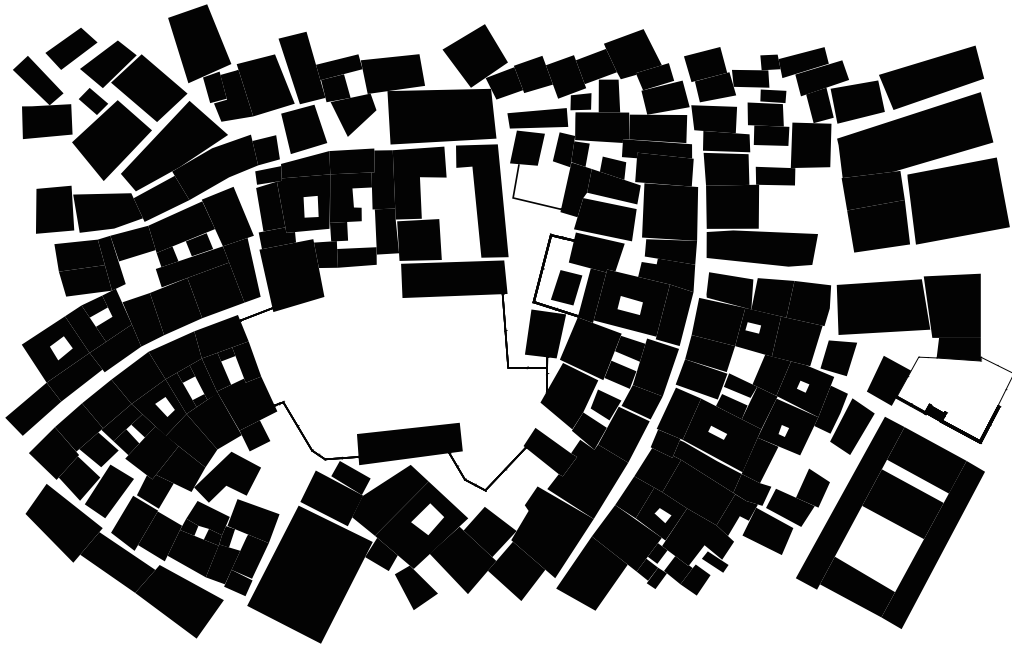


Fig. 5.01  
Noli Map of  
En Yang Town  
in Sichuan  
Province  
Source: Made  
by authors  
based on  
relevant  
materials

En Yang Town in Sichuan province is a typical Sichuanese vernacular town which different from the metropolis in Sichuan province. En Yang Town still keeps its original local characteristics that based on its tradition urban fabric. Instead of modern residences, the vernacular housing composes this town with its local identity that could clearly propagandize local cultural features and customs in

Sichuan region. Use an old Chinese poem to describe the urbanscape in En Yang: “The sound of the rain in the ancient town, the bluestone is far away.”

Enyang Ancient Town is located in Enyang District, Bazhong City, the old revolutionary area in the northeastern part of Sichuan Province, and borders on Bazhong City in the east. The Enyang River flows from the side, hence the name of the ancient town of Enyang. Here is a place of a climate characterized by more precipitation, and the town is surrounded by mountains, its terrain has a slight fluctuation in somewhere. The ancient town of Enyang has a long history. The ancient town was developed from the original water terminal. It was once prosperous in ancient times dominated by

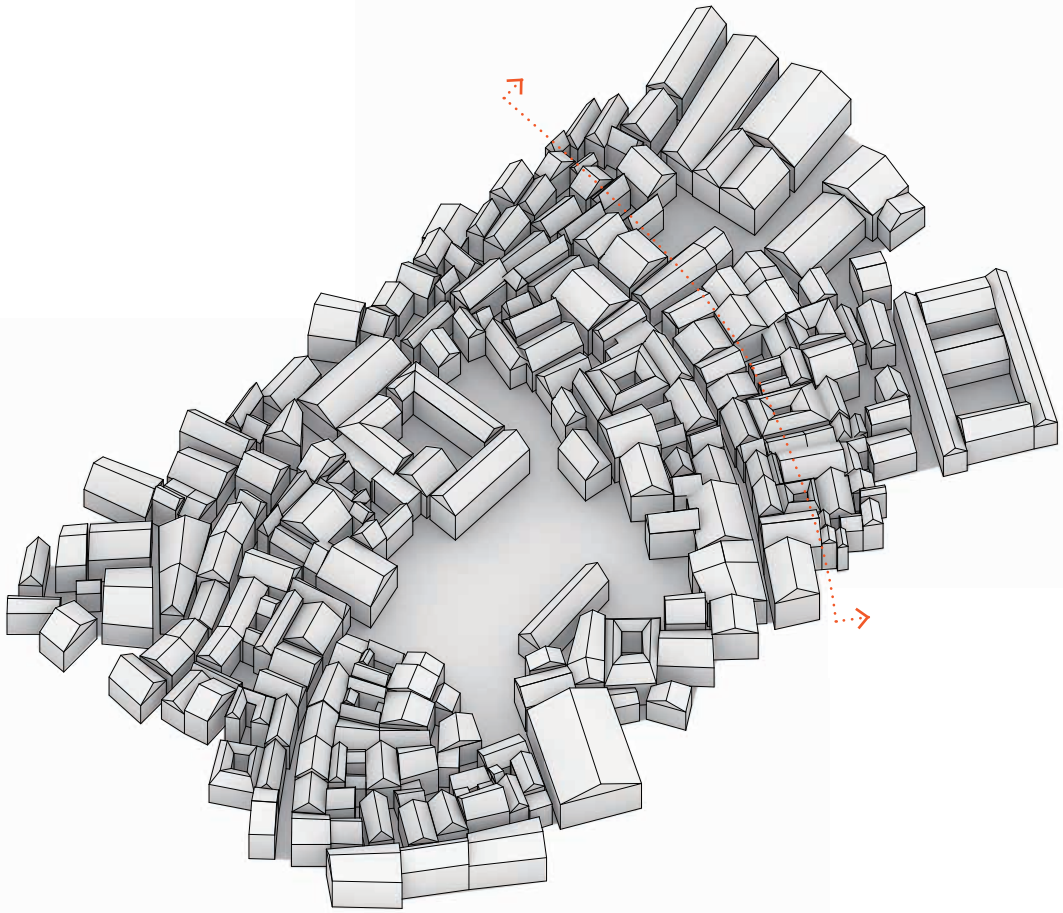
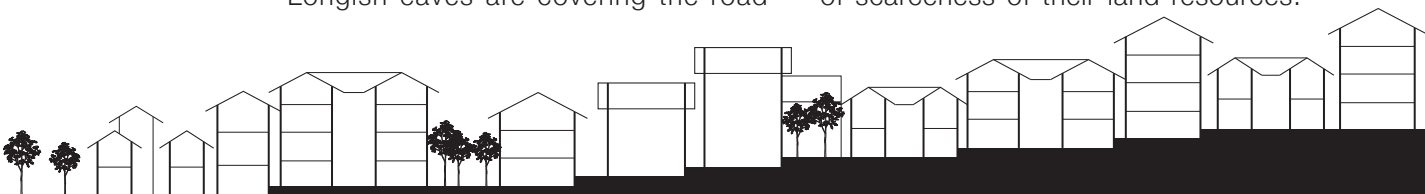


Fig. 5.02  
Abstracted  
Model of En  
Yang Town  
Source: Made  
by authors  
based on  
relevant  
materials

water transport. There are still 28 ancient streets and hundreds of ancient buildings in the Ming and Qing Dynasties. In 1933, the Sichuan-Shaanxi Revolutionary Base was established. Based on aerial photographs of this town. We make masterplan drawing in order to analysis urban layout of En Yang Town. High density of vernacular dwellings are adjoining with each other. Longish eaves are covering the road

that was not too wide. Urban fabric is not following the regular grid pattern but presenting a dynamic tendency. According to our research, this reason might due to the geographical feature of local terrain. most of residential houses are single building without courtyard, but attach with neighbourhoods tightly. Only large families have enclosed courtyards. We could regard it is because of scarceness of their land resources.

Fig. 5.03  
Urban Section  
Source: Made  
by authors  
based on  
relevant  
materials



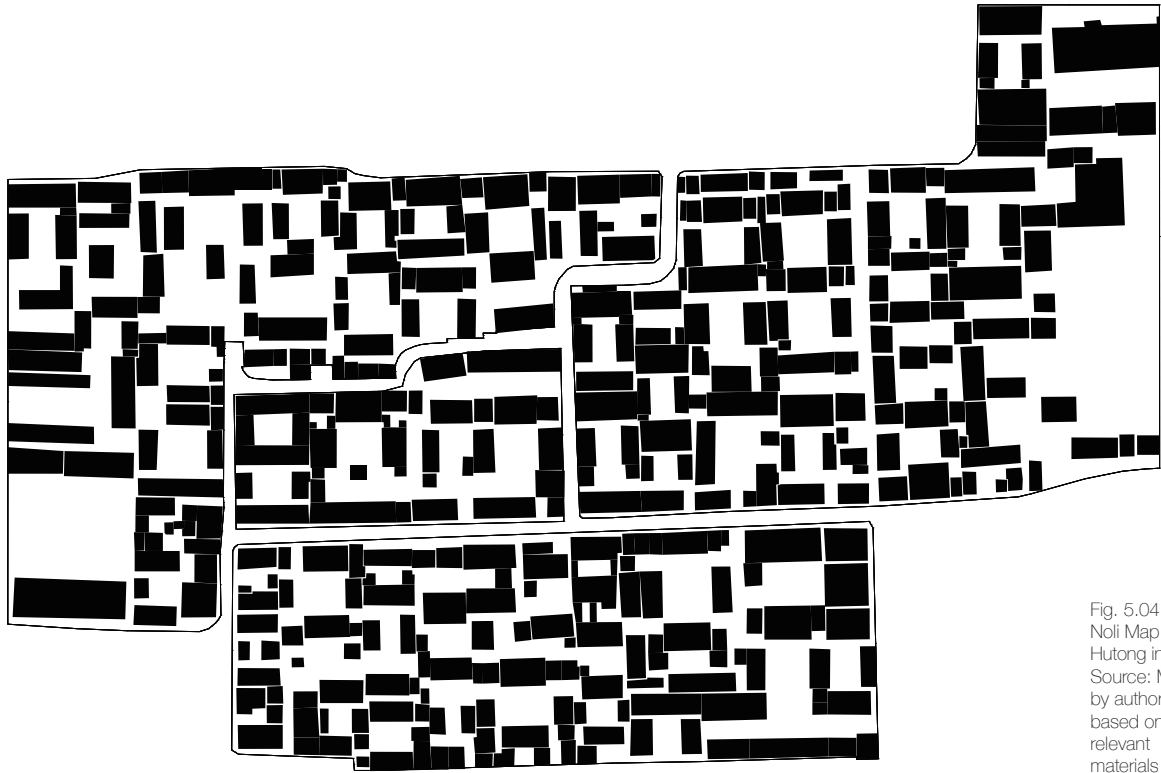


Fig. 5.04  
Noli Map of  
Hutong in Beijing  
Source: Made  
by authors  
based on  
relevant  
materials

The hutong, also known as “alley”, refers to the relatively small streets between the main streets of towns or villages, which lead to the interior of the residential area. It is an integral part of communicating local traffic. According to the road access situation, the Hutong is divided into a dead alley and a live alley. The former has only one opening, the end is deep into the residential area and is interrupted

inside; the latter communicates with two or more main streets. Hutong is a major feature of Beijing. Both In history and in reality, Hutong is a place where ordinary citizens of the city live. The formation and existence of Hutong and Beijing culture play a decisive role. Compared with the Forbidden City, the Temple of Heaven and the Summer Palace, which represent the royal culture, Hutong can be said they are

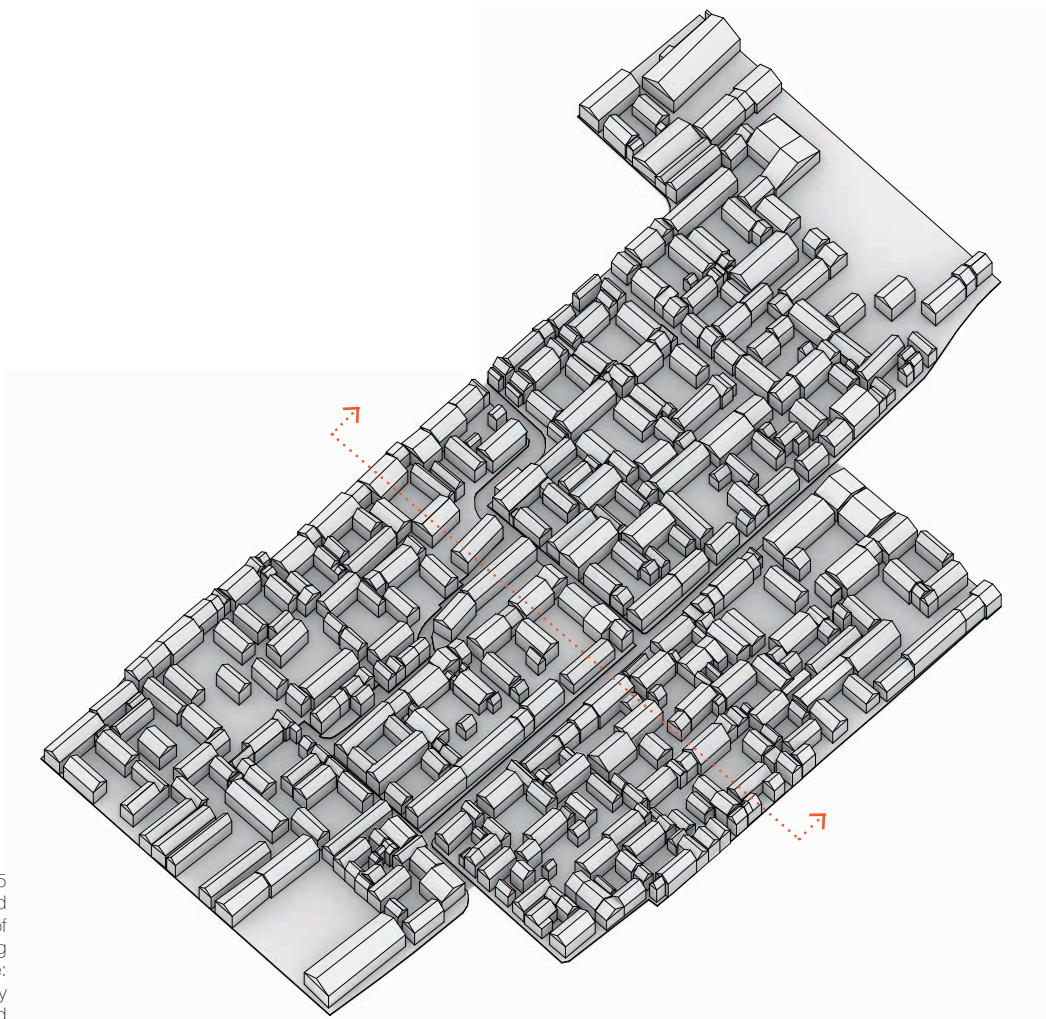


Fig. 5.05  
Abstracted  
Model of  
Hutong  
Source:  
Made by  
authors based  
on relevant  
materials

presenting the culture of Beijing civilian.

Therefore, the descendants who built the courtyard in the middle of the open space must rely on the small alley as the access passage. This has produced a large number of unknown small alleys in many famous big alleys. So there is a

saying: "There are thousands of famous Hutong and the number of unknown hutongs is even greater. Because Beijing Hutong is not only the fabric, the traffic channel of the city, it is also the place where ordinary people gather and live, and Hutong is also the important stage of the Beijing culture development.

Fig. 5.06  
Urban Section  
Source: Made  
by authors  
based on  
relevant  
materials



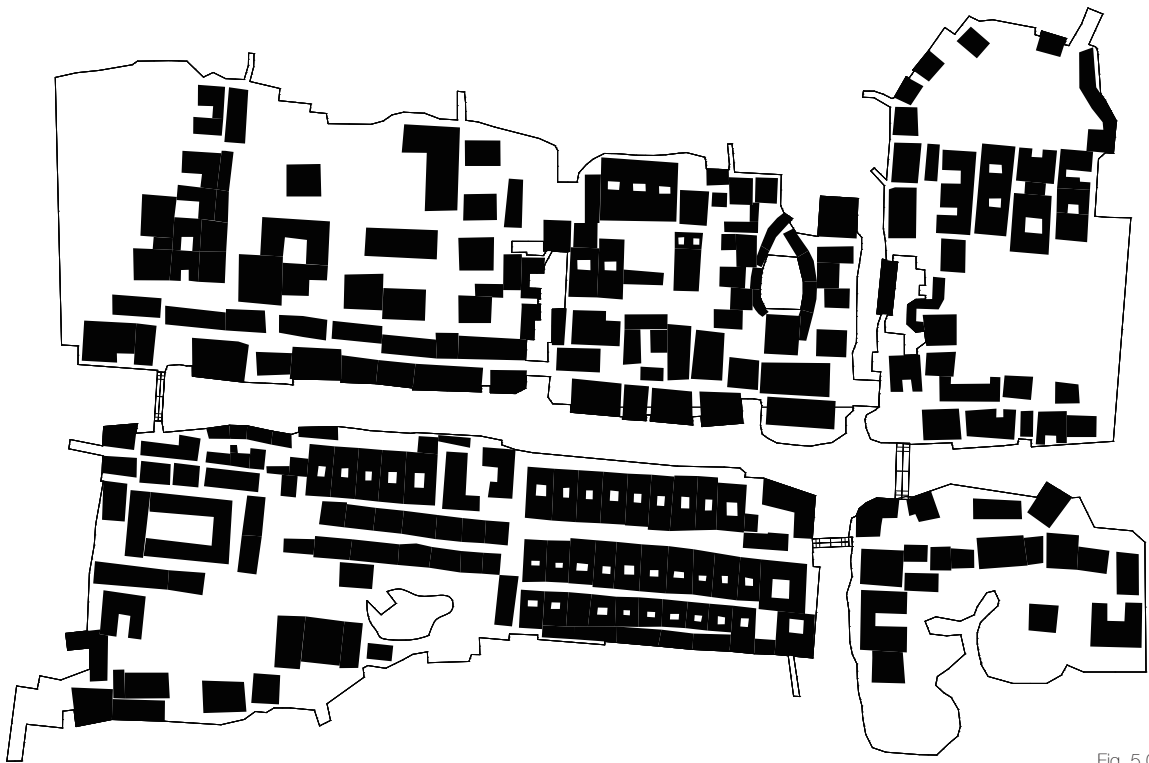


Fig. 5.07  
Noli Map of Wu  
Town in Zhe  
Jiang Province  
Source: Made  
by authors  
based on  
relevant  
materials

Wu Town, located in Tong Xiang, Jia Xing City, Zhejiang Province. It is located in the “Golden Triangle” of Jiangsu, Zhejiang and Shanghai, and the hinterland of Hang Jia Hu Plain. It is 60 kilometers away from Hang Zhou and Su Zhou and 106 kilometers away from Shanghai. It belongs to the Tai Lake water system, and the rivers are intertwined. The Beijing-Hangzhou Grand Canal passes by the town. Wu Town, located in Tong Xiang, Jia Xing City, Zhejiang Province.

It is located in the “Golden Triangle” of Jiangsu, Zhejiang and Shanghai, and the hinterland of Hang Jia Hu Plain. It is sixty kilometers away from Hang Zhou and Su Zhou and one hundred and six kilometers away from Shanghai. It belongs to the Tai Lake water system, and the rivers are intertwined. The Beijing-Hangzhou Grand Canal passes by the town. Its excellent geographical location and the dense urban characteristics of the river network have contributed to the rapid economic

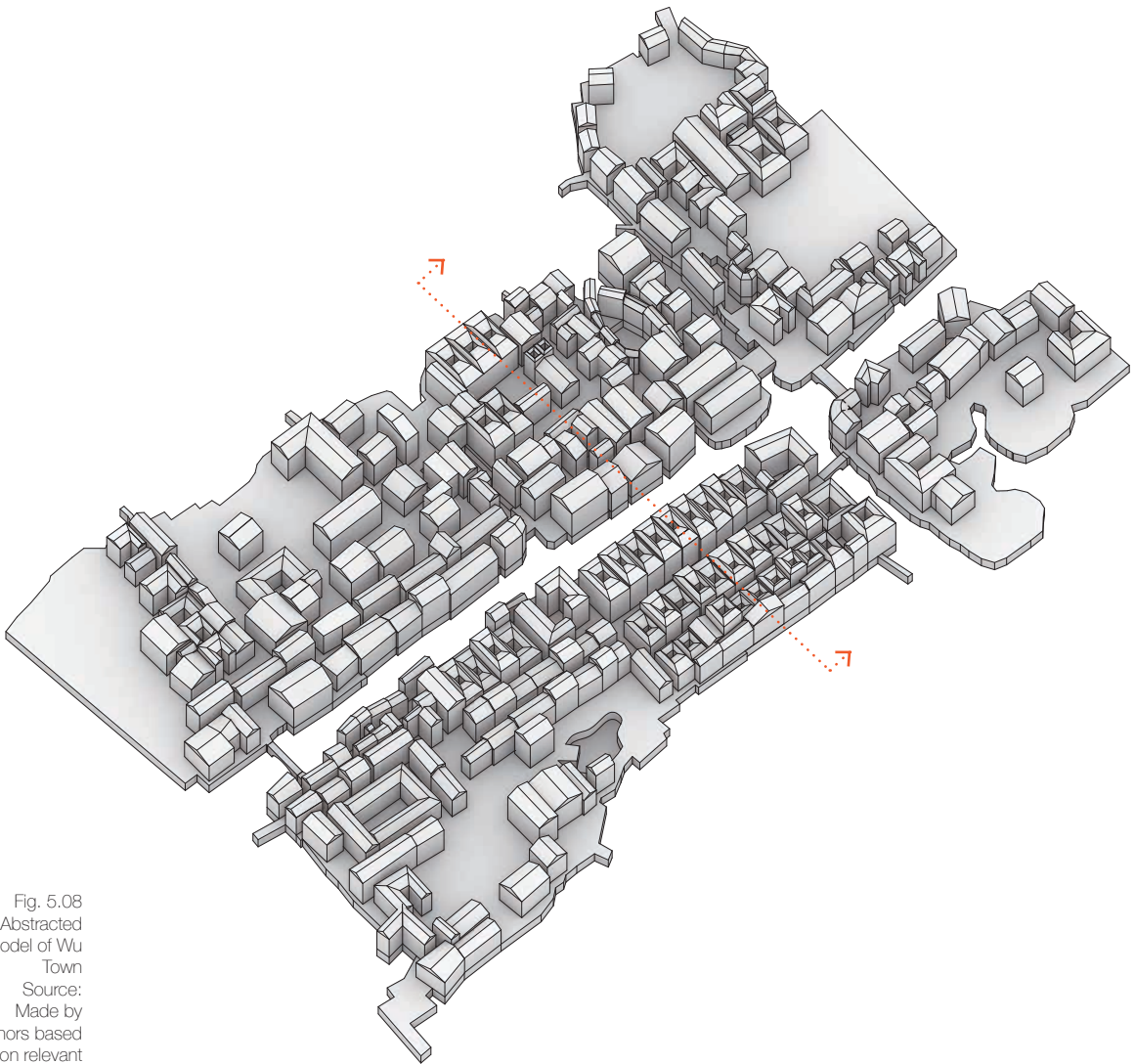


Fig. 5.08  
Abstracted  
Model of Wu  
Town  
Source:  
Made by  
authors based  
on relevant  
materials

development of the region and the modernization of the city. At that time, the local government tried to preserve the traditional city as much as possible.

which in south of the Yangtze River, completely preserves the style and pattern of the ancient towns in the late Qing Dynasty and the Republic of China. The urban characteristic of intertwined river network is evident to understand from the abstraction model above. The abstraction helps us to understand the spatical organization in realistic situation.

Fig. 5.09  
Urban Section  
Source: Made  
by authors  
based on  
relevant  
materials

From the aerial photo on the right side (Figure.3.11), the region is in the west gate of Wu Town. Apparently, there is a typical vernacular town in this region





Fig. 5.10  
Noli Map of Bei  
Ying Village in  
Shan Zhou  
Source: Made  
by authors  
based on  
relevant  
materials

Bei Ying village is located in Shan Zhou, He Nan province. Bei Ying is famous for its nearly a hundred of sunken Yao Dong. As an ancient and magical residential style, the sunken Yao Dong is rich in local traditional culture. It is the only underground ancient residential building in China and even in the world. Meanwhile the sunken Yao Dong is one of the four unique ancient residential buildings in China. Known as the ancient village under the horizon, the construction skills of the underneath excavation were included in

the national intangible cultural heritage protection list in 2011.

The sunken courtyard has a history of more than six thousand years. As early as the Miao Digou culture period, it has already had the prototype of the sunken Yao Dong. Because of its special geographical location in the Chinese yellow loess region, these places have formed their own urban environment which is dwelling below, fields upstairs. Each sunken courtyard is basically six





Fig. 5.11  
Abstracted  
Model of Bei  
Ying Village  
Source: Made  
by authors  
based on  
relevant  
materials

to ten meters underground, in order to ensure that the land on the roof is safe enough to provide people with normal living places. The fundamental reason of this special urban phenomenon was due to the peculiarity of loess. The loess is actually sand, thanks to the migration and deposition of loess with the wind, as well as it has high softness and porosity, local people were easier to excavate

to create some liveable spaces. Here, the land plays a dual role, agricultural fields on the surface of land, vernacular dwelling under the land. The local thick land provides good thermal insulation and keeps living environment in a good condition. Although the local people living underneath, but each family possess their own courtyard.

Fig. 5.12  
Urban Section  
Source: Made  
by authors  
based on  
relevant  
materials





Fig. 5.13  
Nollli map of Yongding Tulou Village  
Source: Made by authors base on relevant material

## Hakka Tulou

The Tulou residences are distributed in mountainous villages and towns in southern China coastal provinces. The Hakka people attach great importance to Feng-shui. One of the most important things is that there is a mountain on the back of the house. At the same time, it is best to face the water. If there is no river, a pond will be set up. From this we can see that the Tulou is always arranged with the water source, standing on the flat land between the mountains, surrounded by the fields. Therefore, the space between Tulou is closely connecting to nature in

village. However, the tall and thick volume of the Tulou creates a completely different atmosphere between the interior and the exterior of the building, and the interior is closely inter-personal and intimacy while it is indeed an isolated gesture exterior, because it is a defensive dwelling.

However, what the Tulou has to mention is its construction features, surrounded close by four sides, only one entrance and exit, the overall volume is huge. The wall is made up of three materials (red earth, coarse sand, lime) as the basic material. It is blended with glutinous rice juice and brown sugar water. After rammed, it is

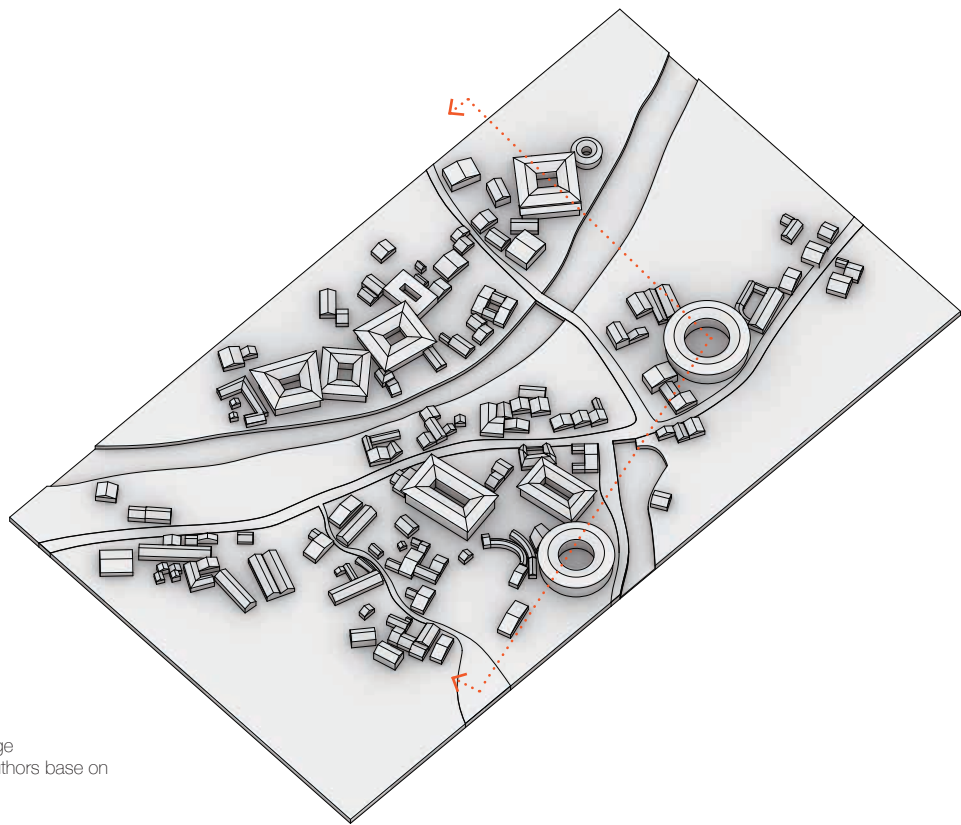


Fig. 5.14  
 Perspective view of  
 Yongding Tulou Village  
 Source: Made by authors base on  
 relevant material

very hard and can not be easily nailed in. This wall is made to a very large thickness. For example, Eryi Lou is currently known to be the thickest wall, reaching 2.53 meters and an overall height of 16 meters.<sup>1</sup> Moreover, the general low floor does not have an external window, or a very small window, and the top window is used as a function of lookout, attack, and defense. The roof is also huge whose extending part outside the wall reach 2- 3 meters, which is impressive.

A group of Tulou can be a village. Their

characteristics reflect that the Hakka people admit that they are guests and at the same time pursue the purpose of housing, and they are very strong in internal centrality and external closure. When the group layout, the distance between the Tulou volume is very close, so the land is compact and does not occupy the cultivated land.

All in all, every emphasis generantes from bloody boundary thought and denfensive purpose, which leading to a hamony self-sufficiency community and life style.

Fig. 5.15  
 Urban Section  
 Source: Made  
 by authors  
 based on  
 relevant  
 materials

1 Institute For Planets. "土楼从何而来? *Where Does the Tulou Come From?*" Weibo Sina (blog), July 22, 2018. [https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#\\_0](https://www.weibo.com/ttarticle/p/show?id=2309404264554841413798#_0).

Fig. 5.01  
 Section of Yongding Tulou Village  
 Source: Made by authors base  
 on relevant material





Fig. 5.16  
Nolli-map of Zili Village  
Kaiping, Fujian Province  
Source: Made by authors

## Diaolou

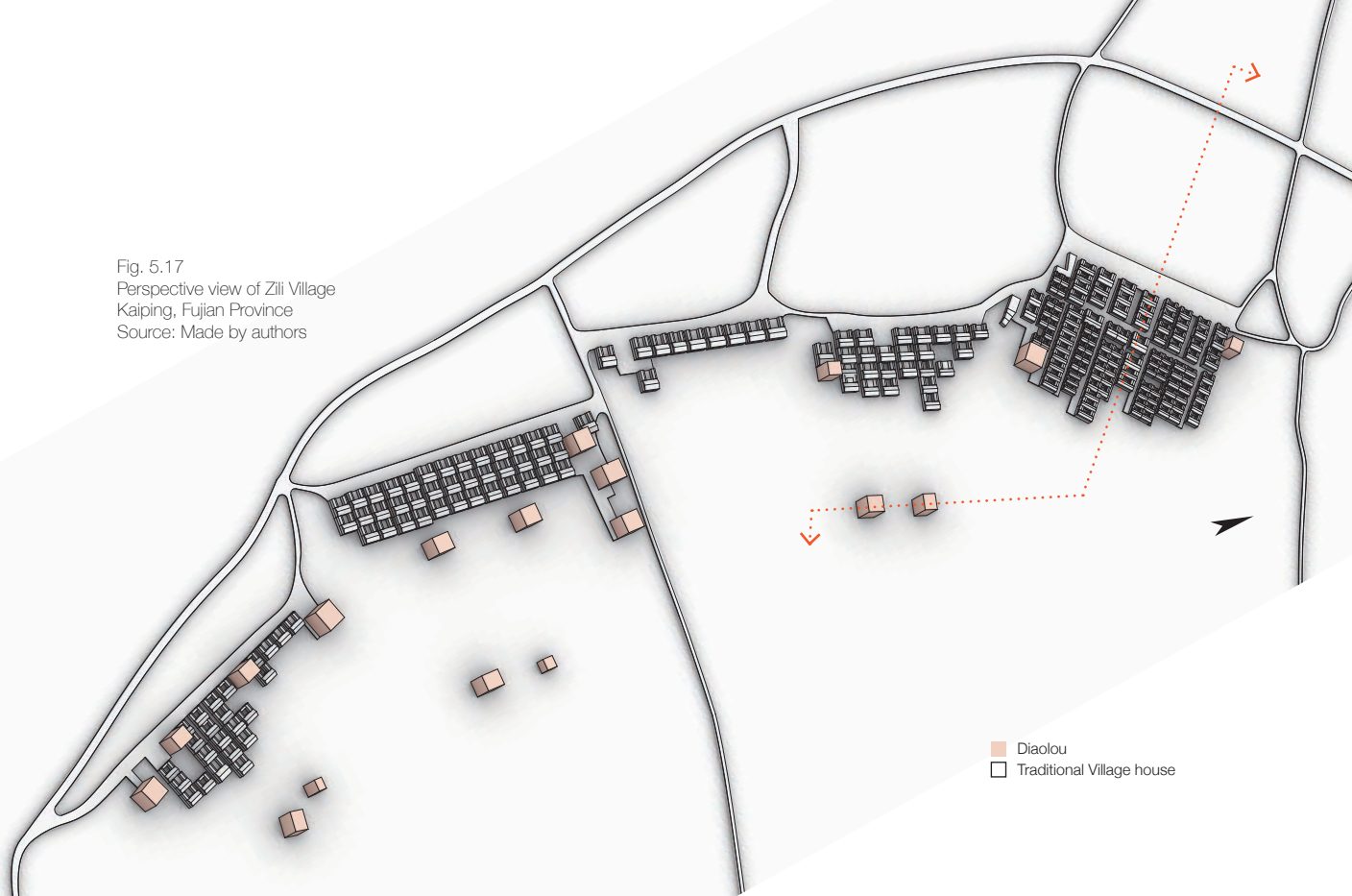
The overseas Chinese of Kaiping began to return hometown from abroad to build their homes from the end of the Qing Dynasty. The 1920s to 1930s were the peak period of construction.<sup>1</sup>

At the beginning, most of the overseas Chinese built the traditional three-bay-two-corridor style houses belonging to the Lingnan area, but in the later period, due to the social environment of the gangsters and the frequent floods in Kaiping. The defensive housing of the tower has been built frequently. It belongs to the multi-story buildings in the style of combination of Chinese and Western that were popular during the same period, which includes Diaolou, villas, schools, office buildings, and even the ancestral halls that are regarded as sacred places, and the architectural style changes due to the needs of the era. At the same time, the layout of the village is also more scientific.

In the early years of the Republic of China, the economic development of overseas Chinese in the Kaiping area, Diaolou was also built on a large scale. The villages in the Kaiping area are rich in architectural types, and the defensive dwellings

<sup>1</sup>Kaiping Diaolou Traveling. "侨乡建筑与村落 Architecture built by overseas Chinese". <http://www.kptour.com/culture/read1.aspx?cls=3&id=18>

Fig. 5.17  
 Perspective view of Zili Village  
 Kaiping, Fujian Province  
 Source: Made by authors



Diaolou and traditional village houses coexist.

The layout of village houses form a comb pattern and orderliness like it. In front of a group of houses there a samll square for drying the crops, and a pond is front of it, which is shape in semicircle or irregular long oval, for water storage, fish farming, drainage, irrigation, fertilizer, flood control, fire prevention. But in the mountainous area where the village close to river then

no need artificial pond. Behind the house or cultivated land of the village, there are planting trees, which can weaken typhoon and also obstruct cold wind. The traffic is road, alley Li and path, and usually the width of Li is 1.2 - 2.0 meters<sup>1</sup> and the main roads will be usually parallel to summer prevailing wind direction. As the result, the layout of comb pattern follow the traditional layout of Chinese village and adapt well with the climate which is hot and humid.

1 Lu, Yuanding, and Yanjun Wei. *Traditional Dwelling in Guangdong*. Beijing: China Architecture & Building Press, 1990. Page 22.

Fig. 5.18  
 Section of Zili Village  
 Kaiping, Fujian Province  
 Source: Made by authors



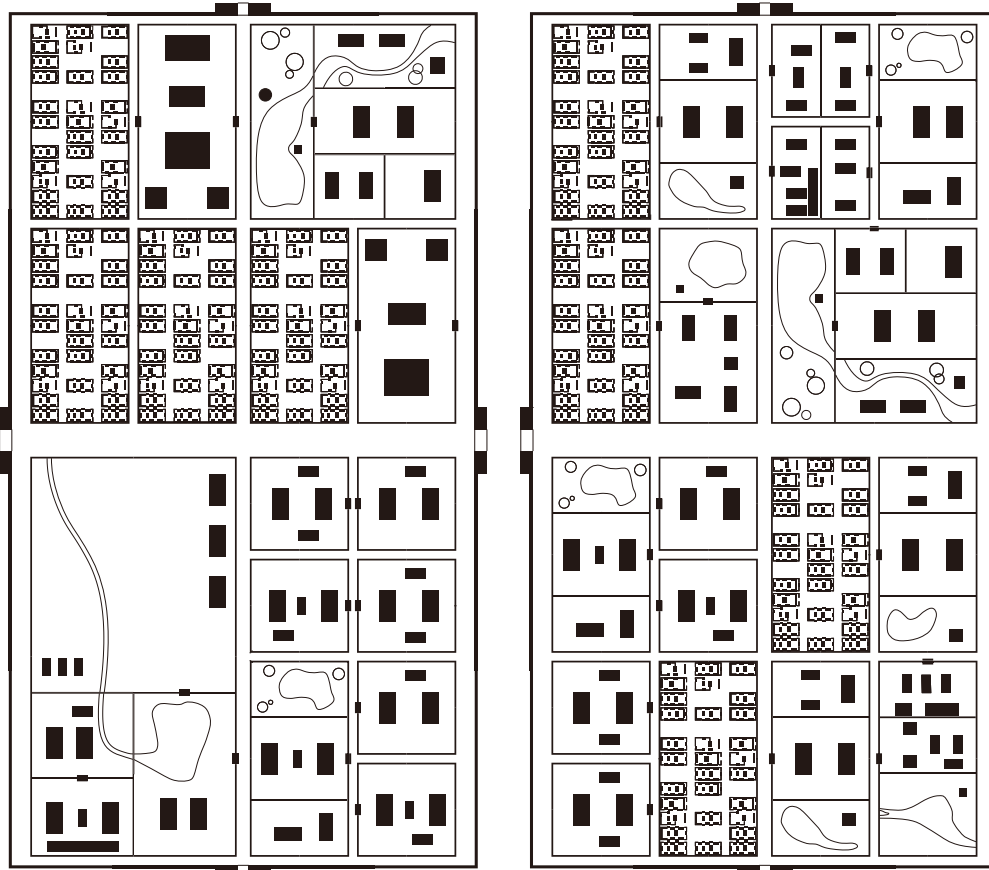


Fig. 5.19  
Nolli-map of  
Block Pingkang and  
Block Xuanyang  
Source: remade by  
authors base on  
relevant material

## Houses in Ancient Chang'an City

The arrangement inside a block was also in regular and strict principle. It was divided into 16 areas. For the different class of people at that time, they could receive one or more than one "piece" of the 16 areas. For example, there was a royal family member even received the whole block at a time, like a small city. For the normal citizen, their houses were

arranged in a specific area in 16, which we can see the highest density of houses area in the nolli-map analysis. According to archaeological excavations, the city's east-west wide is 9721 meters (the document contains: 18 li and 150 steps), and the north and south are 8651.7 meters long (the document contains: 15 li and 115 steps). The outer city area was about 84 square kilometers.

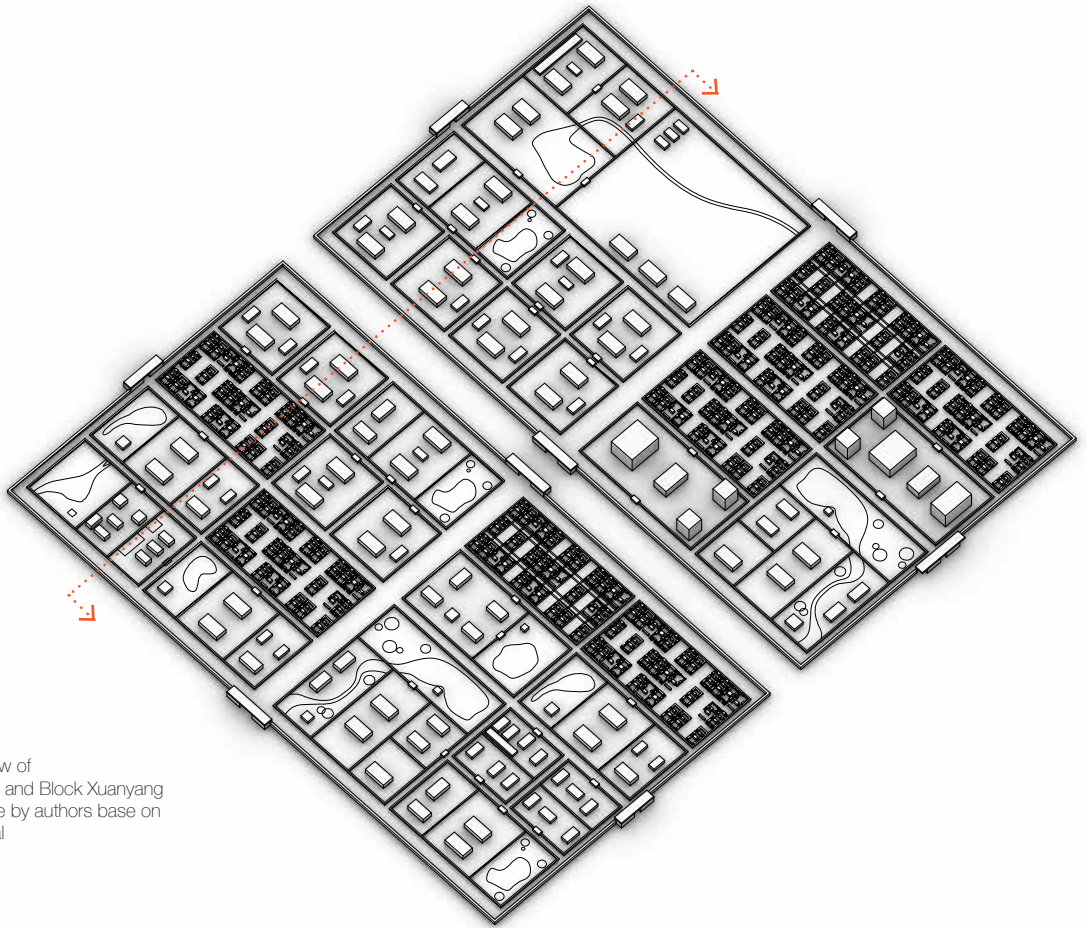


Fig. 5.20  
 Perspective View of  
 Block Pingkang and Block Xuanyang  
 Source: remade by authors base on  
 relevant material

There were 12 north-south streets in outer city and 14 east-west streets. The three main roads leading to the south gate and the east and west gates were called the “six-street”. They were the main roads in the city. The “six-street” scale were very large, with a width of 55 meters or more than 100 meters. Especially on the central axis, Suzaku Street was the widest, about 150~155 meters. Other streets that do not pass through the city

gate are generally between 35 and 65 meters wide. The road between imperial city and palace complex was about 220 meters. The area dimension of each block was different, but their dimensions of the length of each side were in regular pattern. From north to west were 450 steps, 550 steps and 350 steps, and from center to both sides were 350 steps, 450 steps, 550 steps and 650 steps.

Fig. 5.21  
 Section of Street View of  
 Block Pingkang and Block Xuanyang  
 Source: Made by authors base on  
 relevant material





Fig. 5.22  
Plan of Ma'an Village  
Source: remade by authors base on relevant material  
Reference: Li, Changjie, ed.  
*Vernacular Architecture in North Guangxi*. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 32.

## Stilt-House

Take the Ma'an Village as the example, where it located is mainly the foot of a hill and some on the col, surrounded by river. The constituency of the village location was affected by ethnic culture. The reason for choosing the 700-800 meters high mountain and large hills was to prevent the attack of gangsters, but it was necessary to develop mountainous areas to increase the cultivated area, thus forming a large terrace of high and low.

In the village built on the mountainside, it has good sunshine, ideal ventilation and moisture-proof conditions. But in general, these villages are all arranged according to the terrain, and there is no fixed geometric boundary. It is interesting to see that there are often some organic integration with the mountain to form a special village space.

The mountainous landscape is complex, and the road system that forms the skeleton of the village makes full use of



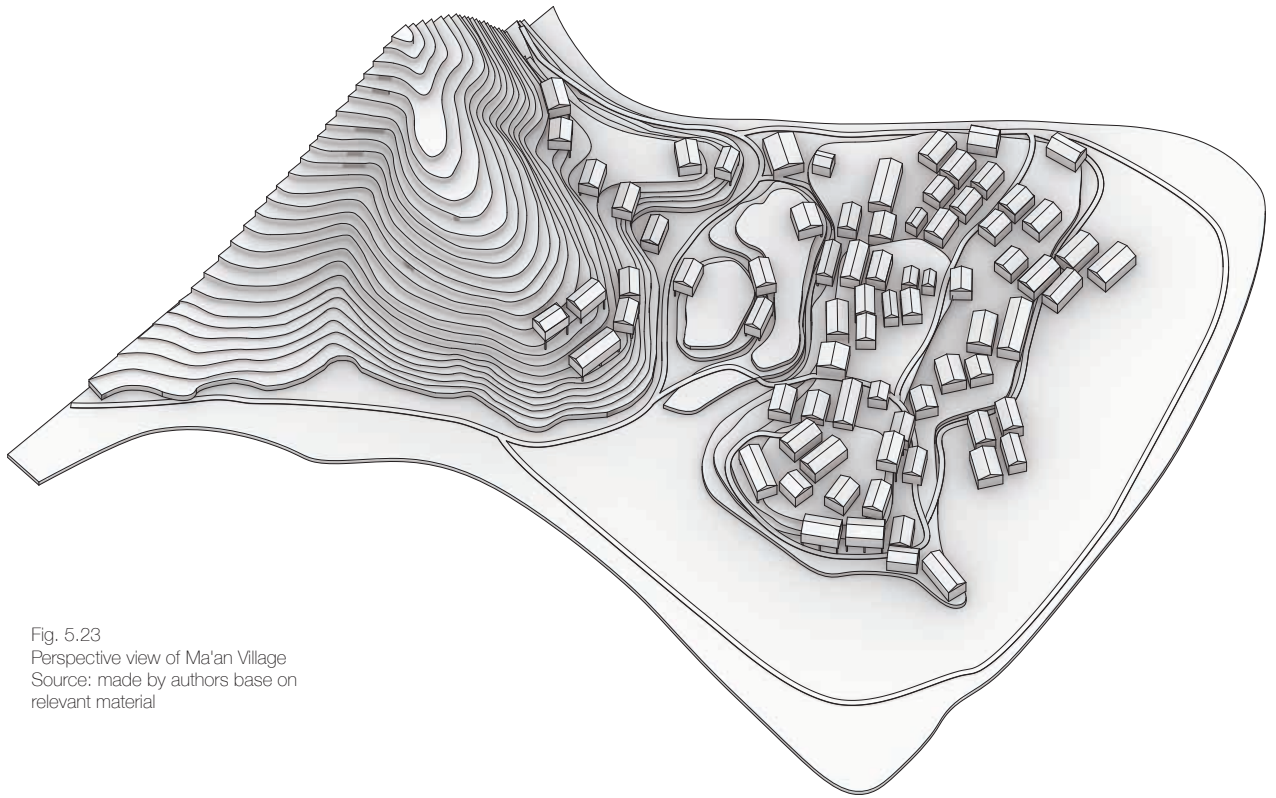


Fig. 5.23  
 Perspective view of Ma'an Village  
 Source: made by authors base on relevant material

the terrain, and it is natural and flexible. It has a dendritic, radial, or checkerboard pattern<sup>1</sup>, and both parallel or vertical to contour lines are all exist. There is no fixed form, and the roads often cross through the overhead floor of the stilt-house, to

facilitate the layout of the village traffic. Moreover, the natural and free planning style are surprisingly to form many special landscapes scenery. Not only that, these semi-open space also take shelter form the rain and sun.

1 Li, Changjie, ed. *Vernacular Architecture in North Guangxi*. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 38.



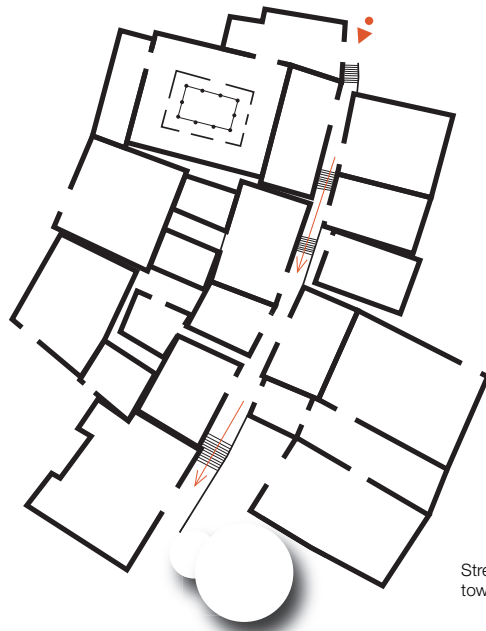
Fig. 5.24  
 Partial Section of Longji Village Road  
 Source: Li, Changjie, ed. *Vernacular Architecture in North Guangxi*. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 53-54.



2

Abstraction from  
Chinese Streets  
and Garden

With the purpose on dissecting the architecture composition, the analysis of district scale, as the middle scale, will be helpful for introducing us into the deeper level, to be easier to process and accept. Street scale is a scale that can be directly felt by humans. Interestingly, when expressing the space of this scale, we can begin to discover that people perform different behaviors with different spatial components. We believe that people's types of activities, ways, directions and circulations, like the glue between buildings and streets, make them inseparable interacting. A space suitable for people should be relaxed, continuous and participatory, rather than having a sudden fault. This also directly indicates the importance of understanding the constituent elements of the street scale, the analysis of district scale, as the middle scale, will be helpful for introducing us into the deeper level, to be easier to process and accept. Street scale is a scale that can be directly felt by humans. Interestingly, when expressing the space of this scale, we can begin to discover that people perform different behaviors with different spatial components. We believe that people's types of activities, ways, directions and circulations, like the glue between buildings and streets, make them inseparable interacting.



Street scale plan of En Yang town, Si Chuan.

Fig. 5.25  
District Map of  
En Yang Town  
Source:  
Produced by  
authors based on  
relevant materials

## District in En Yang

Due to the diversity of topographical conditions and the diversity of ethnic distribution in China's Sichuan region, the forms of traditional dwellings are also diverse, ranging from Tibetan houses in the plateau to ethnic Han traditional dwellings in the basin. The overall characteristics of the existing Ming and Qing Dwellings in Sichuan are: large scale, diverse types, and can be better combined with topography, especially large large-scale courtyard houses. The first type of urban dwellings is like a

large settlement in this residential area with the city as the core. Between the dwellings and various temples, there are dozens of streets of different sizes. There are many shops on both sides of the streets. The shop is actually a resident of a street-side residence, and the front part of the house is specially used as a shop for business activities. The second township residence is the center of trade exchanges in the vast rural areas. It does not have the prosperity of towns or cities, but it also forms a lively place for people from nearby areas to trade. It can be regarded as a traditional Sichuan market.

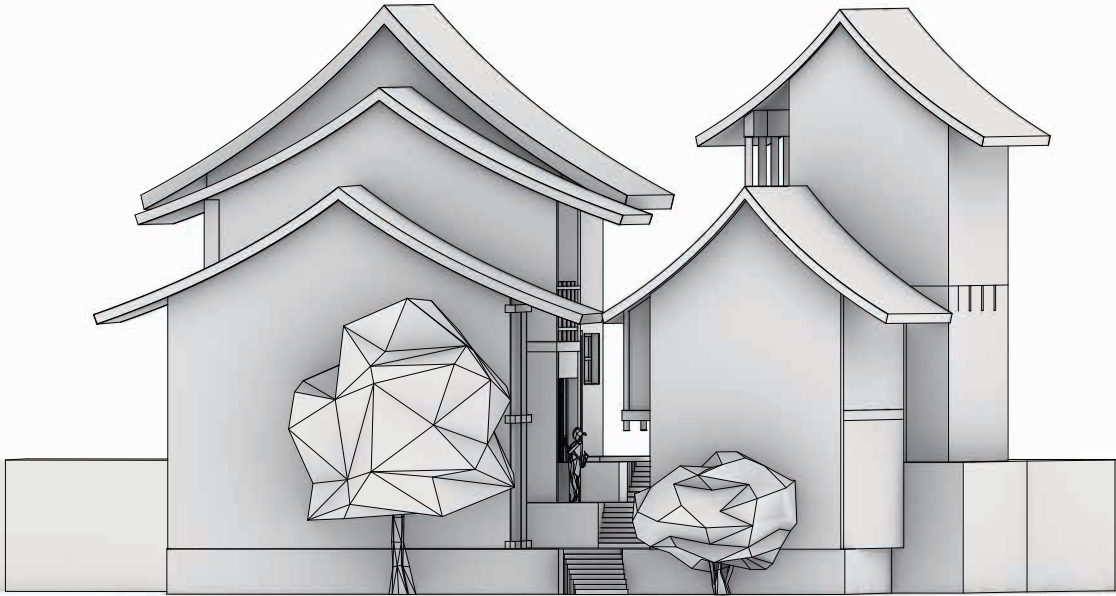


Fig. 5.26  
Modelling for  
Anthropology  
Perspective of En  
Yang Street  
Source:  
Produced by  
authors

Small market in the middle. Because of the continuous development, such a trading center has gradually become a fixed area, so that some people have built houses nearby to facilitate transactions, and gradually formed a different residential town. Most of the layout forms are arranged by the streets where the

cross intersects, and the two sides of the street are corridors under wide eaves, forming a promenade street. There are also rural areas in the mountains, which are very practical and beneficial in the old times when the soldiers were in turmoil, because it is extremely defensive and can better protect the normal life and safety.

Fig. 5.27  
Modelling for Perspective  
Section of En Yang Street  
Source: Produced by authors

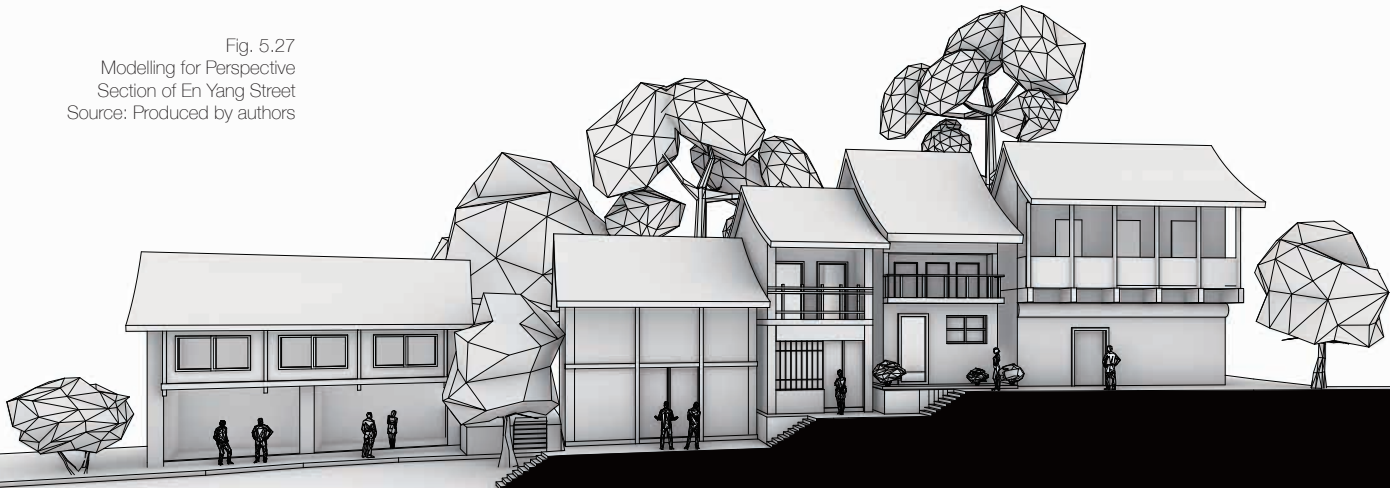
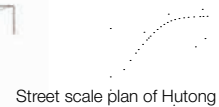




Fig. 5.28  
District Map of  
Hutong  
Source:  
Produced by  
authors based on  
relevant materials



Street scale plan of Hutong

## Hutong in Beijing

Beijing Quadrangle is a typical form of traditional courtyard-style dwellings in China, and it is also the representative of the residential houses in the northern courtyard of China. Although Beijing Quadrangle is a typical and representative of the Chinese Quadrangle houses, but it can be divided into multiple modes. There are certain changes between multifarious models. Frankly speaking, the biggest distinction is the number of courtyards. Generally, there are three halls

and two enclosed courtyards. However, large family may has frontside, backside, left side and right side courtyards and connected to a large group of courtyards. Then let us introduce you the function layout of traditional Beijing quadrangle. In the beginning is the front gate that invite you enter in the house. Then the front courtyard keeps the privacy of living rooms which locates more inside. Commonly, this courtyard has less decoration and is mainly focused on

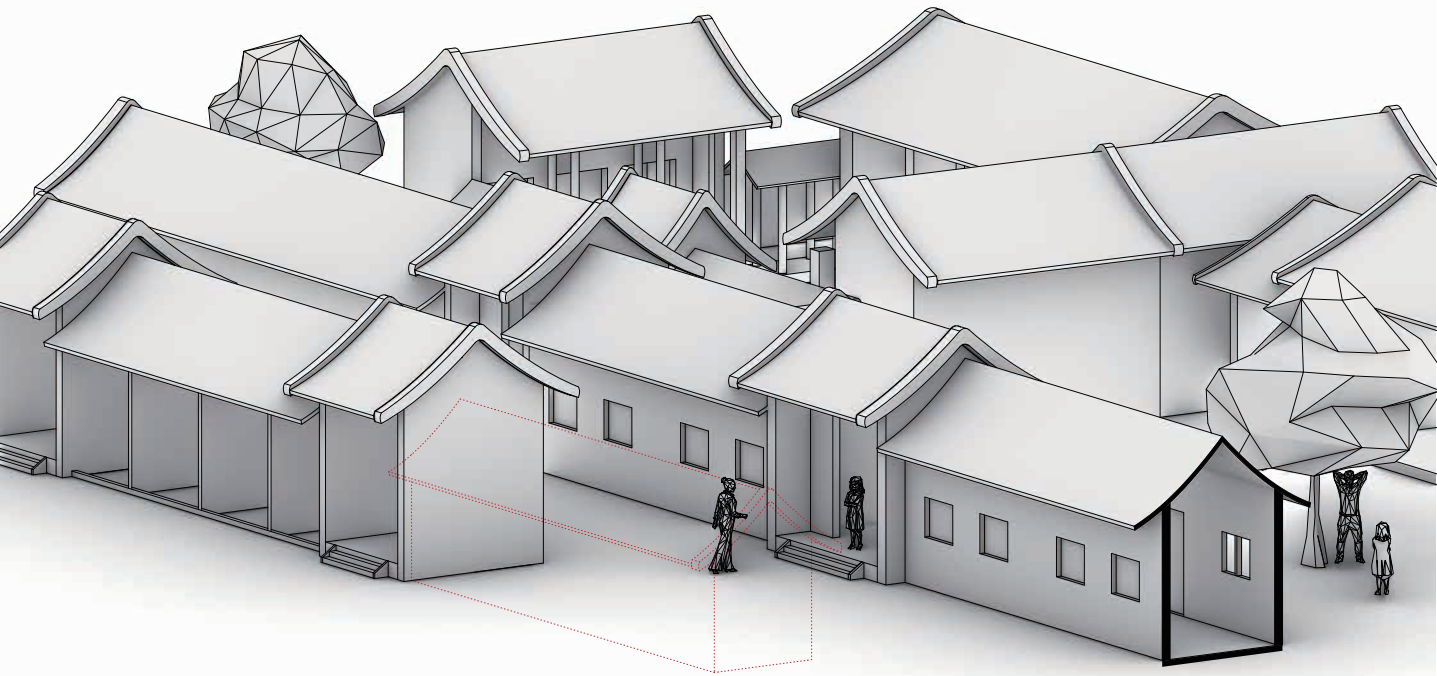


Fig. 5.29  
Modelling for  
Perspective  
view of Beijing  
Hutong  
Source:  
Produced by  
authors

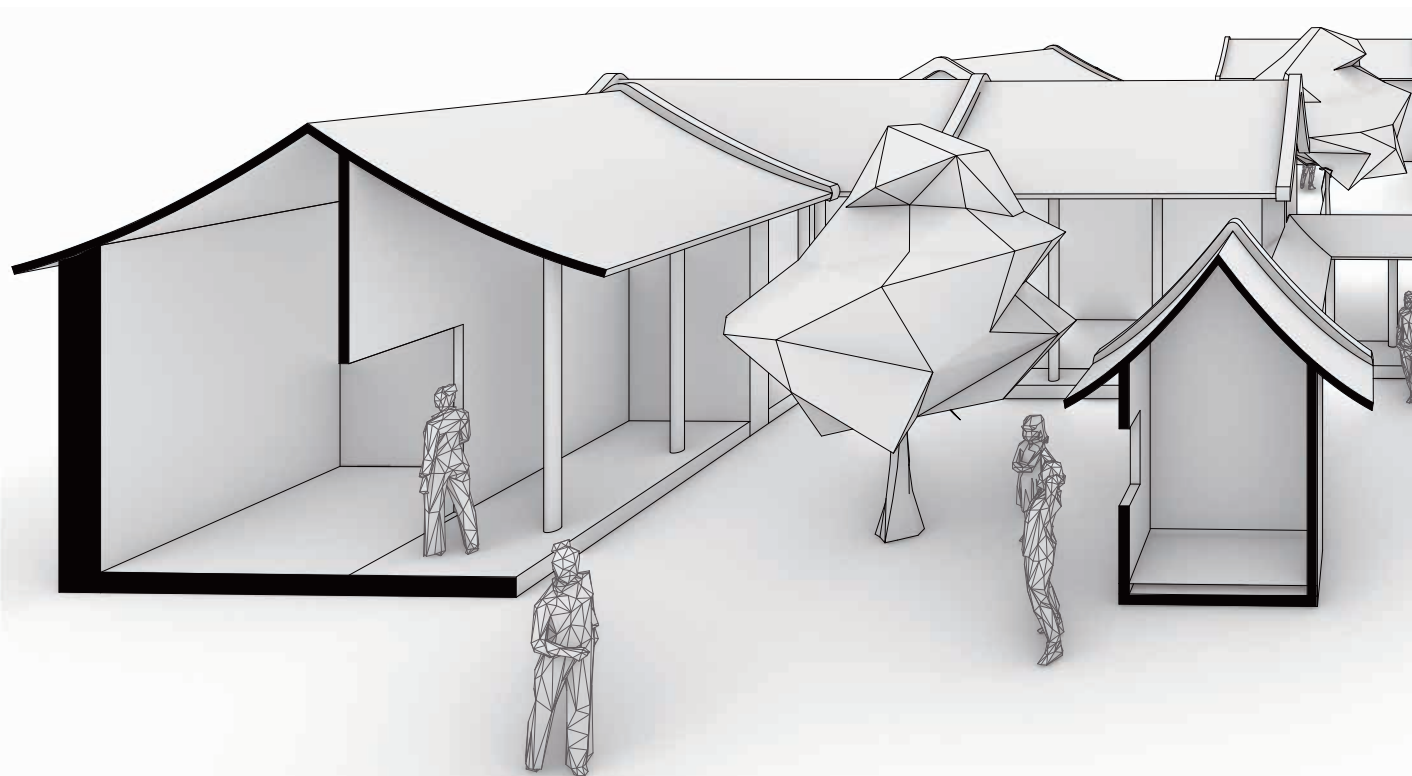
storage and circulation. But there are some decorated windows on the wall. Afterwards, moving through the festooned gate you will arrive at the principle courtyard finally. The main house in the Beijing Quadrangle is the most important house in the courtyard, both in terms of its location and the size of the building. The main body of the main house is a tall house with a width of three open rooms, and one or two side rooms are built on each side of it. Regardless of whether it is from the entire courtyard or from the central main courtyard, the introverted

characteristics of the traditional Beijing Quadrangle are very obvious. The overall feeling is simple and restrained, and the friendly layout is rigorous. The courtyard hall, bedroom, kitchen, study, veranda, car and horse room are all available. At the same time, ah, I have green plants that are reflected in the courtyard because of their love for nature. The embodiment of the unitedness united the family together. It also clearly reflects the traditional ethical concepts of our country. The spatial organization of old Beijing Hutong is interesting to be studied for us.

Beijing's hutong is not only the urban fabric of the city, the channel of transportation, it is also the place where the ordinary people of Beijing live, and the important stage of the development and evolution of the history and culture of the capital. It records the changes of history, the style of the times, and contains a strong cultural atmosphere, like a museum of folk customs, branding the imprint of people's various social life.

Strolling through it, there are places of interest and monuments everywhere, and the taste is similar to Beijing's encyclopedia. Many bricks and tiles in

the hutong have a history of hundreds of years. From the courtyards of large and small hutongs, you can learn about the lives of Beijing citizens, including their lifestyle, life and neighborhood. This house and one courtyard are covered one by one, and they are arranged in a row, then the light and ventilation between one row and the other row must be left in and out. Because of these reasons, the formation of Hutong, small streets and big streets are realized. From the Ming Dynasty to today, there are only forty names in the street alley name that have not changed. Nowadays, the busy the busy metropolis of Beijing, many old hutongs have been

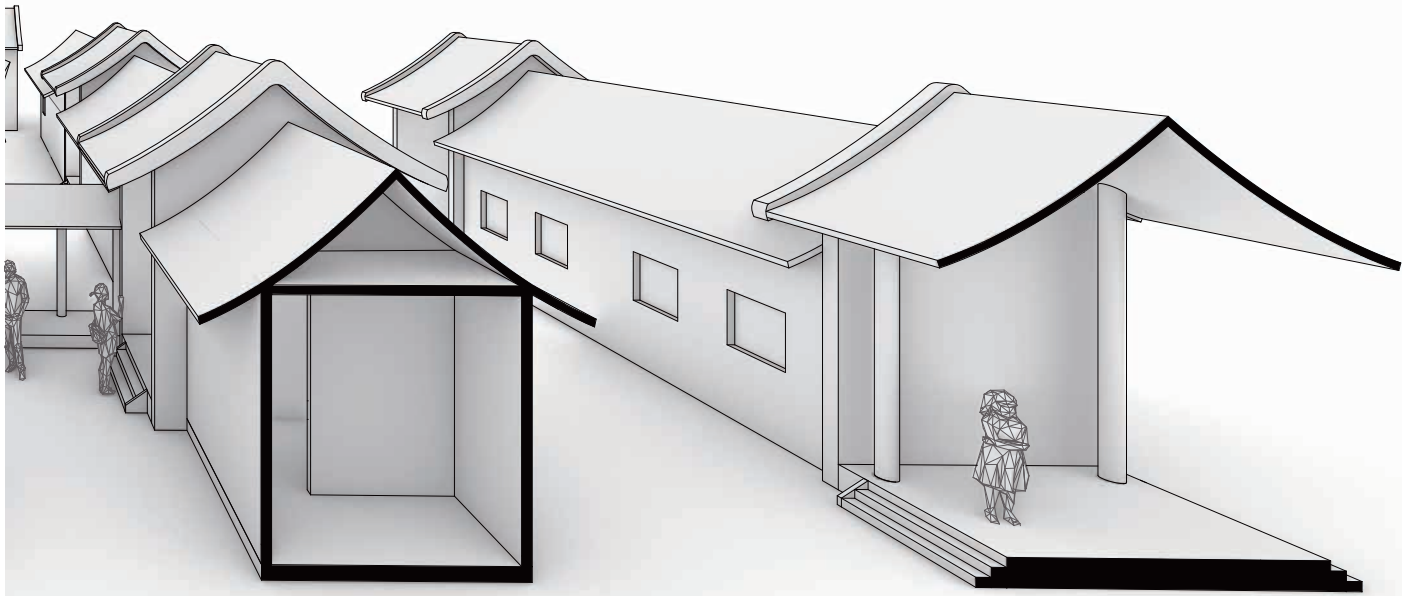


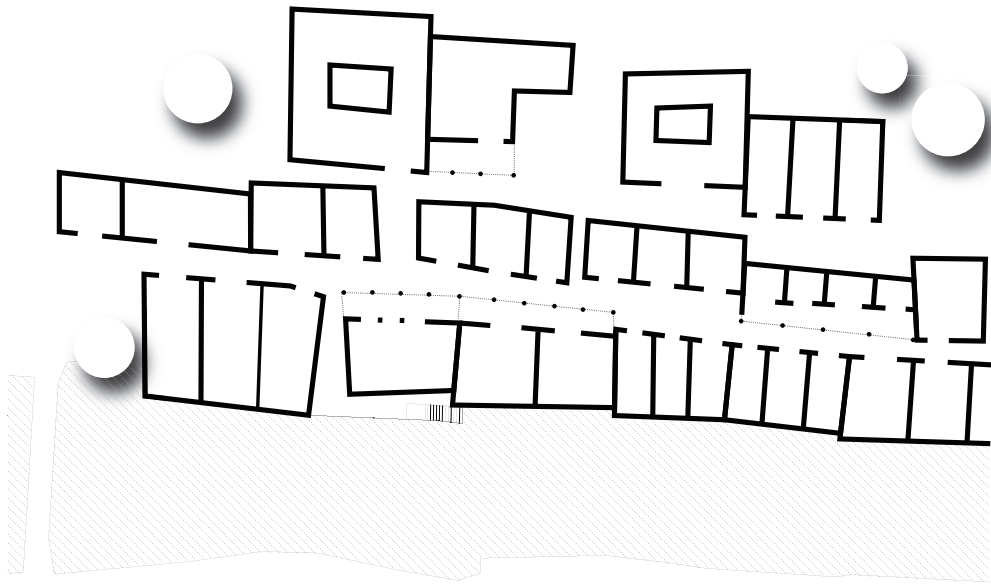


left to be a big problem. In order to develop modern transportation and capacious urban public space, many hutongs have been demolished during rapid urban development. The initial and naming of the formation of the hutong is from the water demand of the people's livelihood. The arrangement direction of the hutong is based on the right center of the emperor, and the square pattern of the attached courtyard is extended to the four sides. The life style of the hutong is due to the feudal society. Class system, and cultivate different cultural heritage. The narrowest hutong in Beijing is the Qianshi Hutong in the Dashilan area outside the front door. The narrowest part in the middle of the hutong is only 40 cm.

There are also some twists and turns of the hutong in the shape of the nine ileum. For example, there is more than 20 bends in the original section of the North New Bridge. It is divided into five hutongs. It not only reflects the historical evolution, but also shows the social customs. In recent years, it has been developed as a rare tourism resource. After making models through the abstracting from vernacular Beijing Hutong district, we find this is another language of spatial organization. The urban district is mainly composed by introversive type dwellings. Its space series is presenting as the introverted courtyard to public Hutong and to another introverted courtyard.

Fig. 5.30  
Modelling for  
Perspective  
Section of  
Beijing Hutong  
Source:  
Produced by  
authors





Street scale plan of Wu Town, Zhejiang.

Fig. 5.31  
District Map of  
Wu Town  
Source:  
Produced by  
authors based on  
relevant materials

## Wu Town in Zhejiang Province

The residential houses in the water town mainly refer to the residential areas in Jiangnan Region, such as Jiangsu Province and Zhejiang Province in China, mainly including the residences of Shaoxing, Wu Town, Nanxun and Suzhou. These waterfront dwellings are built by drowning, and the traffic is mainly waterway.

The houses of a single independent volume are the smaller ones in the water town. Most of the houses in the single-

seat detached house are bungalows with two or three rooms, or buildings with two or three rooms on each floor. The scale of such dwellings is suitable for ordinary civilians to live in. The space is basically fully used, which is mainly used as a living room, bedroom and kitchen. All rooms must be used to the best of their ability, and there is no ancillary rooms for maintaining temperament, such as a studio or a piano room or study room in those house for wealthy people. In the Jiangnan water town, where the water network is densely populated, the construction of houses close to the water

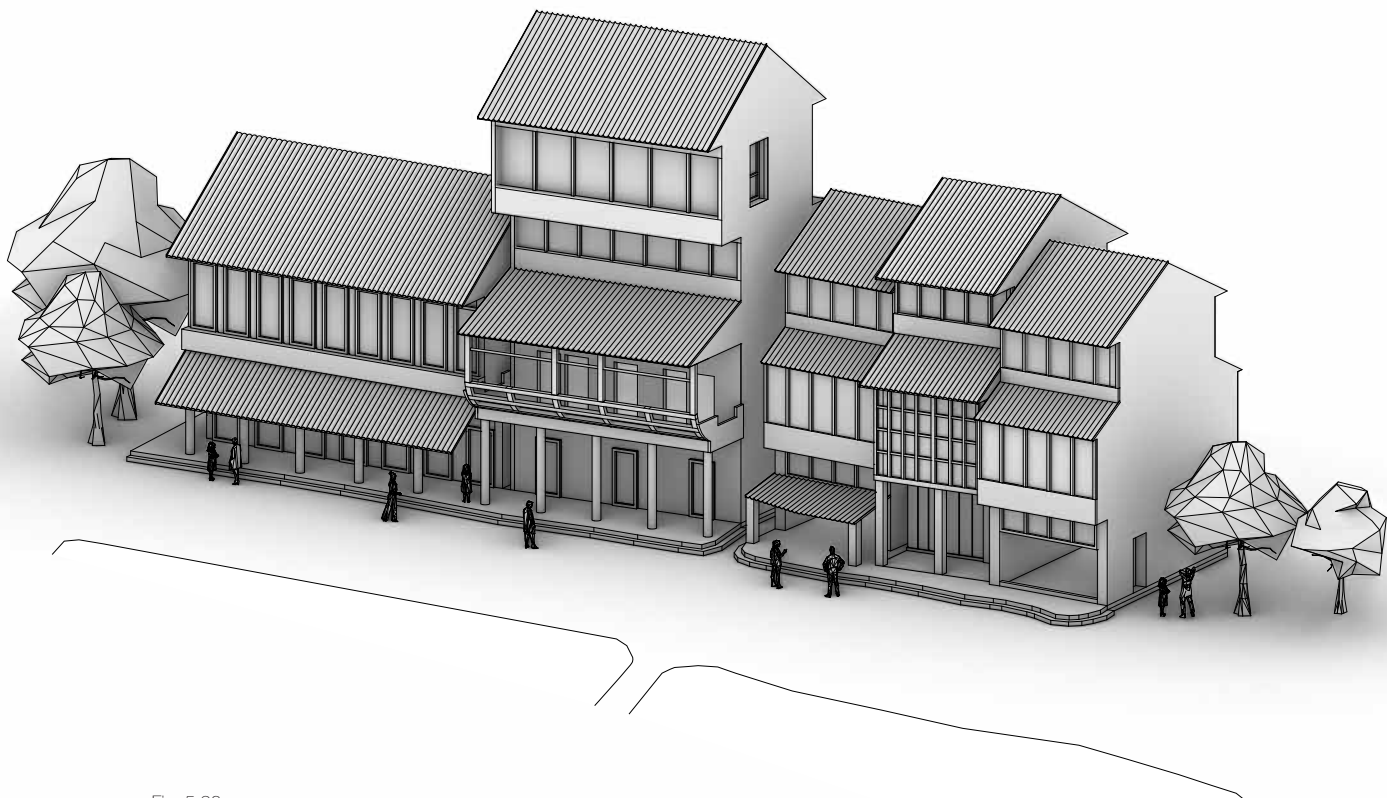


Fig. 5.32  
Modelling for  
Perspective  
view of  
Alleyway in Wu  
Town  
Source:  
Produced by  
authors

surface will naturally make people's lives more convenient, but after all, it is impossible for every household to be close to the water. Therefore, in order to make as many people as possible to live next to the water, the Jiangnan water town houses are vertically expanded or in depth, and rarely expand horizontally, there is often only one bay in the opening face, forming a single-open multi-entry. The form of residential houses presents the unique characteristics of the folk houses in the water towns. The waters in the south of the Yangtze River are humid

and rainy. Therefore, in order to protect the wooden decoration of the houses, people often add vestibules to the outside to cover the wind and rain and protect the wood from rain. There are a large amount of bridges in Jiangnan Water Township, which is an essential setting for people's transportation. At the same time, it is closely related to the dwellings. Some houses even use the body of the bridge as a wall of their house. This method called "Lean bridge" is a way for residential house in the water town to expand space inside a block space.

Wu Town is a thousand-year old town with water as its source. It is a famous tourist town at home and abroad. It is also a world Internet town that will open an international platform with the World Internet Conference. In the era of great changes in the Internet, new industrial functions will be injected into the traditional urban space of Wu Town, how to continue the traditional style of ancient towns and water features, improve the environmental quality of towns, expand the development space of Wu Town; how to integrate the city Naturally, let the town continue the historical context and realize the urban construction goal of “seeing the mountains, seeing the water, remembering the homesickness”.

Although every house in the water town is a residential house, because of the differences in the economic strength, social status, and the conditions of the building construction base, there are different sizes of different sizes, which also result in different water houses and form. Specifically, there are residential houses with separate houses and multi-family residential houses.

In Wu Town, there is only a single-family house, which is a small-scale form of a dwelling house. It is usually a bungalow or a building on the first floor and the bottom. One of the bungalows is the smallest example, but in fact most houses of individual layout detached house are

Fig. 5.33  
Modelling for  
Perspective  
view of  
Alleyway in Wu  
Town  
Source:  
Produced by  
authors



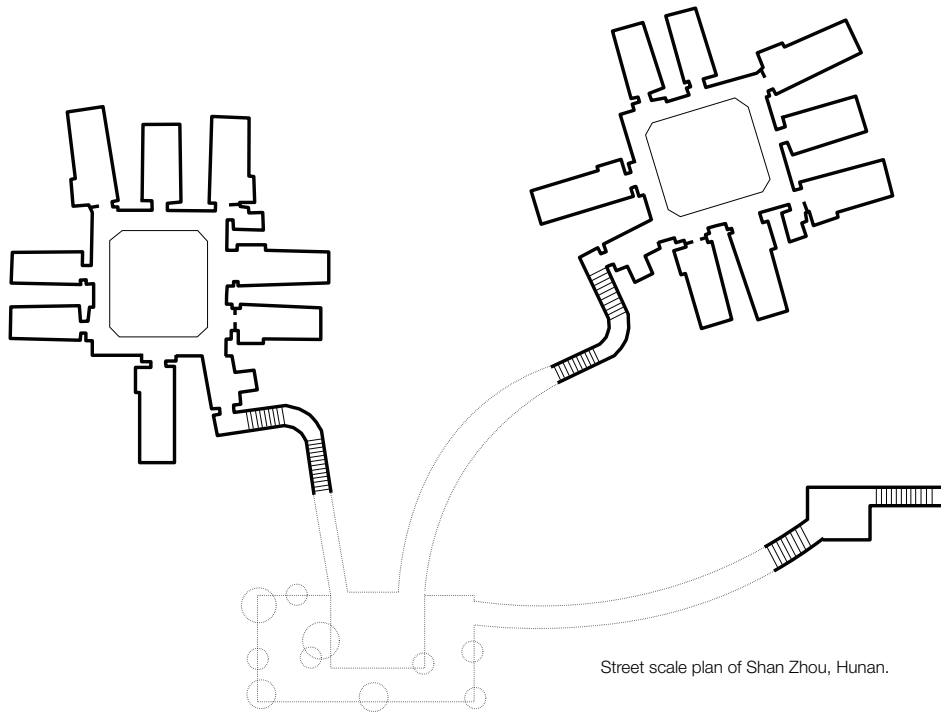


Fig. 5.34  
Modelling for  
anthropic view  
of Alleyway in  
Wu Town  
Source:  
Produced by  
authors

two or three squares or one or two floors.<sup>1</sup> Such dwellings are suitable for ordinary civilians, and the space is basically used, mainly as living room and bedroom, kitchen. A single-seat, detached house has its own unique extension: increasing the number of rooms along the horizontal direction of the original house. However, courtyard-style dwellings are different, and courtyard-style dwellings generally extend in the direction of vertical water. The construction area of the water town

is much less than that of the ordinary land, so the size of the house is small, but the density of the house is high. As you can see from the scene we produced from our simulated modelling(Figure.5.34) above, the density of the architectural area comparing with open space is much more higher. Due to the narrow commercial street with residential buildings of three to four stories high on both sides, and there are vernacular commercial shops on the street front in addition, the representative local atmosphere is generated.

1 Wang Qijun. *Vernacular dwellings, in Chinese Ancient Architecture*. China Electric Power Press, 2008. Page 78.



Street scale plan of Shan Zhou, Hunan.

Fig. 5.35  
District Map  
of Yao Dong  
Community  
Source:  
Produced by  
authors based on  
relevant materials

Cave dwellings is a housing based on geographical environment, which are a unique form of dwellings in the Loess Plateau of China, and also a mature form of primitive burrowing in China. It is a form of residence that has evolved over a long period of time since ancient cave dwellings. The material of the cave dwellings is mainly loess. It is a form of dwelling that uses loess as a support system. There is no pillar support in the house. It is a living space that is artificially excavated in the yellow earth belt. The ceiling is dug into an arch and the exterior is covered with soil.

The vault door hole is basically the biggest appearance feature of the cave dwelling. The characteristics of cave dwellings in all parts of China have outstanding commonalities and exist in specific forms. There are quite a few differences. There are three main types of cave dwellings in China: One is a cliff-style cave, the other is a free-standing cave, and the third is a sinking cave. These three forms are used in the distribution areas of various caves in China, but they are slightly different due to the different distribution. This is determined by the topographical conditions of each distribution area.

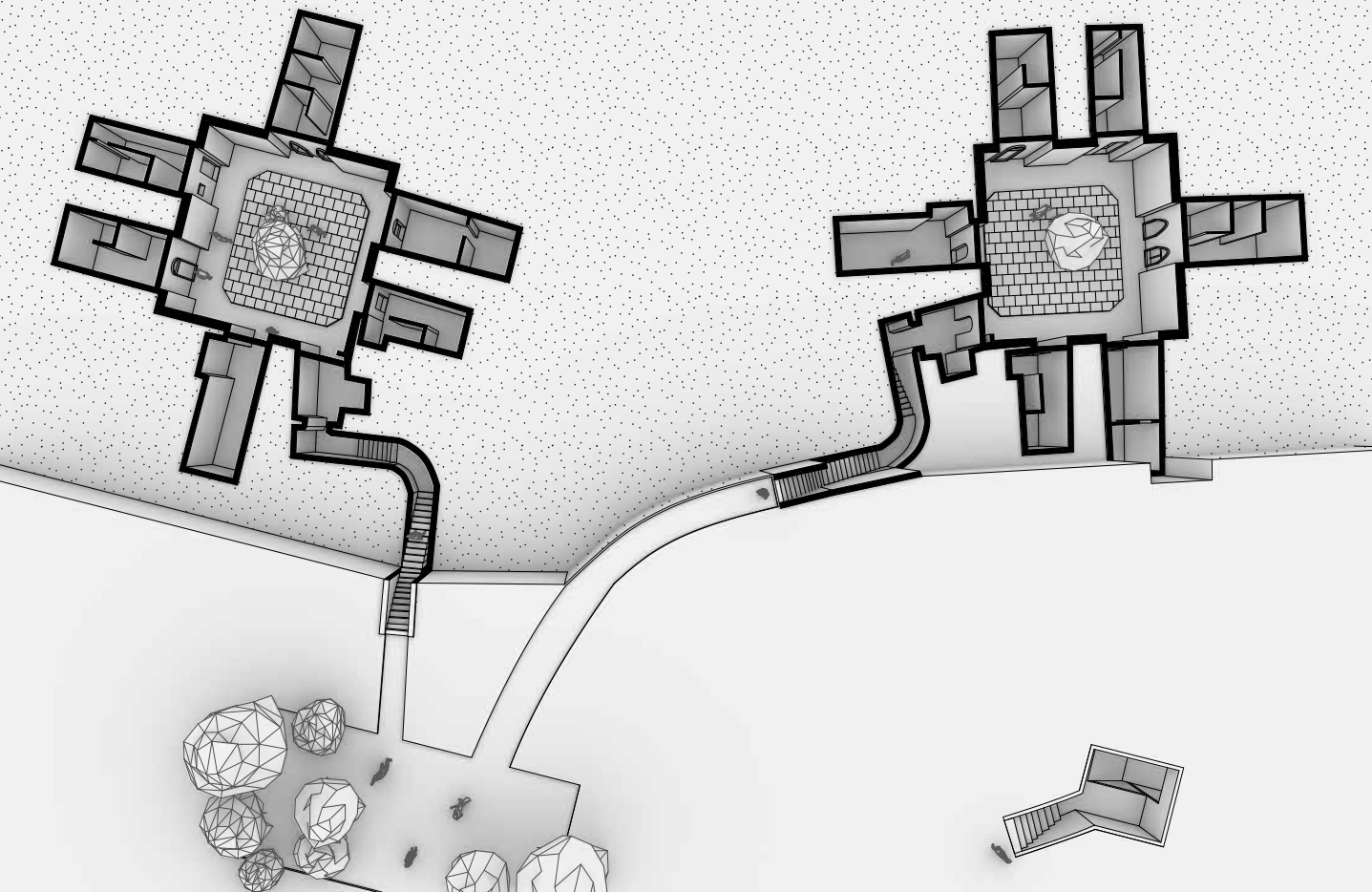
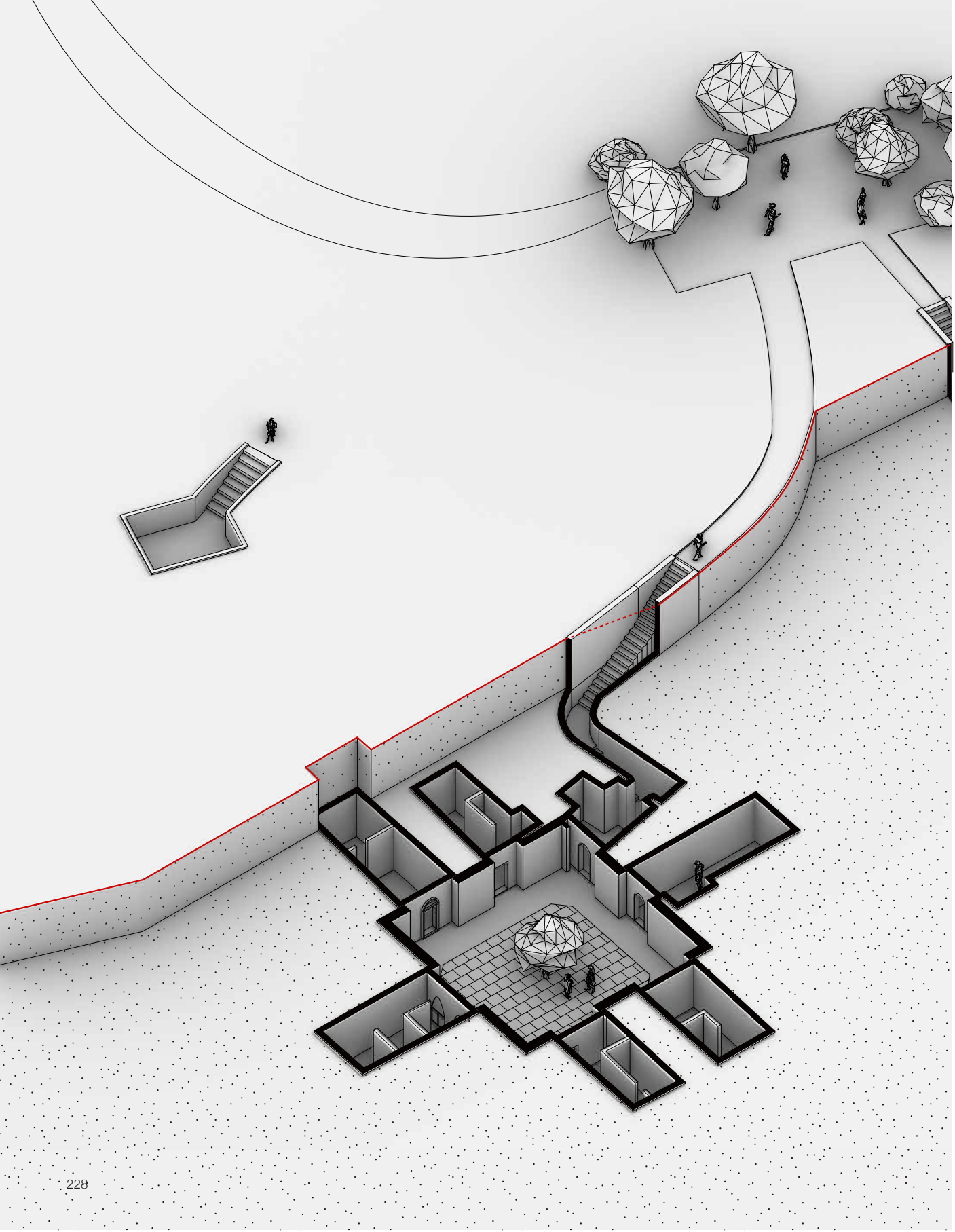


Fig. 5.36  
Modelling for  
Perspective  
Top View of  
Yao Dong  
Community in  
Shan Zhou  
Source:  
Produced by  
authors

It can be said that the independent cave dwellings are the form of overburden buildings in ordinary bungalow houses. According to the same construction techniques and materials, the layout of the independent cave dwellings or the arrangement of the courtyards is not limited by the cliff potential. The sinking cave dwelling is a cave dwelling below the ground. It is a courtyard that is excavated underground on a relatively flat and open loess, and then several cave dwellings are drilled across the walls of the courtyard.

Basically, each The sinking courtyard is a family, independent. Cliff-style caves are caves that rely on natural cliffs or slopes. The excavation is carried out in parallel on the façade of the natural cliff slope. According to the height and slope of the slope, one layer, two layers or more layers of cave dwellings can be dug. After the cave dwelling is completed, the front side is an open space in front of the cliff slope, which is convenient for people to go out and usually activities.





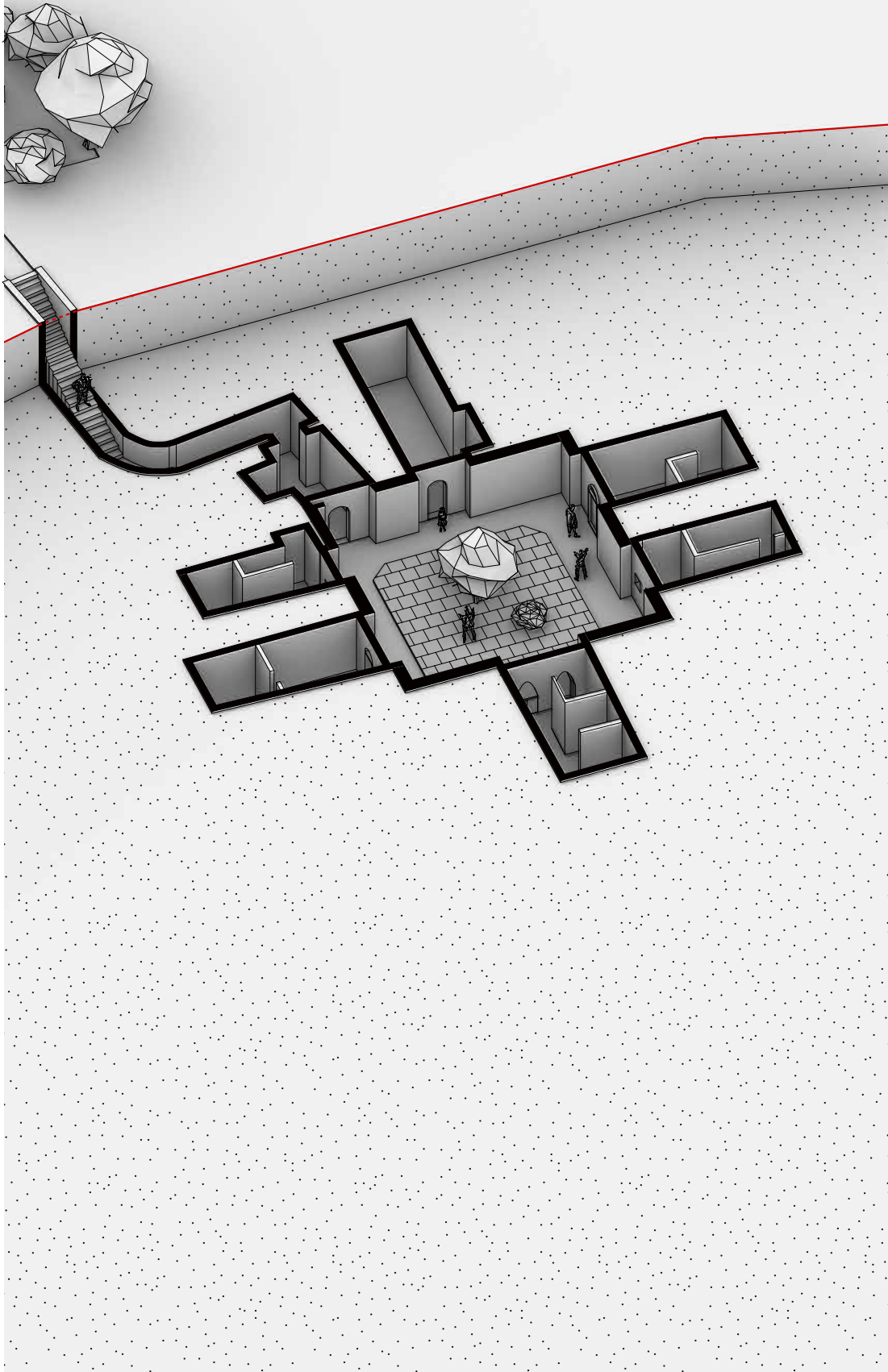


Fig. 5.37  
Modelling for  
Aerial View of Yao  
Dong Community  
in Shan Zhou  
Source: Produced  
by authors

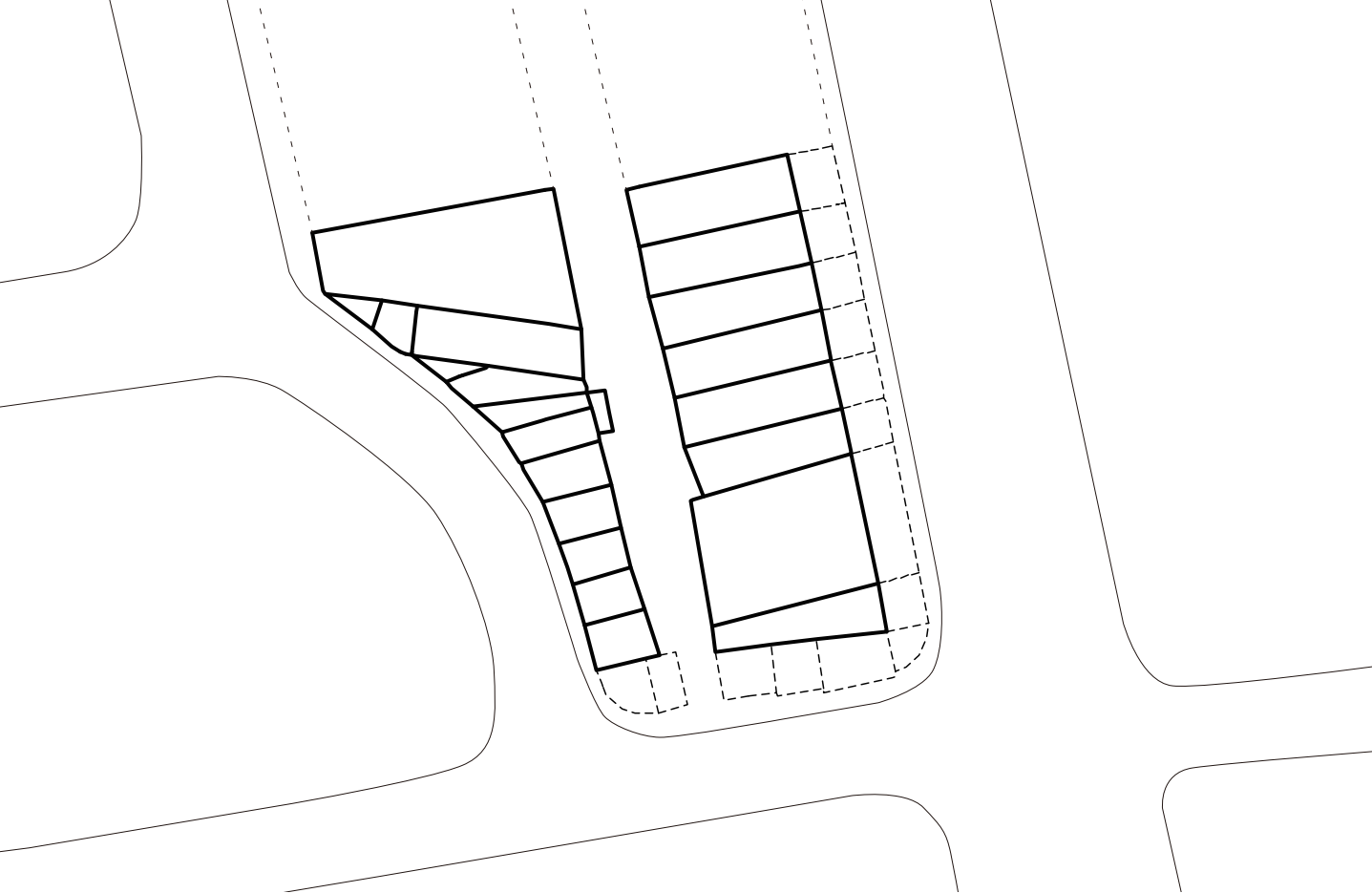


Fig. 5.38  
Plan of Partial Arcade Street  
Source: Made by authors

### Bamboo House and Arcade Building

In central Guangdong, there were more people and fewer land, which was also expensive, so the depth of the layout of house was increased to save land. Then there was a bamboo house with a narrow width and a deep depth had been built, name after its space which looks like a bammbboo. The depth will bring problems such as ventilation, lighting, etc. Therefore, the inner patio,

the open hall and the corridor are used to solve these difficulties. In addition, in order to save land, houses often make in serveral storey. These houses are all in the inner streets and alleys. Its internal organization often appears as “lixiang” (a lane is a traffic out of a residential group). There are also some inner streets as the intersection, and the houses are arranged along the street.

At the beginning of the 20th century, the

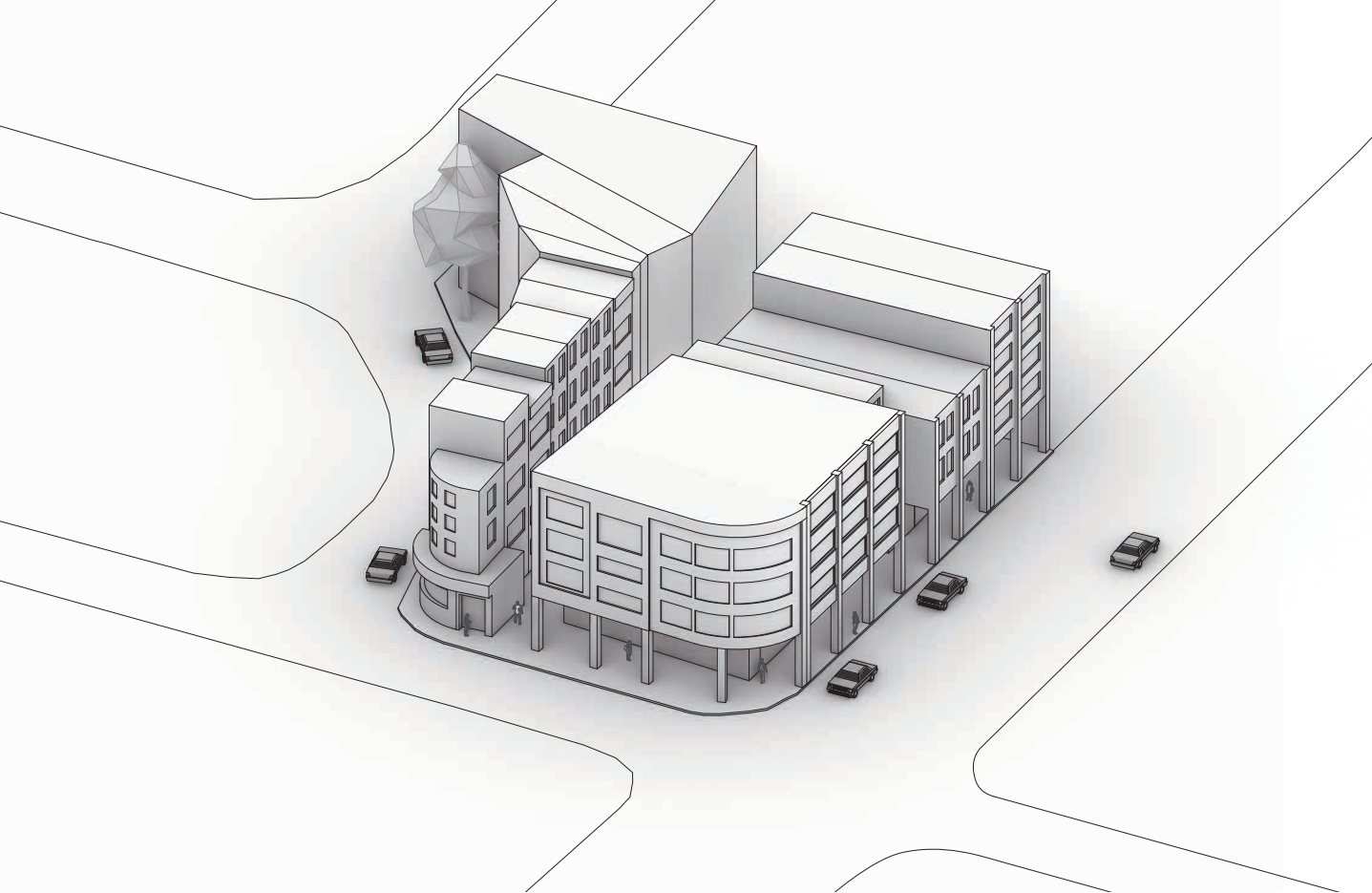


Fig. 5.39  
Perspective view of Partial  
Arcade Street  
Source: Made by authors

arcade building began to appear in Guangzhou. It was converted from the traditional “bamboo house”. Therefore, the relatively small width and deep depth are the significant characteristics of the building<sup>1</sup>. They are mostly 2 to 4 floors, and the front part of the ground floor is the arcade colonnade, the back is the shop. A building with more than two floors will be residential. The frontage facade treatment is a Western style or a combination of Chinese and Western

style, which is commonly known as the “foreign style storefront”.

The arcade buildings are generally built side by side, so that a continuous arcade colonnade and a facade along the street can be formed. This is the arcade street. Because the arcade street allows pedestrians to avoid wind and rain during the walk, it is especially suitable for the subtropical climate in Lingnan. In addition, the shops in the arcade can take

1 Gao, Haipeng. "Arcade-house and Arcade-house Street in Guangzhou - the research of historical development and conservation." Master's thesis, Xi'an University of Architecture and Technology, Sep. 2003. Page 21.



Fig. 5.40  
Main City Road  
Between  
Two Arcade  
building group  
Source: Made by  
authors

advantage from the colonnade space to open the pavement and display the goods to attract customers.

The arcade buildings usually are 2-4 floors, some building will reach the

number of 5-6 floors. The height of the ground floor is generally 4-6 meters, the width is 3-5 meters, and some are small and narrow which is only 2-3 meters in width. There will be some very big with the width in 6 meters, which will usually

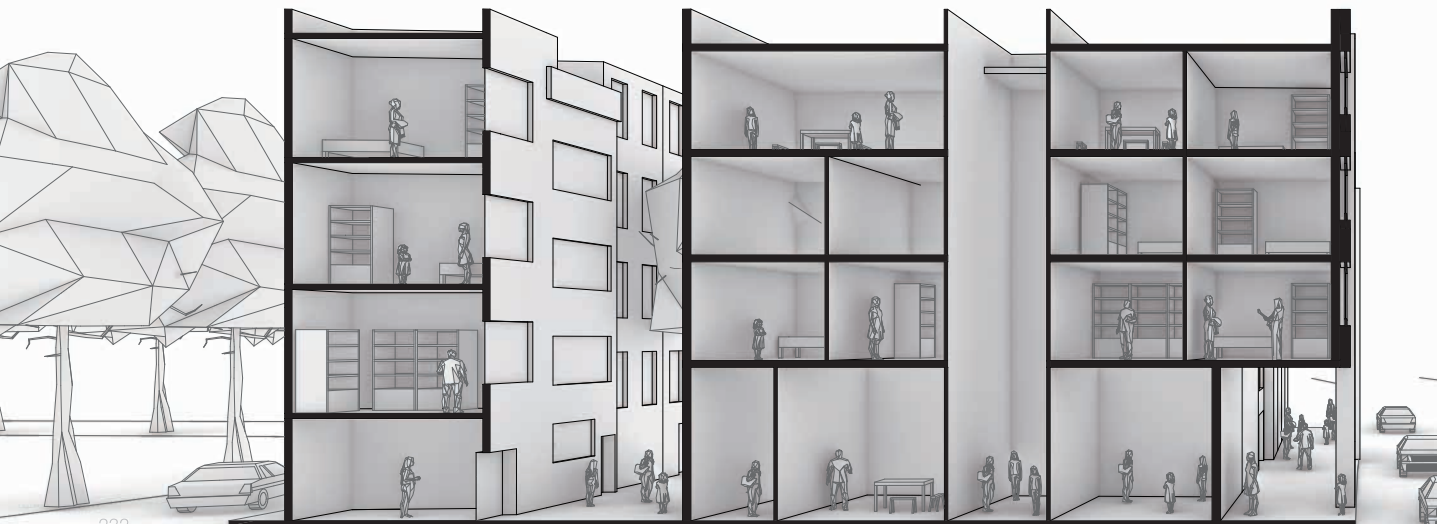




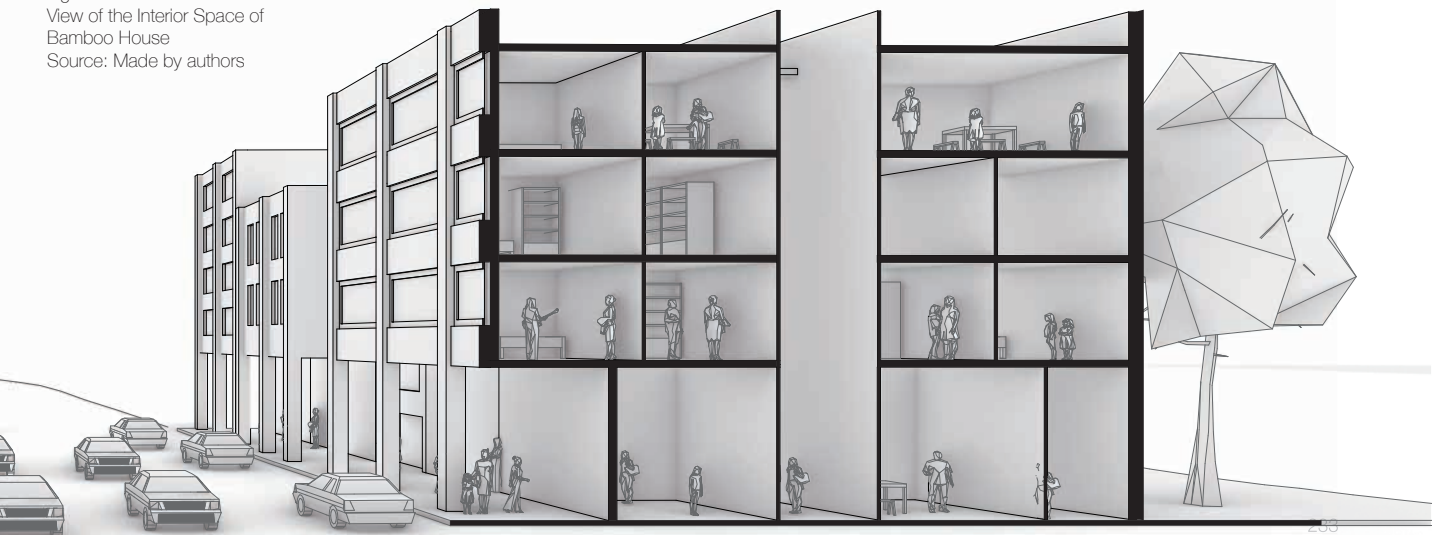
Fig. 5.41  
Street View of Arcade building group  
Source: Made by authors

pair with the large depth is generally reaching 10-20 meters, and some can even reach 30-50 meters.

There are stairs setting inside the building sometimes cooperate with the patio

space as a stairwell. After that, in order to save more space for living area, two family next to each other will has one stair set used together making the bamboo house in parallel form.

Fig. 5.42  
View of the Interior Space of Bamboo House  
Source: Made by authors



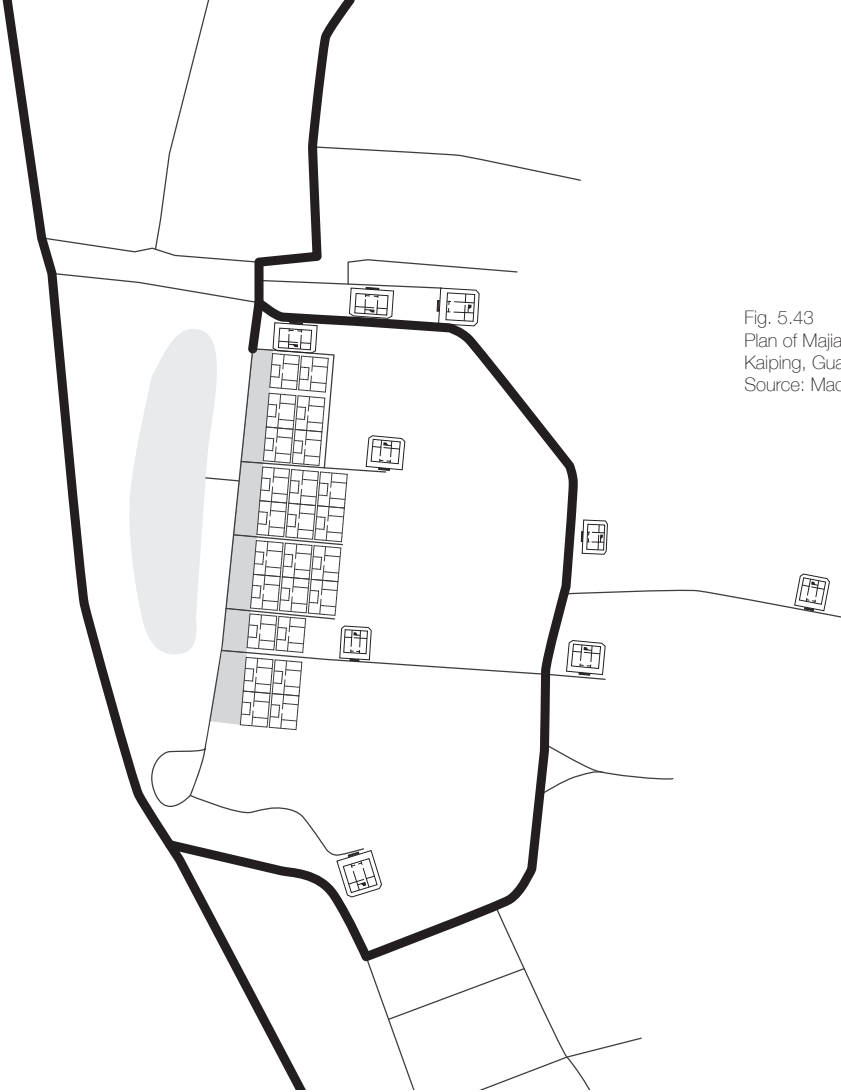


Fig. 5.43  
Plan of Majianglong Village  
Kaiping, Guangdong  
Source: Made by authors

## Diaolou

The traditional village houses in Kaiping used the three-bay-two-corridor style, which belongs to the Linnan Region. It involves the construction of one or two rows of houses with a width of 3 bays as well as an open patio in the front of the middle bay. According to the three types of functions, Diaolou, the watchtower, communal tower and residential tower,

their layout is still the traditional style layout of the three-bay-two-corridor (Figure.5.xx), and the high-rise buildings are stacked in the height direction. Then the form of the lower part of the volume is roughly the same, only the difference of size and dimension and the height of each level.

The big Diaolou, such as the Nanlou of Chikan Township, have seven floors, while



Fig. 5.44  
 Connection between village  
 houses and Diaolou  
 Source: Made by authors

the short Diaolou has only three to four floors, which is no much higher than the average residential building. However, the change in their shape is mainly presenting at the top of the Diaolou tower building. On the top floor, it is cantilevered around, and it is about 80 centimeter wide<sup>1</sup>. It forms an outer-collected cloister. The walls of the cloister and the cantilevered slabs are all chiseled with small trapezoidal holes. People inside the Diaolou can spy the outside, and shoot at the directions in an emergency.

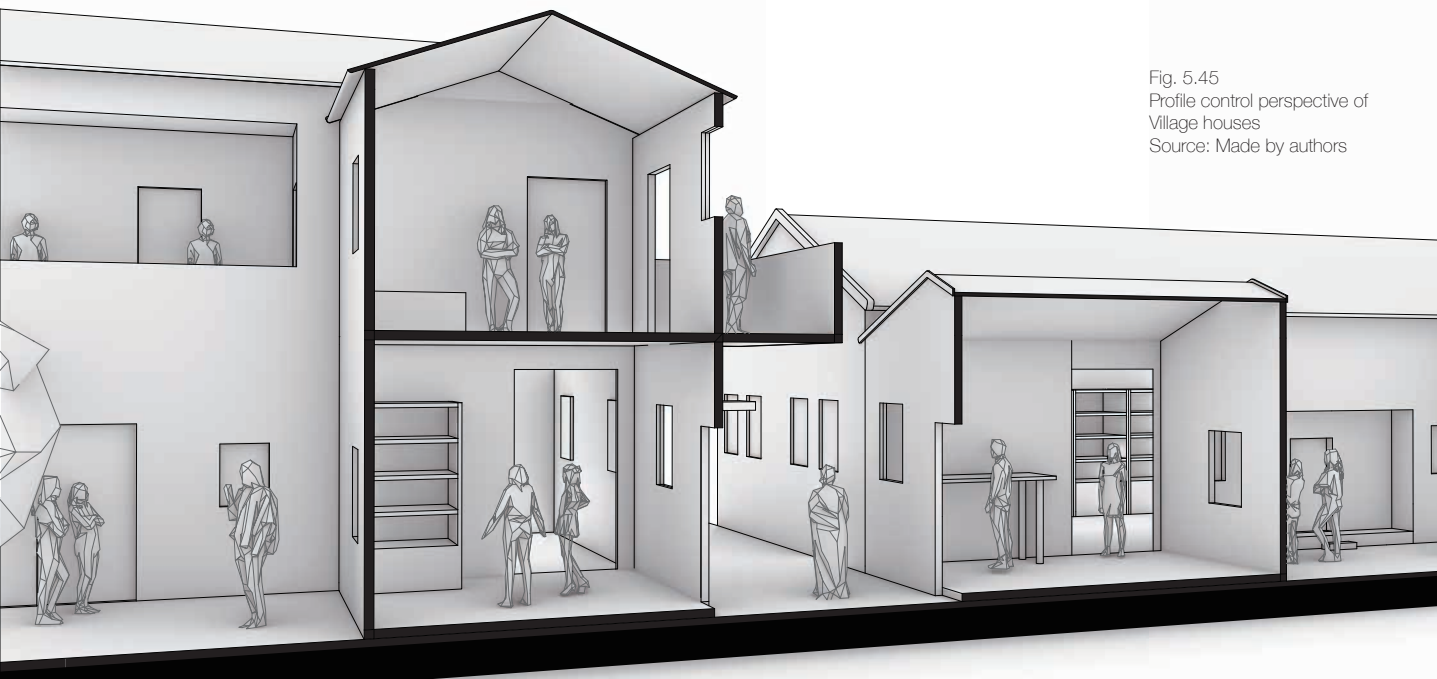
It is the passages and stairwells in the middle in some Diaolou. The rooms are

on both sides which are relatively small. It is built by several households, so each household can get a room on each floor. The ground floor is used for storage and kitchen, the first floor is for food storage and living, and the second to fourth floors are for young people to live and use as guards. Diaolou is usually vacant. Once there is an emergency, or at night, all family members from the elderly to the children go to the Diaolou to ensure safety.

There is sometimes a distance between Village houses and Diaolou, which usually surrounded by cultivated land connecting

<sup>1</sup> Lu, Yuanding, and Yanjun Wei. *Traditional Dwelling in Guangdong*. Beijing: China Architecture & Building Press, 1990. Page 135.

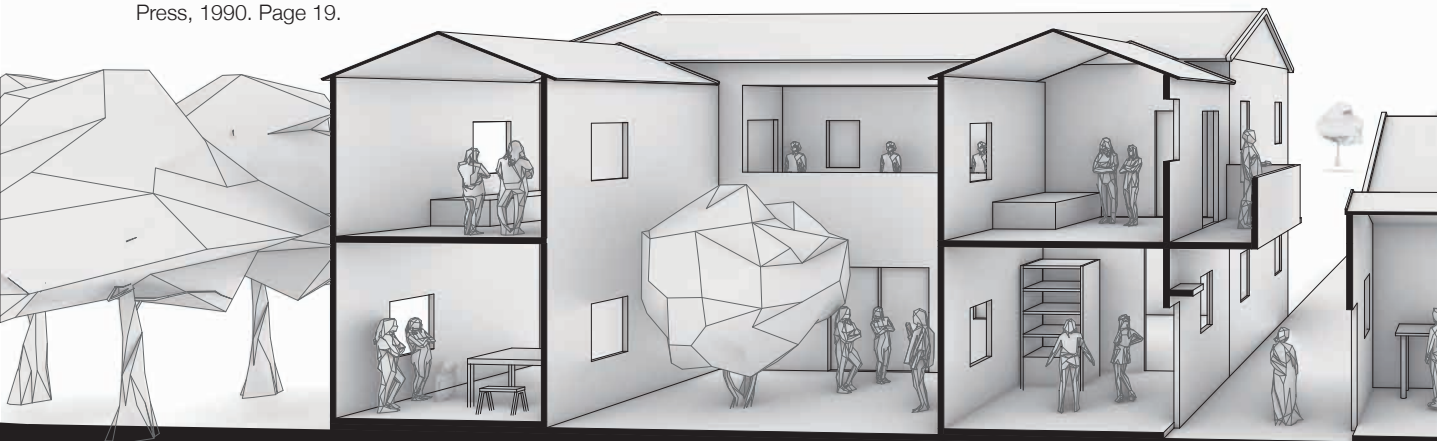
Fig. 5.45  
Profile control perspective of  
Village houses  
Source: Made by authors



with small path. The village houses are arranged in comb pattern layout, which is a traditional and typical type in Linnan Region. Their appearance and plane are neatly arranged like a comb. Most of the houses are courtyard houses (three side is rooms and one side is the wall) (Figure.5.00), and the front and rear buildings have a gap of about 50 centimeters<sup>1</sup> for fire isolation. There is an

alley between the two rows of houses called “Li”, which is connected to the main traffic in the village and entrance of houses are usually facing to the Li to open. The Li is relatively semi-private space providing a intimated distance for people to meet, and also function in adapting to the monsoon to produce cross ventilation for regulating the microclimate of the village.

1 Lu, Yuanding, and Yanjun Wei. *Traditional Dwelling in Guangdong*. Beijing: China Architecture & Building Press, 1990. Page 19.





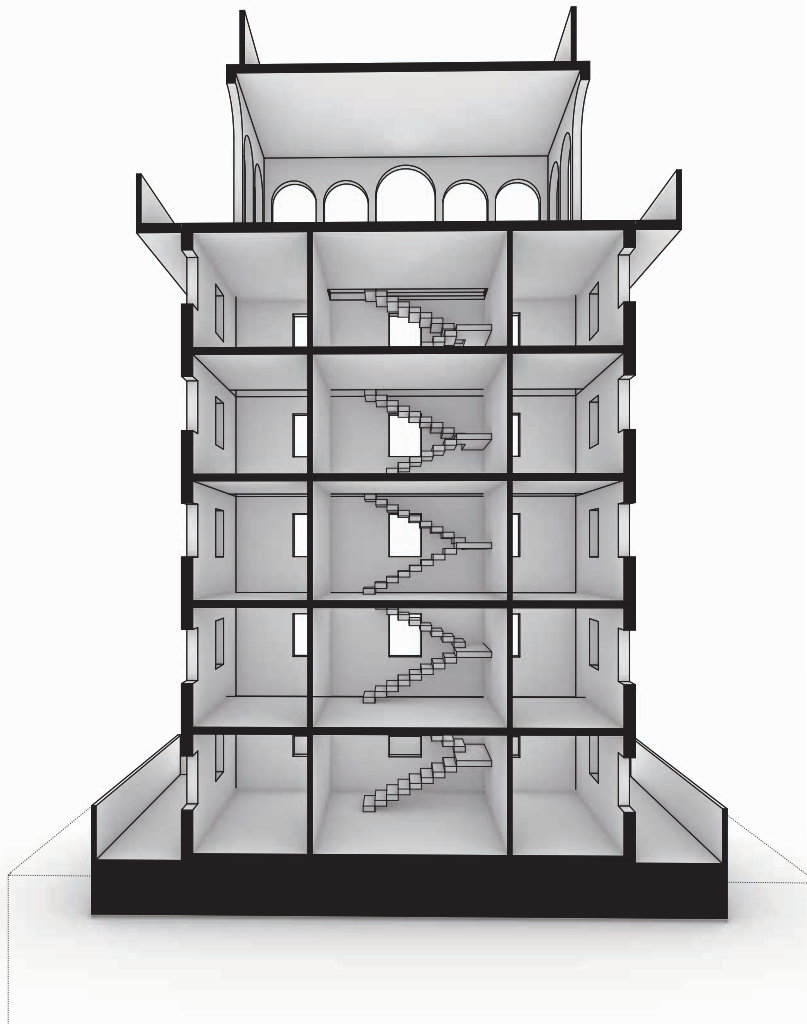
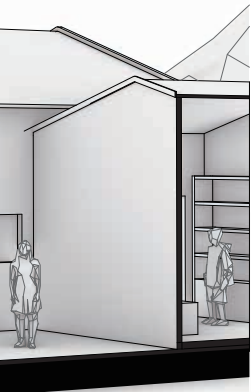


Fig. 5.46  
 Profile control perspective of  
 Diaolou Tower  
 The three-bay-two-corridor Layout  
 Source: Made by authors

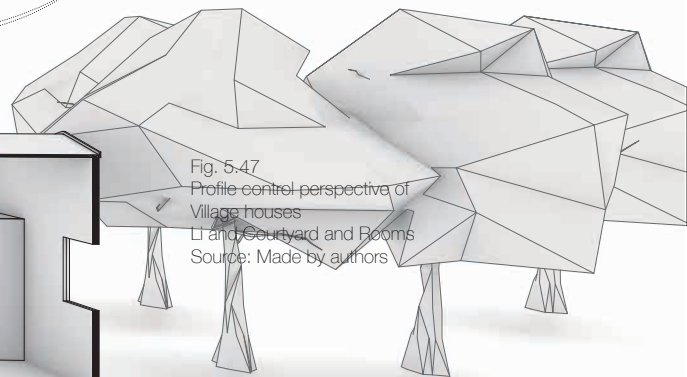
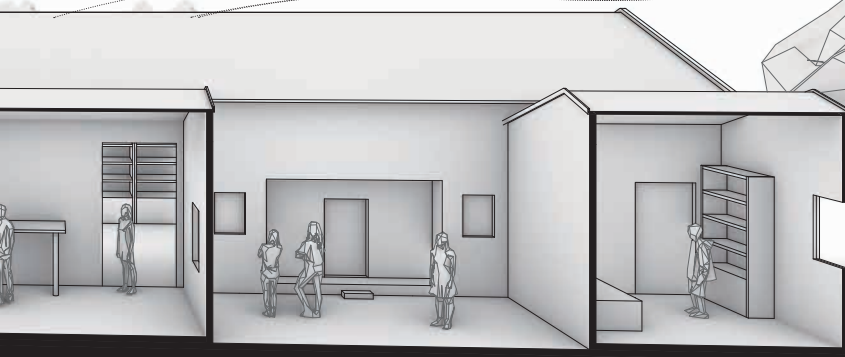


Fig. 5.47  
 Profile control perspective of  
 Village houses  
 U and Courtyard and Rooms  
 Source: Made by authors

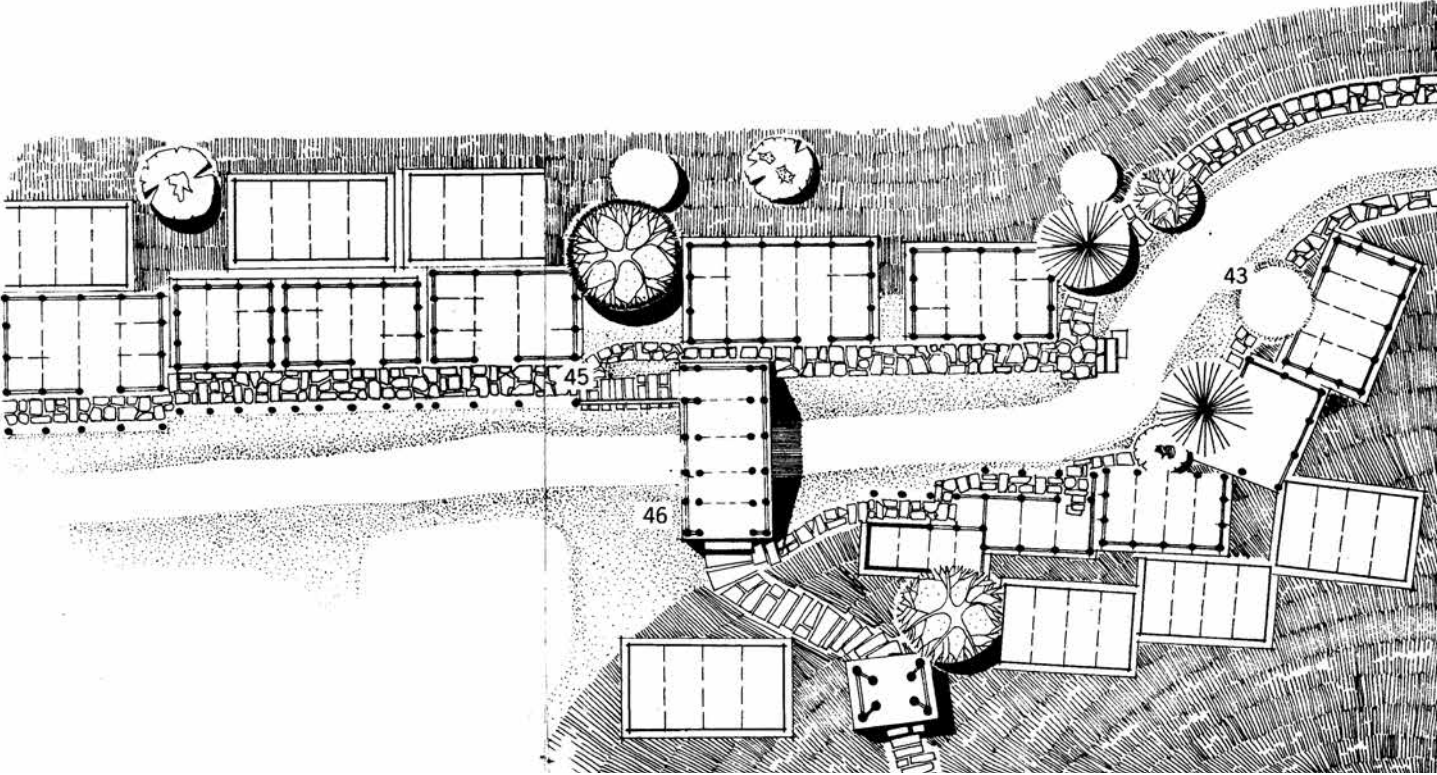


Fig. 5.48  
Plan of Houses Arranged Along River  
Source: Li, Changjie, ed. *Vernacular Architecture in North Guangxi*. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 45.

## Stilt House in Northern Guangxi

The settlements formed by these stilt houses are composed of many different ethnic minorities. Different ethnic habits lead to different living habits and social ways, which have different effects on the layout, spatial form and façade of their buildings. For example, due to the well-organized nationality organization of the ethnic Dong, many social activities are carried out outside the home. This external gathering of social characteristics has prompted the village of ethnic Dong

to establish a huge public building system including the drum tower, wind and rain bridge, stage, and pavilion, which presenting the concentric layout<sup>1</sup>. As for the ethnic Zhuang people, there are social characteristics of internal gathering. Many activities are concentrated in the home. The halls occupy an important position in the interior of the houses in the plane and space. Therefore, the layout of their village of houses is mostly in a freely dispersed form.

The fire pit of the stilt style dwelling house

<sup>1</sup> Li, Changjie, ed. *Vernacular Architecture in North Guangxi*. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 26.



Fig. 5.49  
House Along River  
Source: Made by authors

is one of its important features. It located in the center of the living room of the house. It is the kitchen of the home and also a family activity center, an important place for living, and a place to entertain guests. For example, especially for the culture of ethnic Zhuang people, as a social center within the family, it has a lofty position.

The stilt style housing that adapts to the climatic environment and geographical environment is the second important feature. These houses are generally

built to be very good ventilating so that they can easier to dissipate the hot air in time in the summer, so they often have a platform for outward picking. The underlying overhead features a rich space, such as a gallery-style passage (Figure.5.XX), combined with a variety of terrain, and the spatial sequence is open and closed switching. Besides, the overhead ground floor is open space, where sometimes it can become a place people can meet and chat and doing the processing work of agricultural products together. Another characteristic of stilt



Fig. 5.50  
View of the Path in Village  
Source: Made by authors

house which need to be mention is its construction of roof. In order to prevent rainwater erosion to the wooden structure of the house, and protect the wall, the roof is made of about 30 degrees of blue tile slope<sup>1</sup>, long

overhang eaves or layered eaves towards outside, setting up waist eaves or double eaves. The hot and rainy weather makes

1 Li, Changjie, ed. Vernacular Architecture in North Guangxi. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 10.

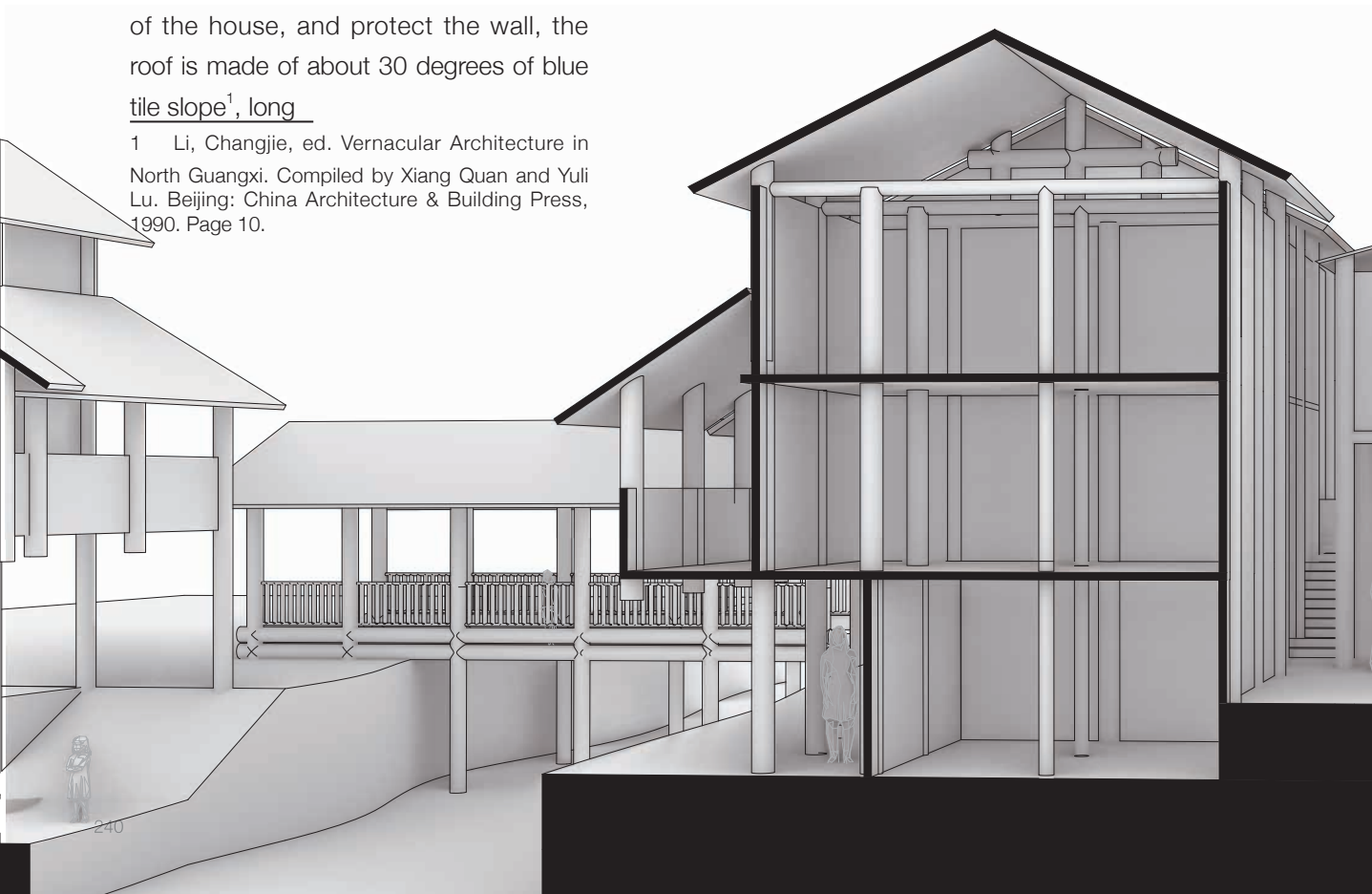
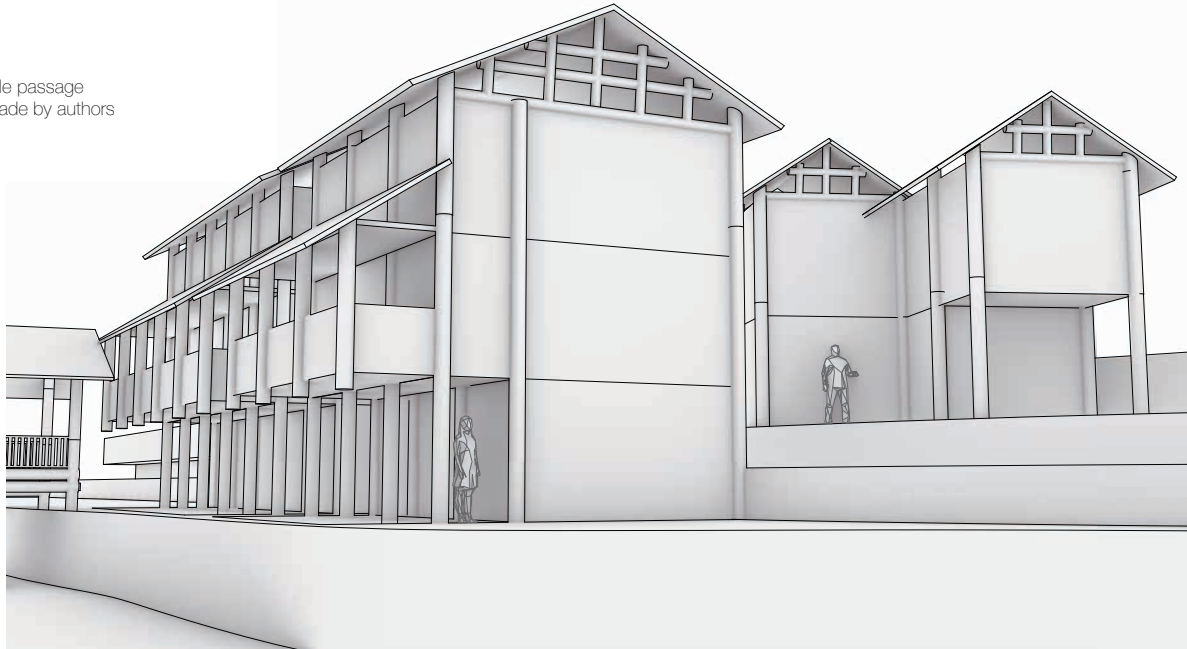


Fig. 5.51  
 Gallery-style passage  
 Source: Made by authors



the houses be built with more open spaces, and air running through indoors and outdoors, but the bedroom only opens small windows to reduce the entry of cold air in winter, achieve the purpose

to persist coldness. And the stilt house is famous of flexible to adapt the terrain, which usually extend on its width, being parallel to control line, or deal with the steel ground by digging, filling and building method then locate the house being perpendicular to control line. If they meet the gentle slope, they will move the house towards in order to get more space on ground floor.<sup>1</sup> They also have a variety of clever ways to introduce the water from the surrounding rivers into the villages and farmland, while leaving fire-proof spaces between the various timber-framed houses, and constructing ponds for water access in the event of fire, and using in fish ponds in ordinary days.

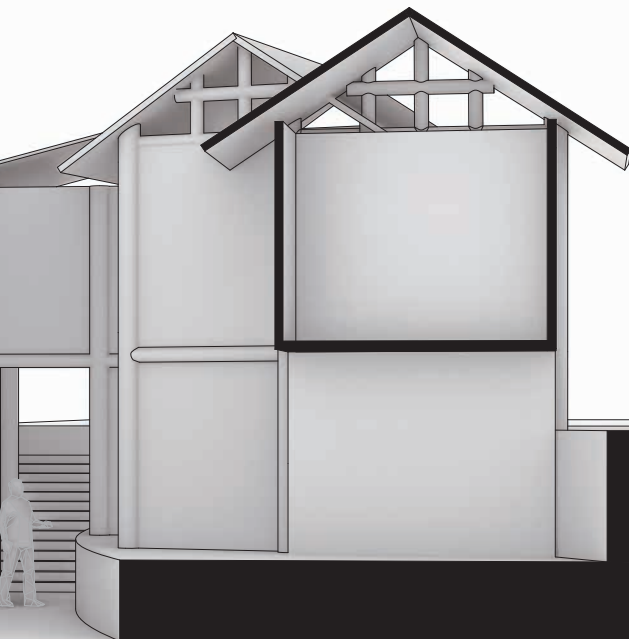


Fig. 5.52  
 Variety of terrain  
 Abundant Type of  
 Country Road  
 Source: Made by authors

1 Li, Changjie, ed. Vernacular Architecture in North Guangxi. Compiled by Xiang Quan and Yuli Lu. Beijing: China Architecture & Building Press, 1990. Page 366.



Fig. 5.53  
Plan of Tulou  
in Yongding Village  
Source: Made by authors base  
on relevant material

## Tulou

The overall spatial design of the Tulou is that it is stacked upwards from the inside, and each floor is divided into many room space one by one. The layout mainly has two forms: the inner corridor or the unit. The inner corridor type is a corridor on the inner side of each floor facing the courtyard. Along the corridor, people can circle the courtyard. Each room in the entire building has a door which is directly

connecting with the corridor. While the unit type, there is no horizontal corridor to connect the rooms, but each has a whole independent unit from the bottom to the top, connected by stairs, and each has a portal in the center of the courtyard. Neighboring houses are not connected, but most of the houses where the same family with same surname are living together, so the interconnected inner corridors form is dominant type.<sup>1</sup>

<sup>1</sup> Wang, Qijun. *Vernacular Dwellings, in Chinese Ancient Architecture*. Beijing: China Electric Power Press, 2008. Page 132-133.

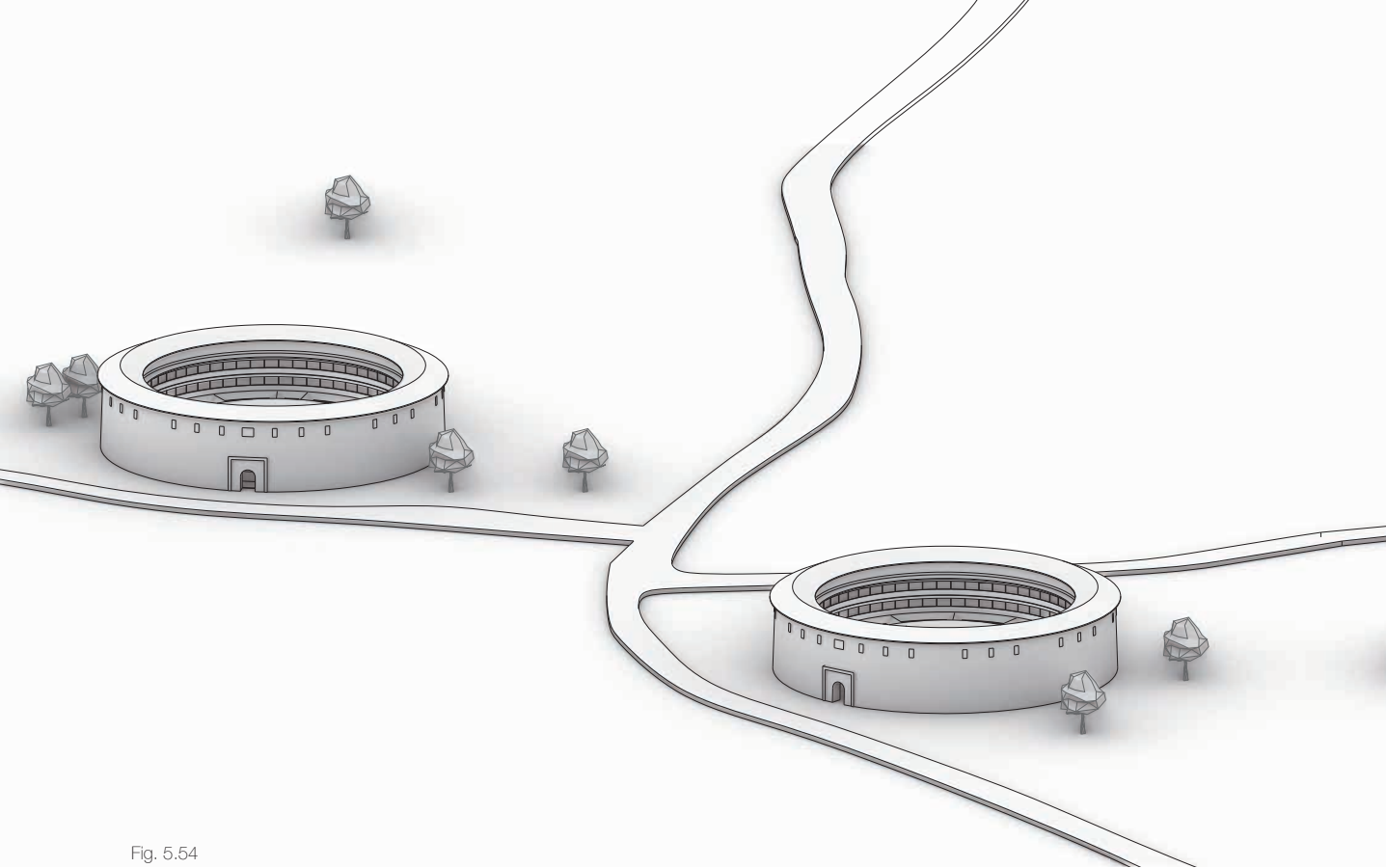


Fig. 5.54  
Perspective view of Tulou  
in Yongding Village  
Source: Made by authors  
base on relevant material

The ancestral monumental halls are usually located in one of the lower floors of the inner end of the central axis, or built in the center yard.

The round building is a kind of house with extremely strong centripetality. All rooms are facing the center of the circle. There is an open public courtyard in the center, which is shared by all residents. It is in the form of a private layout for the outer ring and a public inner ring.<sup>1</sup> The

courtyard is advantaged and convenient for leaving. There allocated the public well for residences and it is an appropriate ground to dry the crops under the sun. Moreover, it is public open space for families activities, which is conducive to enhancing cohesion of the big family. However, the design of central courtyard depends the need of the people which are not always the same, for example, there will be full of facilities in the center without a large dimension courtyard.

<sup>1</sup> Li, Qianlang. *Axonometric of Chinese Building*. Guilin: Guangxi Normal University Press, 2009. Page 300.

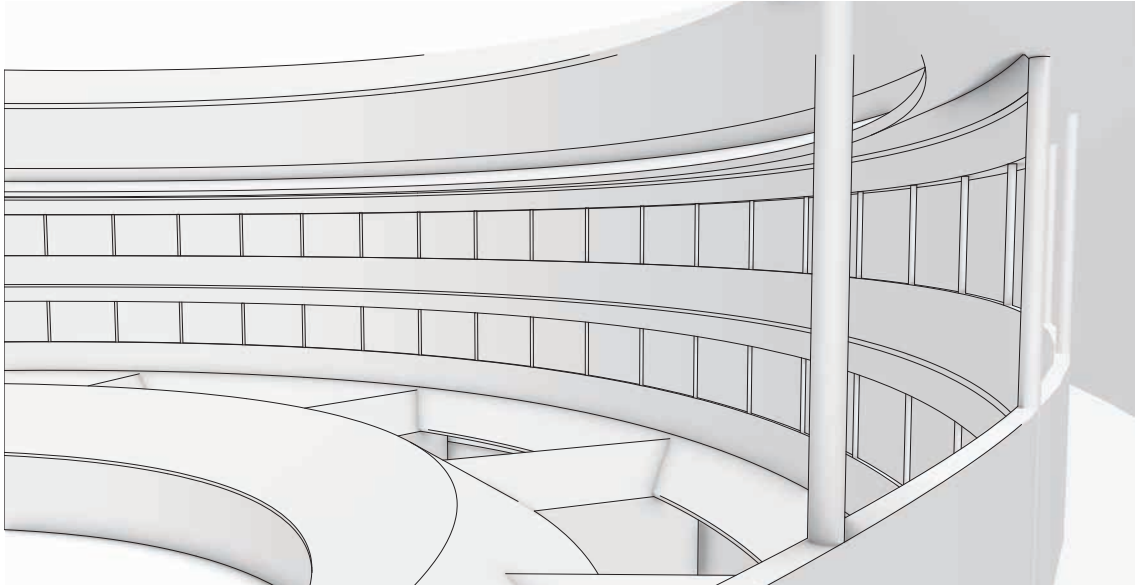
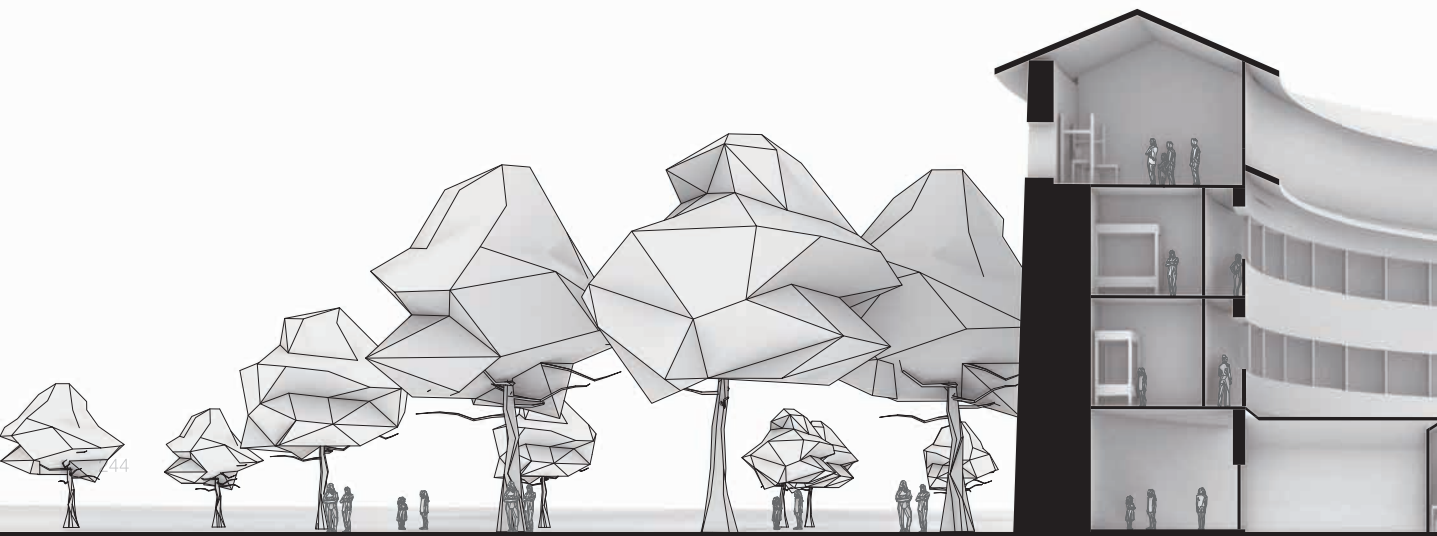


Fig. 5.55  
View of the Corridor of Tulou  
Source: Made by authors

The theory of Feng-shui has received much attention. It has affected the orientation of the round building. In some areas where the terrain is limited, in order to cope with the orientation of the auspicious in that certain year, the situation might not be favorable to the living conditions, which present the ethnic Han people are influenced a lot by the

etiquette system thoughts of hierarchy society.

The corridor of Tulou formed a special characteristic which we can take its continuous (Figure.5.00) form as a vernacular element of Chinese dwelling. It can not only be used in the unit housing, but also the functional spaces which need





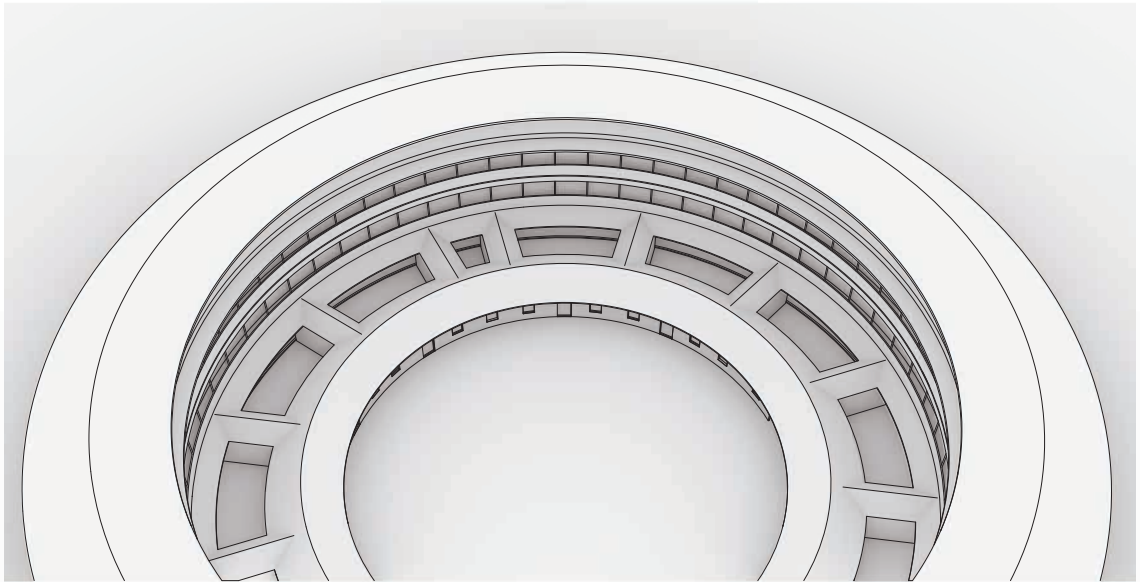


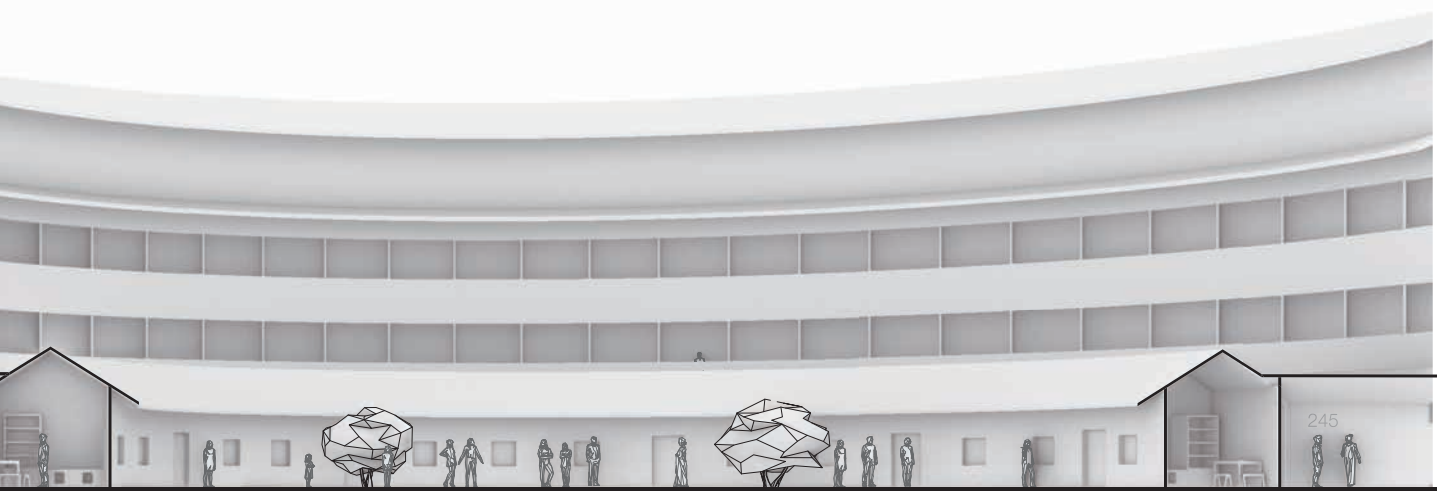
Fig. 5.56  
Aerial view of Courtyard in Tulou  
Source: Made by authors

to be interact with each other. The large volume of architecture can have flexible inner space arrangement by using the idea of the corridor in Tulou, creating the space of Chinese form for people to experience or to preserve the vernacular elements.

The courtyard space (Figure.5.56) also

inspire us to think about the transition of publicity and privacy of space between the interior and the exterior of a building, and the interacting indistinct area could be interesting or contradictory, in order to decide the extent of proximity between people.

Fig. 5.57  
Profile control perspective of Tulou  
Source: Made by authors



## Abstraction of Lingering Garden

Lingering Garden is a renowned classical Chinese garden. It is located at 338 Liu Yuan Rd. Suzhou, Jiangsu province, China. It is recognized with other classical Suzhou gardens as a UNESCO World Heritage Site. In 1997, the garden, along with other classical gardens in Suzhou, was recorded by UNESCO as a World Heritage Site.<sup>1</sup> The masterplan of Lingering Garden is showed above, we try to underline principle visiting route of Lingering Garden as the

Nolimap process to present how richness of moving it is. The Lingering Garden combines the art of Jiangnan garden art, especially the division of architectural courtyards and the combination of garden spaces. It is divided into natural landscape in the central area, northern area is mainly about the countryside style. The western area focuses on diversity of plants, but eastern area shows its exquisite work of stone stacking. In Lingering Garden, most of buildings in the southeast are built adjoin to pool. pavilions, halls and multi storied buildings which are producing amazing inverted image on the pool nearby. Elegant corridors are going to

invite you shuttle in various pavilions with fresh air and gentle sun light. the Southern Song Dynasty were concentrated in the Yangtze River Delta and the Pearl River Delta. Since the gardens in the three regions have different styles, we often divide the Chinese gardens into northern gardens.

Afterwards, when you pass through the Linqun Shuo Shuo Pavilion, then you arrive at the northeast corner of the garden. The plan of this area is shown above. The Huan Yun pool is surrounded by two pavilions and two multi-storeyed buildings which are Guan Yun building and Jiaqing pavilion. Through the sections we presented, it is obvious that the courtyard planning provides diversiform natural scenes no matter which building you are looking at from the opened gallery. Exquisite rockery is communicating with organic shape pool, alternation of green plants and water create a fascinating courtyard.

All in all, classical Chinese garden has deducted a dynamic relationship between internal space and open space, that could inspire us there is a possibility to realize a distinctive Chinses open space applied on modern cities nowadays on this land.

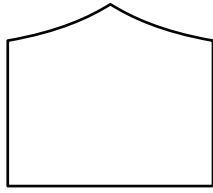
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<sup>1</sup> Congzhou Chen. *Chinese Garden Appreciation Dictionary*. East China Normal University Press, Shanghai. December, 2000. Page 22.

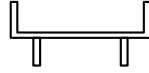
Fig. 5.58 Key Elements of Lingering Garden (Section)



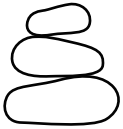
Corridor



Pavilion



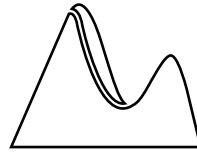
Curved Bridge



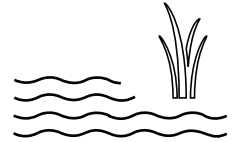
Stacked Stone



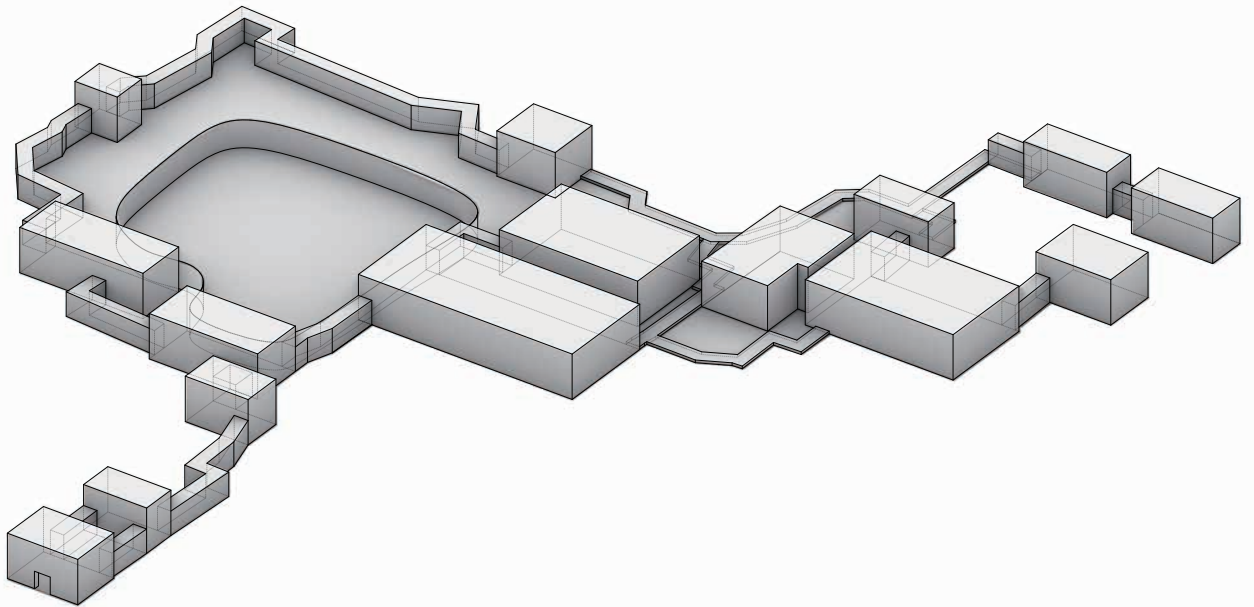
Vegetation



Rockery

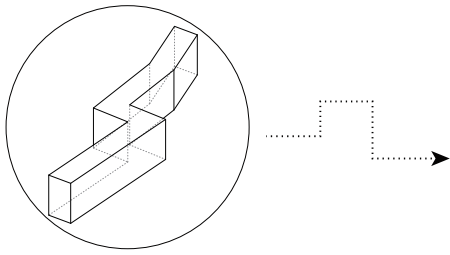


Pond



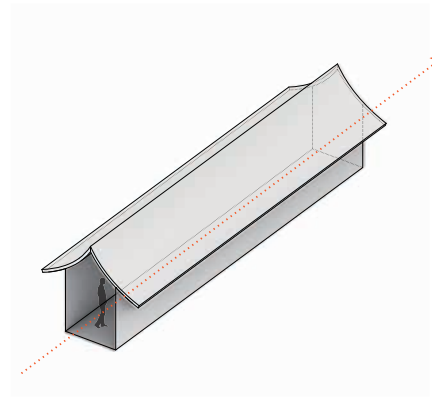
Geometrical Simplification of Lingering Garden

Fig. 5.59 Analysis of Moving Space in Lingering Garden

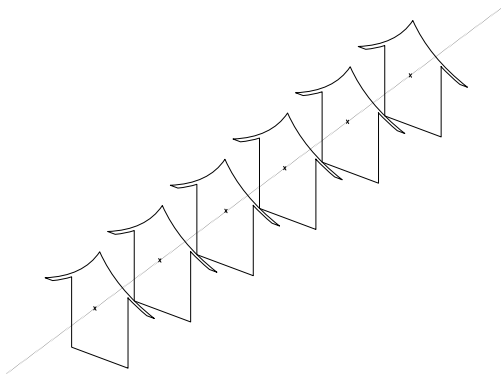


Space for Moving

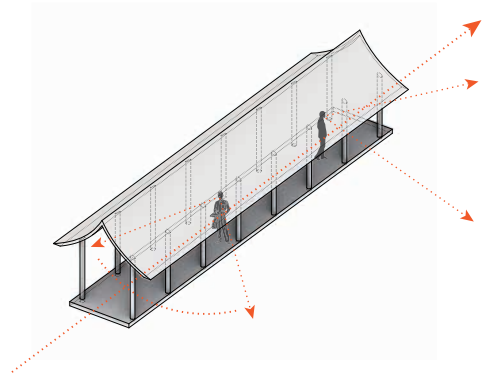
Circulation



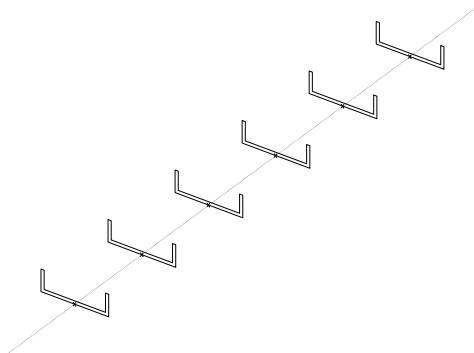
Corridor with wall structure



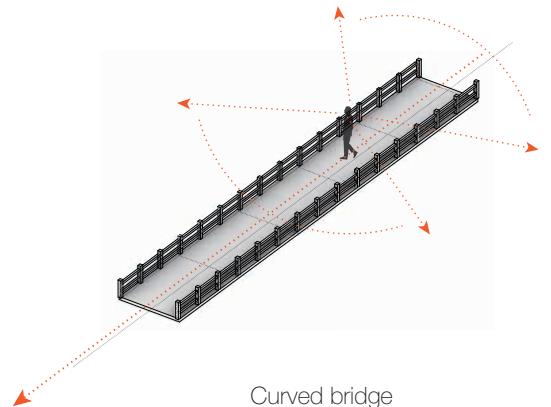
Linear System Corridor



Corridor with light structure

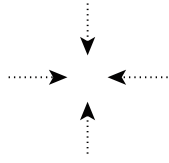
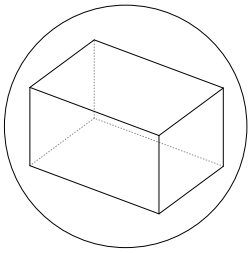


Linear System Path



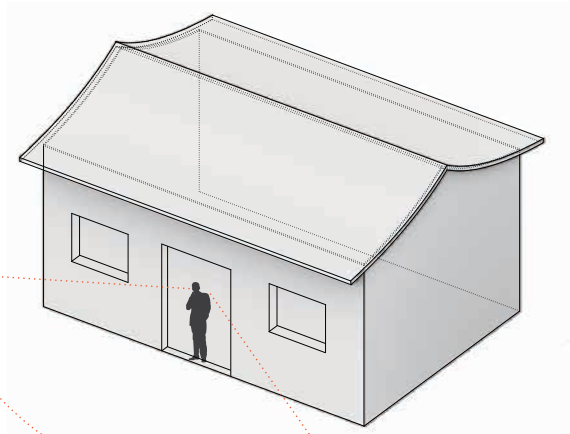
Curved bridge

Fig. 5.60 Analysis of Standing Space in Lingering Garden

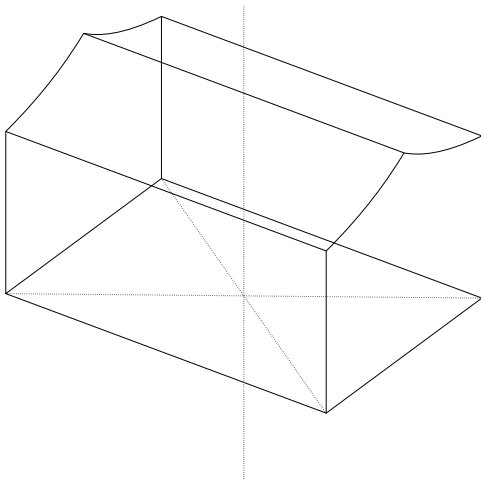


Space for Staying

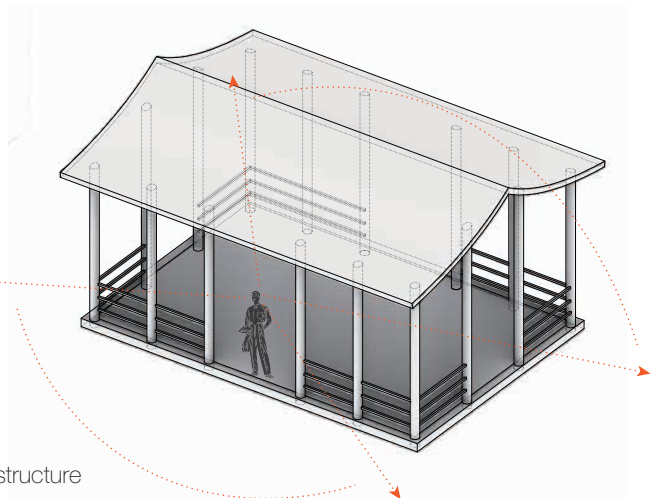
Gathering



Pavilion with wall structure



Centripetal System Room



Pavilion with light structure

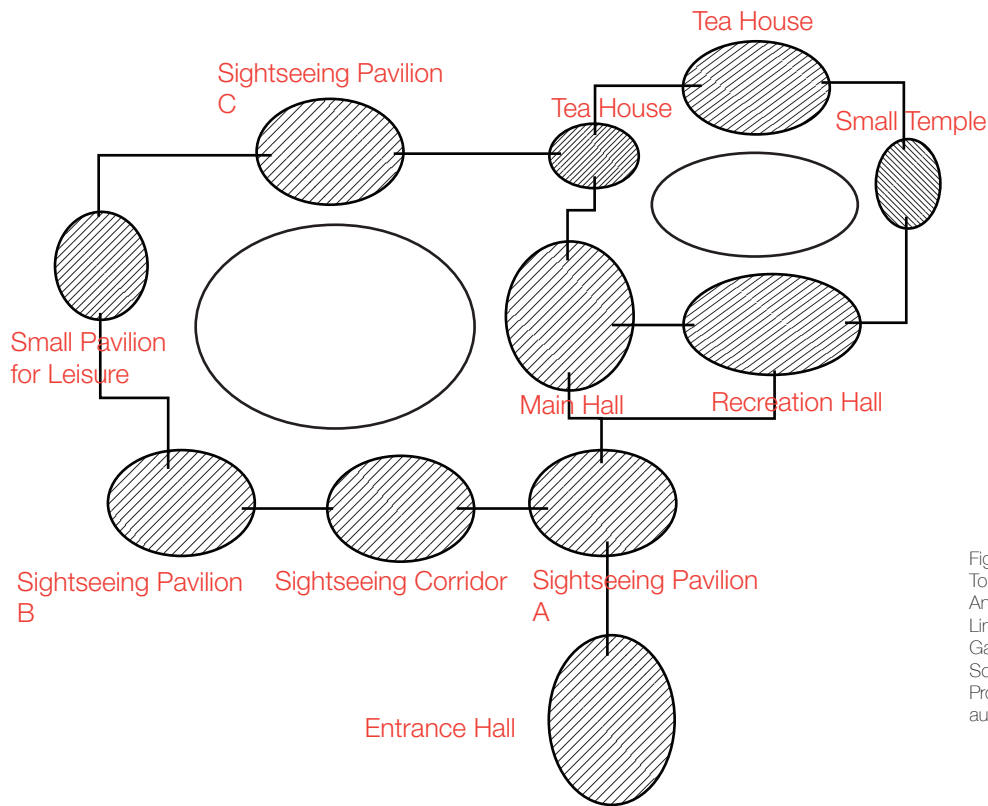
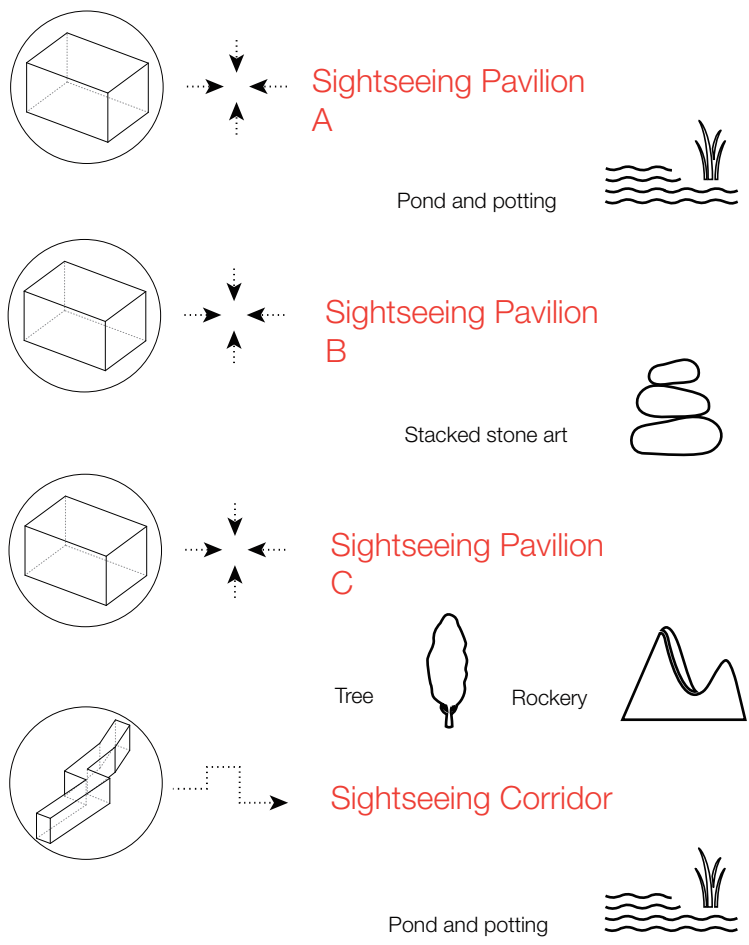


Fig. 5.61  
Topology  
Analysis of  
Lingering  
Garden  
Source:  
Produced by  
authors

In our lives, the relationship between indoor space and outdoor space of a typical building is usually as shown in the above scheme we made. The ideology A describes the interior space is located in the centre and it is always surrounded by open space out ring. The layout generated by ideology A has these features: 1. Centralized layout; 2. Geometrical open space; 3. Manicured plants and last is Massive volume. Different from ideology A, ideology B reflects the balance in Chinese traditional thought. And this balance is

not equal to half of each. It emphasizes the dynamic integration between interior space and open space. As you can see from our diagram, the feature of layout coming from ideology B are listing as following: 1. Free combined layout; 2. Dynamic open space; 3. Natural plants 4. Small but multiple volumes. We think that is quiet clear to distinguish the different architectural philosophy of Chines Garden from the common architectural ideology, the abstraction with functional indication. Originated from traditional Chinese

Fig. 5.62  
 Spatial nature  
 induction  
 in Lingering  
 Garden  
 Source:  
 Produced by  
 authors



material, but use western method to deconstruct the architectural information in this painting helped us improve our analysis became much more relevant. We would continue to use this integrated method to go further study deeply. Because in our opinion,

eastern architectures are complicated for the people who does not understand Chineseradition and culture. But they are all architecture, so we can use the geomatical methods which we use in the whole world to interpret our typical architecture in a common language.

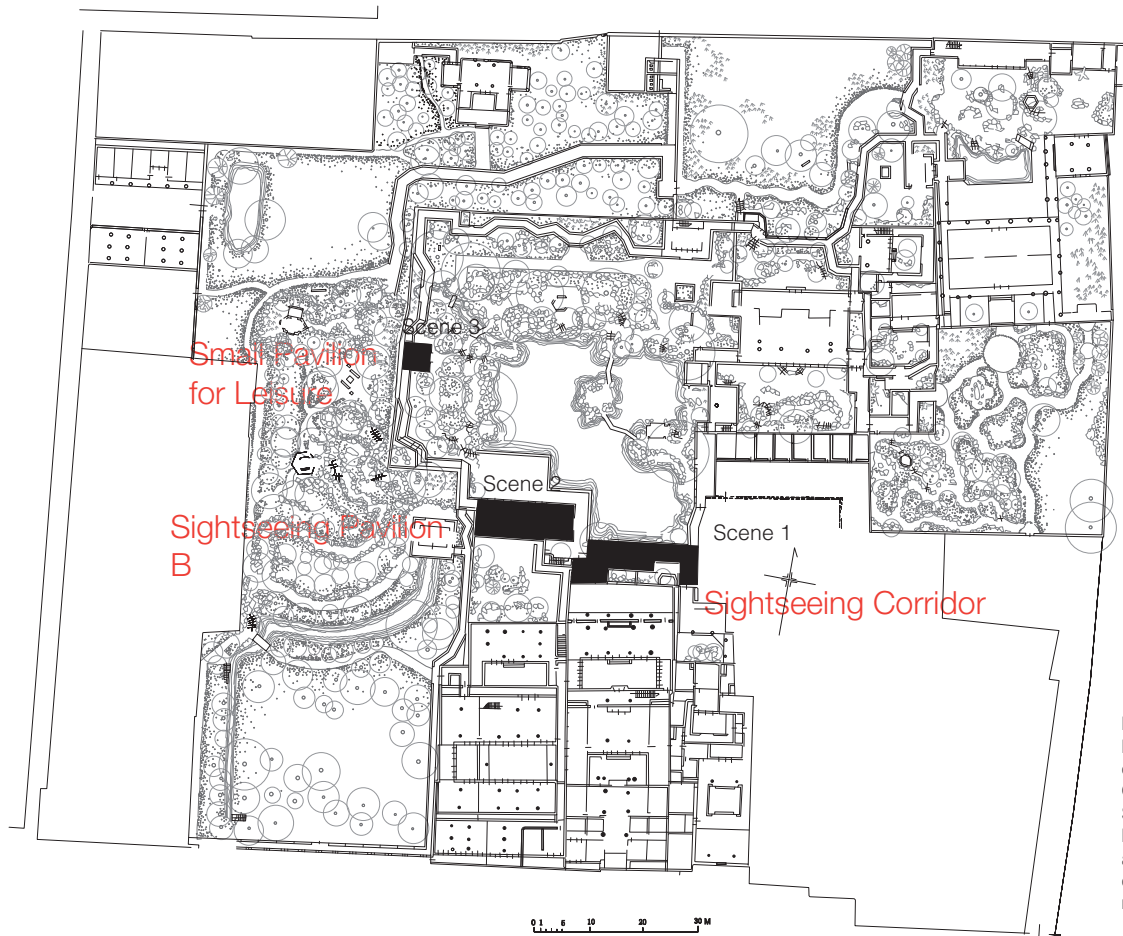


Fig. 5.63  
Masterplan  
of Lingering  
Garden  
Source:  
Produced by  
authors based  
on relevant  
materials

Now we are showing several interesting and representative cases to introduce the specific spatial treatments in Chinese garden. First is the Humble Administrator's Garden, is a Chinese garden in Suzhou, a UNESCO World Heritage Site and one of the most famous of the gardens of Suzhou. The Humble Administrator's Garden is Covering an

area of about seventy two acres,<sup>1</sup> it is the largest classical garden in Suzhou. The entire garden can be roughly divided into three areas: eastern yard, central yard and western yard. One is done indoors and the other is outdoors. In order to adapt to different needs, human beings not only need to build houses, but must also create suitable external space.

1 Congzhou Chen. *Chinese Garden Appreciation Dictionary*. East China Normal University Press, Shanghai. December, 2000.



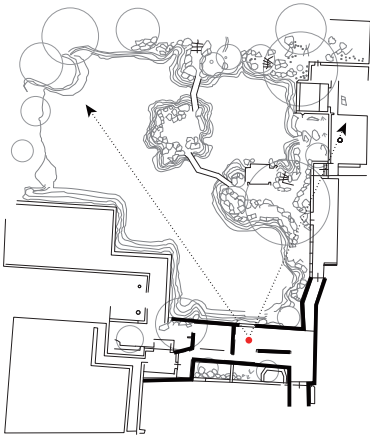


Fig. 5.64 Viewpoint A



Fig. 5.67 Framing scenery from Viewpoint A

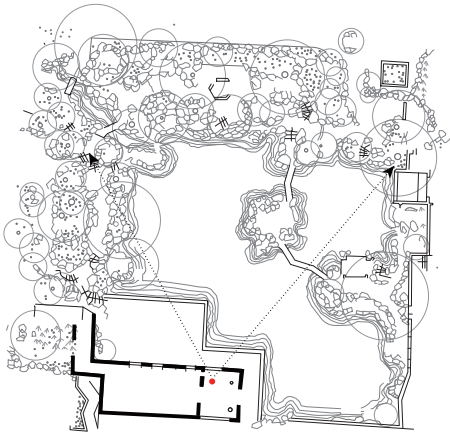


Fig. 5.65 Viewpoint B



Fig. 5.68 Framing scenery from Viewpoint B

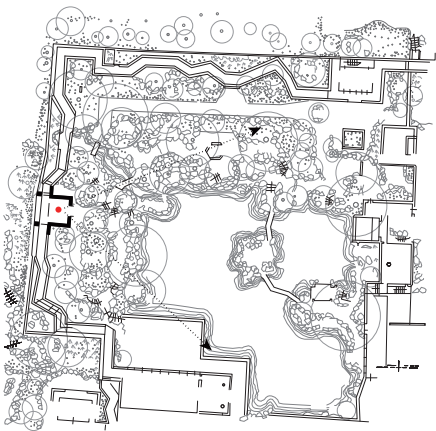


Fig. 5.66 Viewpoint C



Fig. 5.69 Framing scenery from Viewpoint C

All in all, classical Chinese garden has deduced a dynamic relationship between internal space and open space, that could inspire us there is a possibility to realize a distinctive Chinese open space applied on modern cities nowadays on this land.

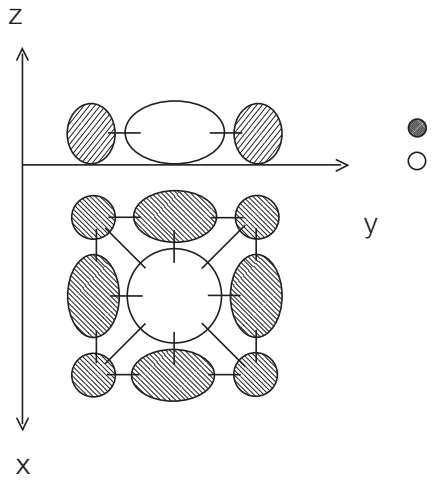
3

Abstraction from  
Vernacular Dwelling  
and Chinese Pagoda

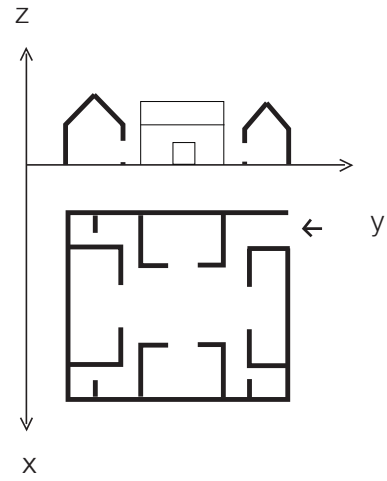
The methodology in the stage are focusing on the simplification from realistic architectural form. We have abstracted geometrical volume from realistic Chinese architecture to have a visualized and understandable sense about vernacular architectures in China. In order to let people who is not familiar with Chinese architectures' background. Firstly, we are going to introduce the concept of topology, the analysis of spatial organization is an important procedure before we study the architecture. Depending on drawing all topology diagrams to classify various spatial organization for all types of dwellings and pagodas. Secondly, drawing the typology schemes for each target architecture helps us to learn the various concepts for their layout and representative characteristics through their sections. As consequence, coming with morphological analysis demonstrates our goal for collecting complete information from these vernacular architectures' envelopes. The nuclear step is about geometrical simplification from complex traditional buildings. we call it as abstraction, which mean we abstract the spatial essence from complex skins. And it is magnificent that obtain these abstracted models for comparing differences from these prototypes in a common analytical language.



Fig. 5.70  
Beijing Quadrangle Dwelling



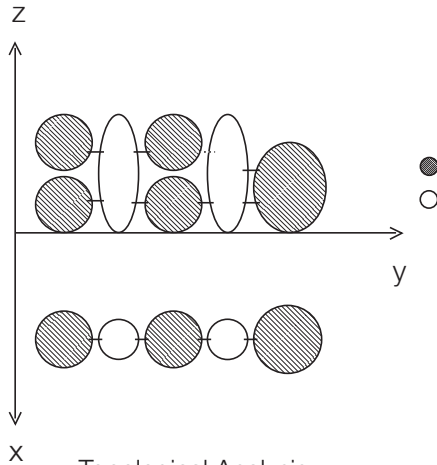
Topological Analysis



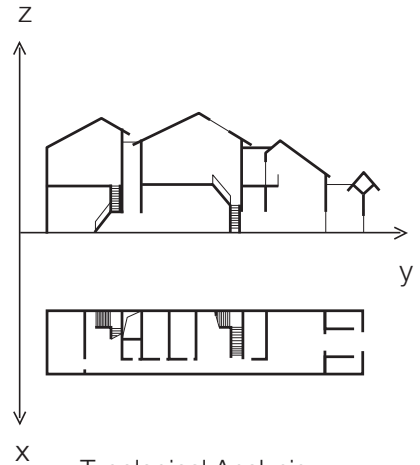
Typological Analysis



Fig. 5.71  
The Bamboo House



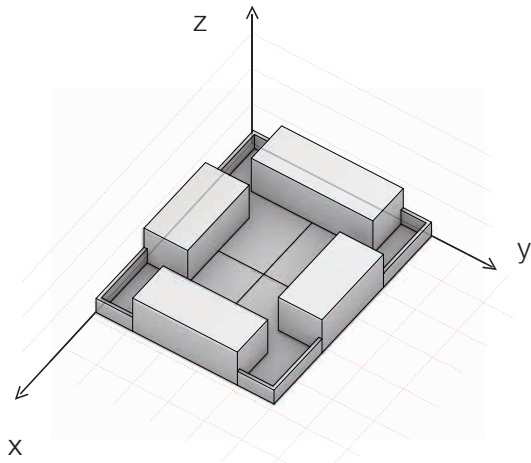
Topological Analysis



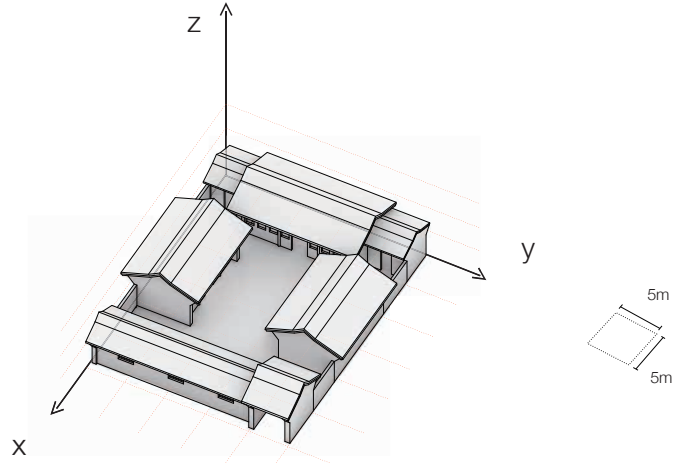
Typological Analysis

The reason why we introducing Chinese Quadrangle dwelling by the typology of Beijing Quadrangle as following is because that many of the traditional dwellings in our country are famous in the form of courtyards, and most of them are quadrangles. Among the many quadrangle houses, the quadrangle

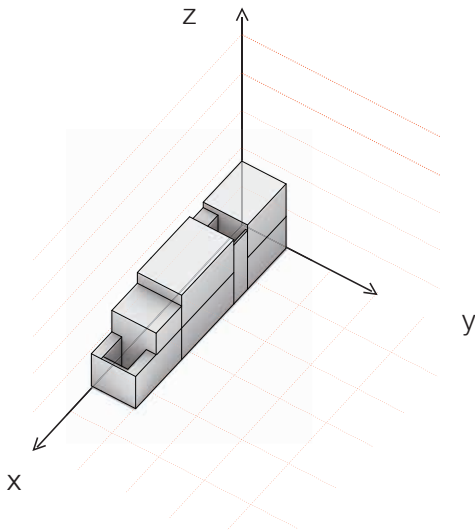
house in Beijing is a kind of typical and voltage. The principle courtyard is not only spacious, but also more square. It is often planted with trees and flowers in the courtyard, for creating a quiet and introverted space. The decoration of the Beijing Quadrangle Dwelling is also more elegant and



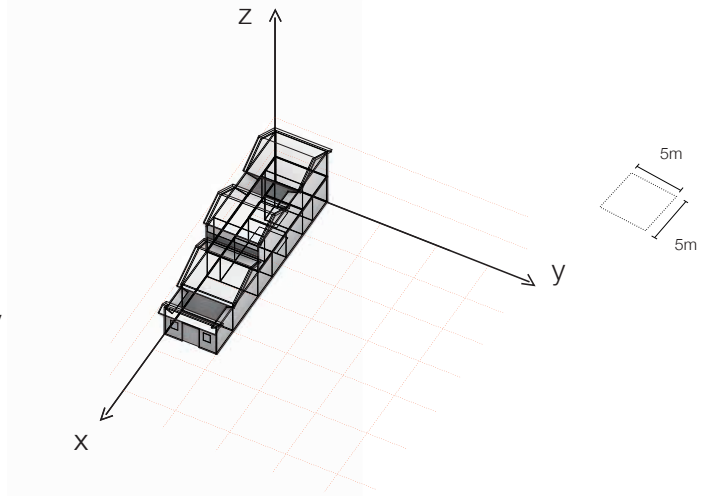
Geometrical Simplification



Morphological Analysis



Geometrical Simplification



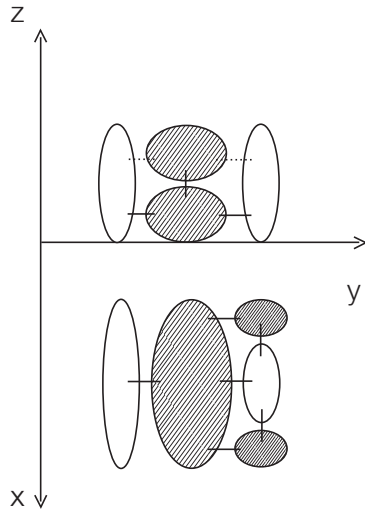
Morphological Analysis

exquisite than other ordinary courtyards. According to the number of courtyards, Beijing Quadrangle has different sizes, from small single courtyards to the multiple courtyards such as horizontal and vertical courtyards. However, having three

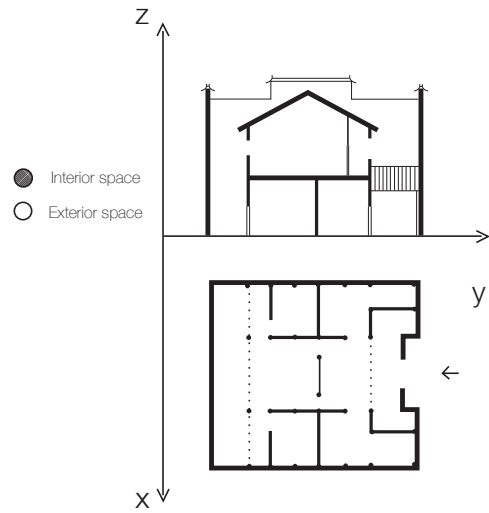
halls and two enclosed open courtyards is the standard form of Beijing Quadrangle. Beijing Quadrangle is a typical form of traditional courtyard-style dwellings in China, and it is also the representative of the residential house in abstraction model.



Fig. 5.72  
Wannan Civil Residence



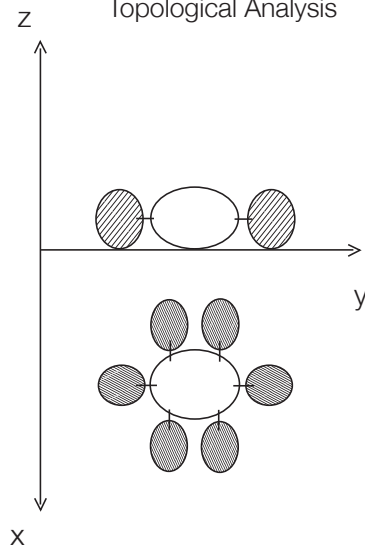
Topological Analysis



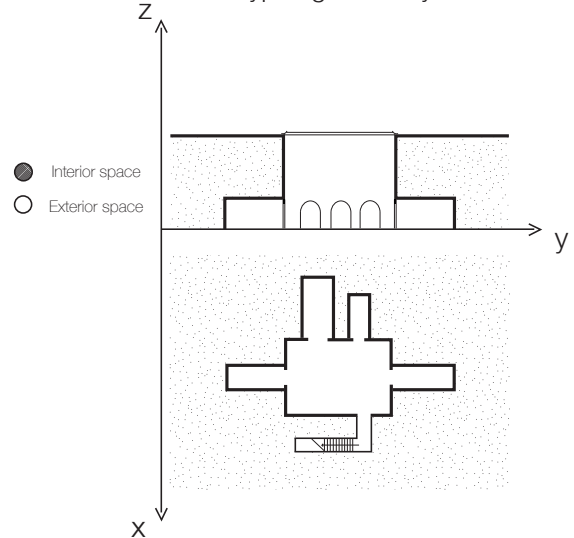
Typological Analysis



Fig. 5.73  
Yaodong Dwelling



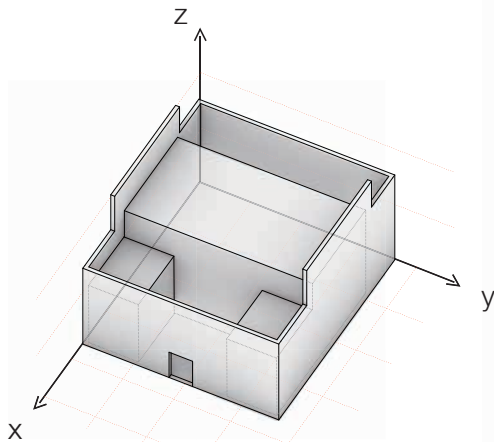
Topological Analysis



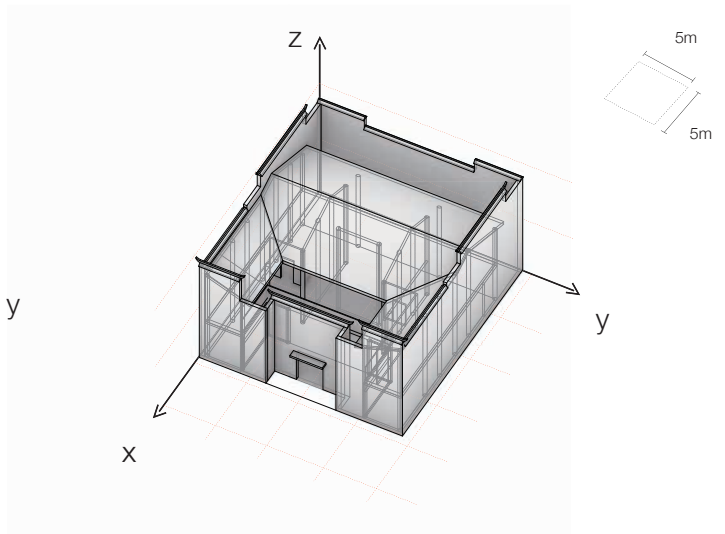
Typological Analysis

In central Guangdong, there were more people and fewer land, which was also expensive, so the depth of the layout of house was increased to save land. Then there was a bamboo house with a narrow width and a deep depth had

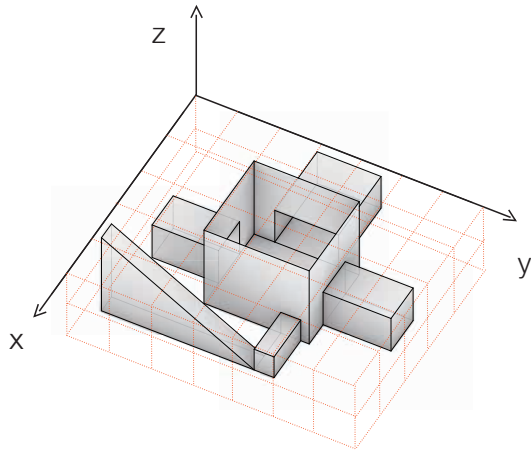
been built, name after its space which looks like a bamboo. The depth will bring problems such as ventilation, lighting, etc. Therefore, the inner patio, the open hall and the corridor are used to solve these difficulties.



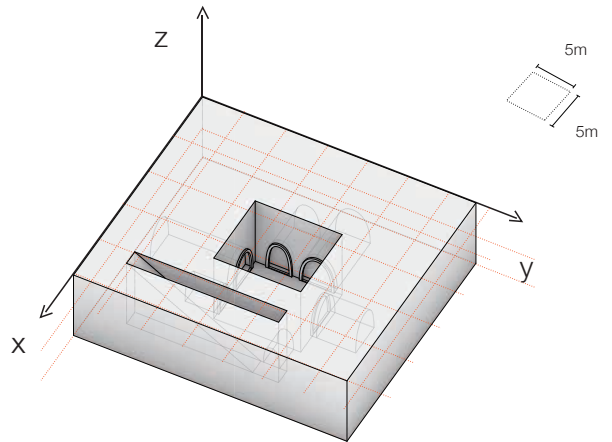
Geometrical Simplification



Morphological Analysis



Geometrical Simplification



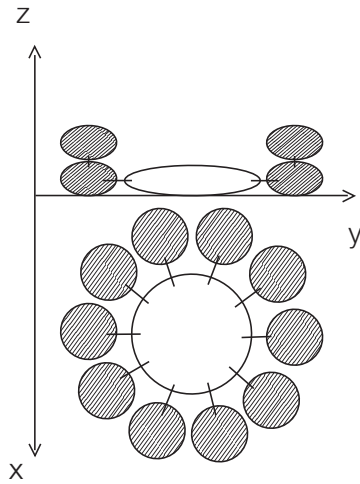
Morphological Analysis

Cave dwellings is a housing based on geographical environment, which are a unique form of dwellings in the Loess Plateau of China, and also a mature form of primitive burrowing in China. It is a form of residence that has evolved

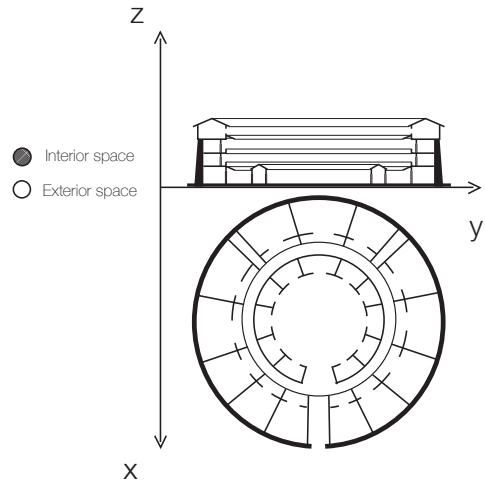
over a long period of time since ancient cave dwellings. The material of the cave dwellings is mainly loess. It is a form of dwelling that uses loess as a support system. There is no pillar support in the house. It is a living space that is artificially



Fig. 5.74  
Hakka Tulou



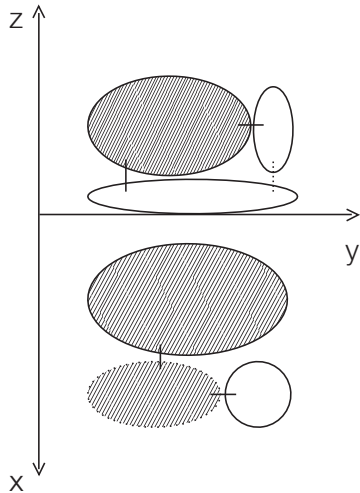
Topological Analysis



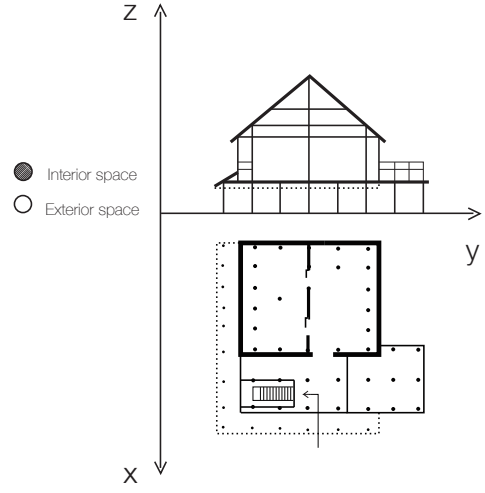
Typological Analysis



Fig. 5.75  
Stilted House



Topological Analysis

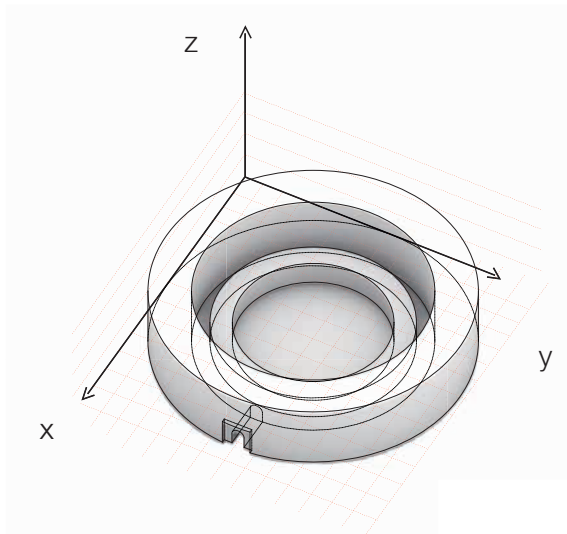


Typological Analysis

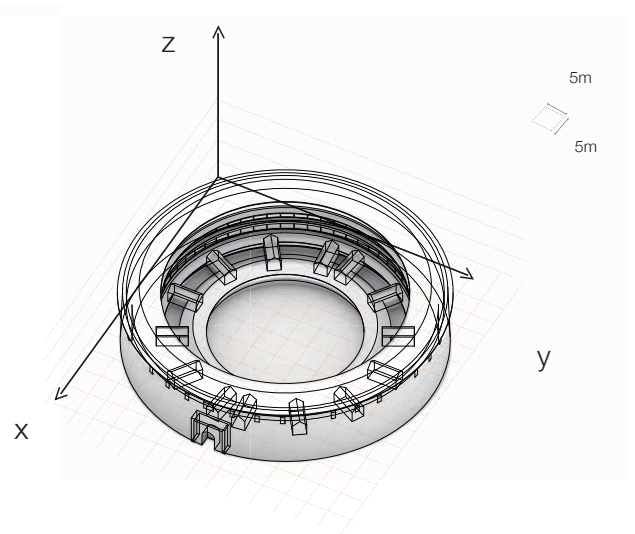
The Tulou residences are distributed in mountainous villages and towns in southern China coastal provinces. The Hakka people attach great importance to Feng-shui. One of the most important things is that there is a mountain on the back of the house. At the same time, it is

best to face the water. If there is no river, a pond will be set up. From this we can see that the Tulou is always arranged with the water source, standing on the flat land between the mountains, surrounded by the fields. The settlements formed by these stilt houses are composed of many

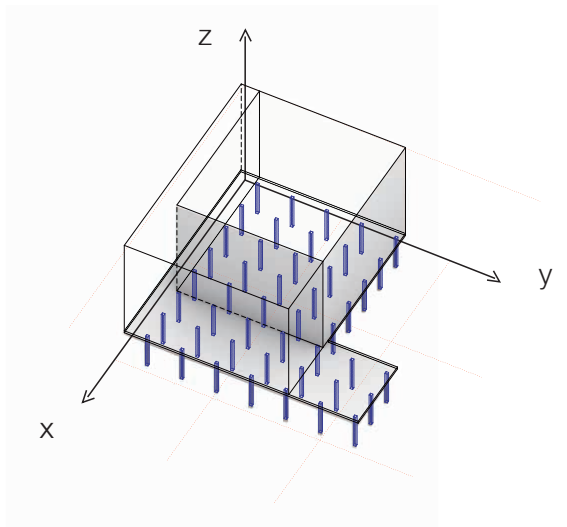




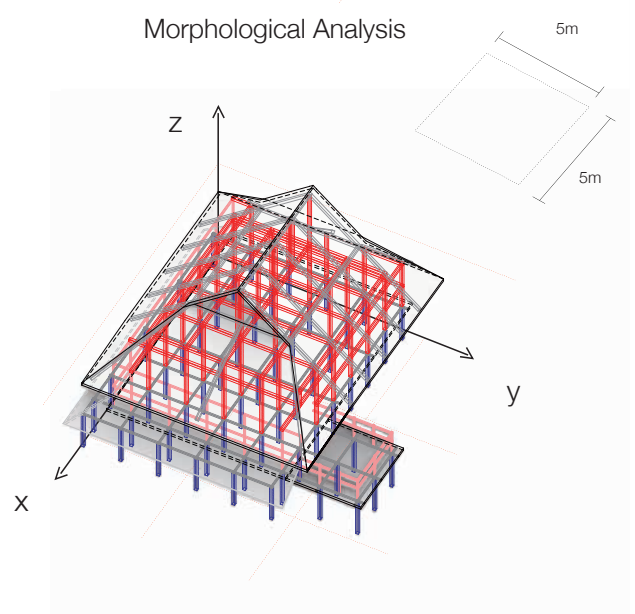
Geometrical Simplification



Morphological Analysis



Geometrical Simplification



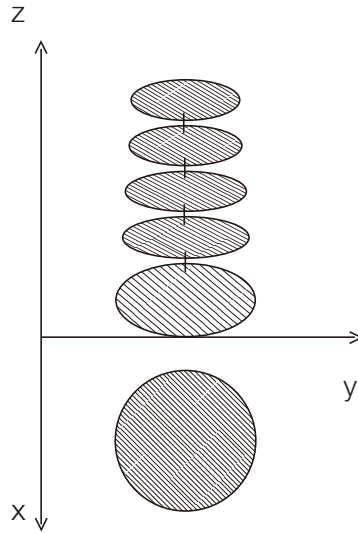
Morphological Analysis

many different ethnic minorities. Different ethnic habits lead to different living habits and social ways, which have different effects on the layout, spatial form and façade of their buildings. For example, due to the well-organized nationality organization of the ethnic Dong, many

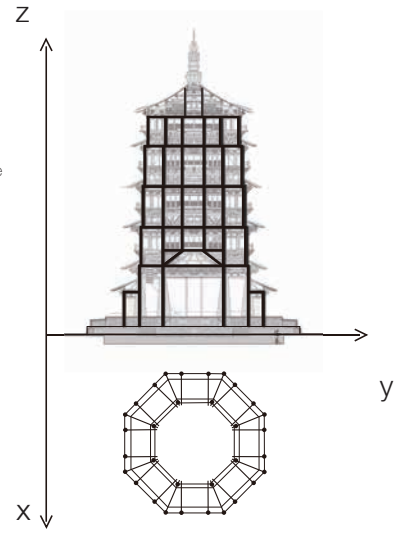
social activities are carried out outside the home. This external gathering of social characteristics has prompted the village of ethnic Dong to establish a huge public building system including the drum tower, wind and rain bridge, stage, and pavilion, which presenting the concentric layout.



Fig. 5.76  
Ying Hsien wooden pagoda



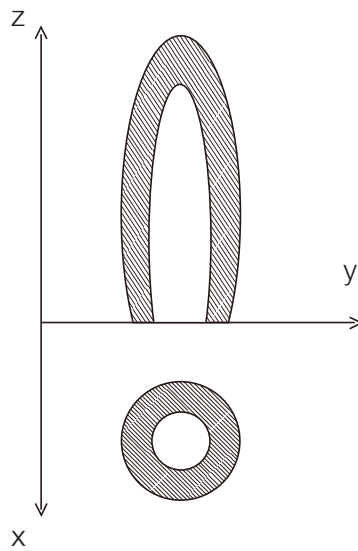
Topological Analysis



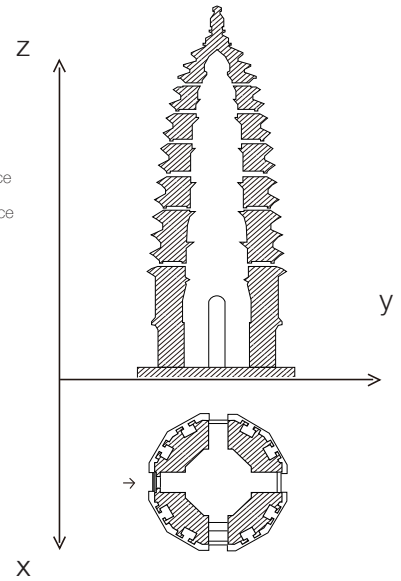
Typological Analysis



Fig. 5.77  
Sung-Yueh pagoda



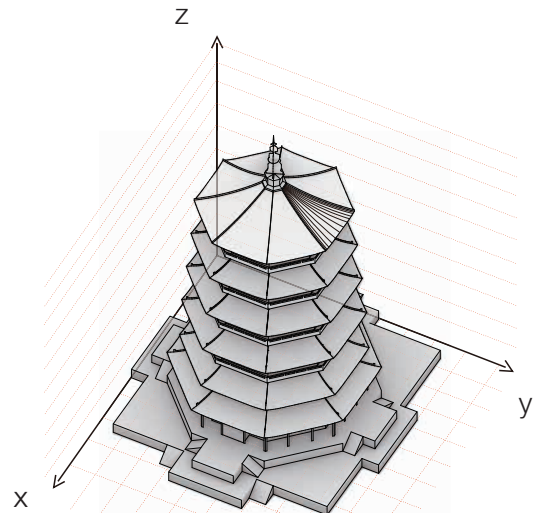
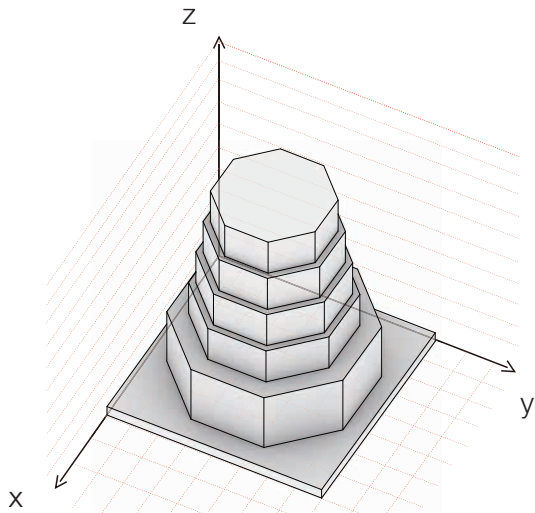
Topological Analysis



Typological Analysis

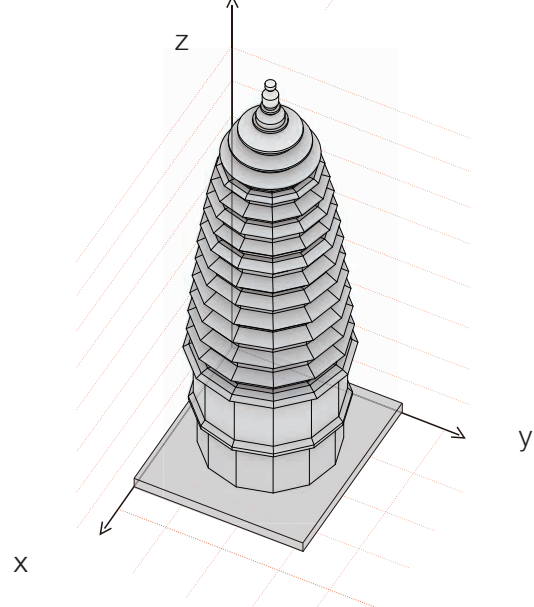
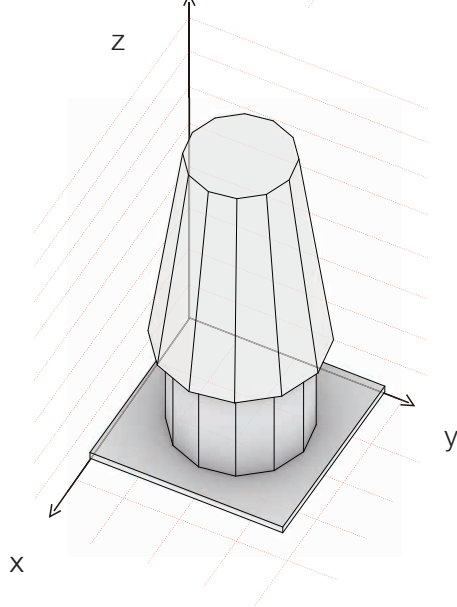
A poverty-stricken Shanxi town, Ying Hsien, boasts the only wooden pagoda known to exist in China, built in 1056 A.D. The only wooden pagoda existing in China today dates from the Song period.

It stands about fifty miles south of Da Tong, Shan Xi Province. The pagoda's eaves and stories are supported by a system of brackets. It is octagonal in plan and it is constructed entirely of wood.



Geometrical Simplification

Morphological Analysis



Geometrical Simplification

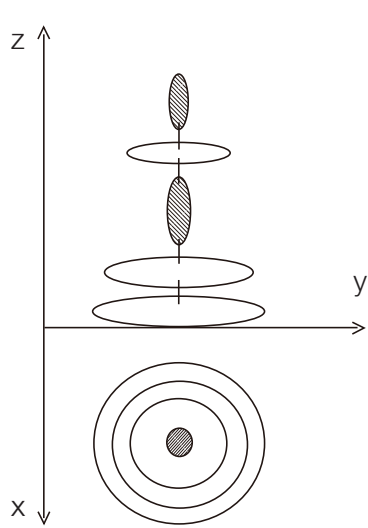
Morphological Analysis

The second case we would like to introduce you about the Sung-Yueh Brick Pagoda. You can see from its ground level plan below, as it shows, the twelve sides and fifteen stories bring its special envelope from others. In China, architects who work for historical

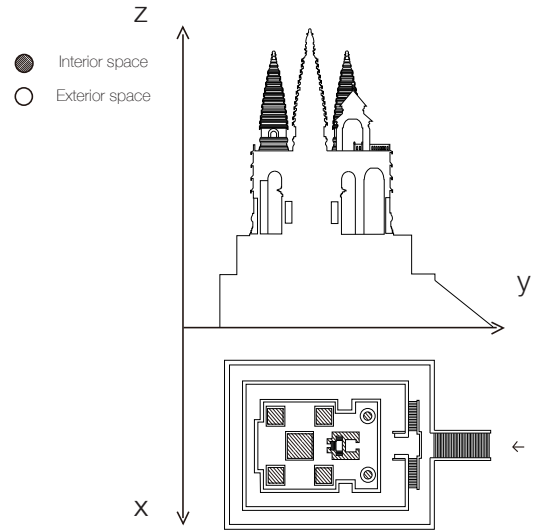
buildings called this kind of pagoda model as Multi-Eaved Pagoda. The fifteen stories of the pagoda also constitute an uncommon feature. On a very high base is the tall first-story, above which are fifteen decks of cornices of roof-eaves.



Fig. 5.78  
CHIN-KANG-PAO-TSO T'A



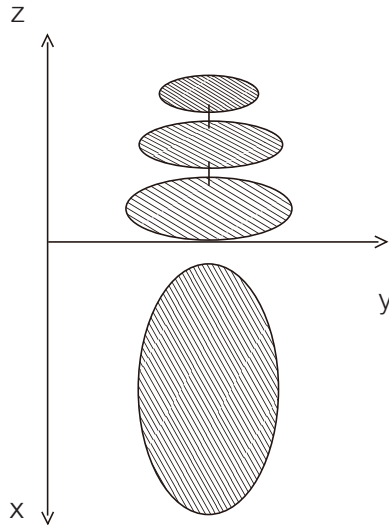
Topological Analysis



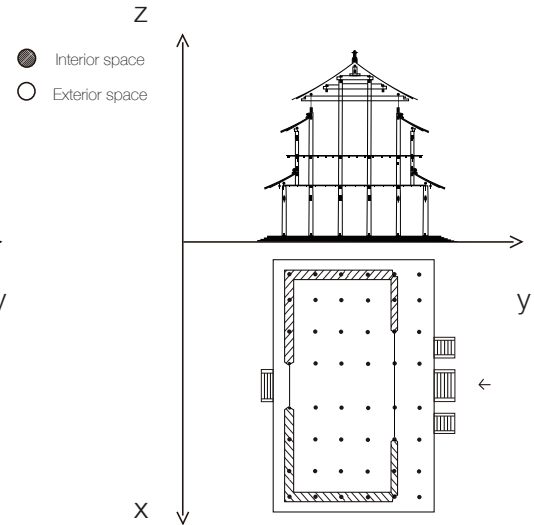
Typological Analysis



Fig. 5.79  
Library Building, Temple of Confucius



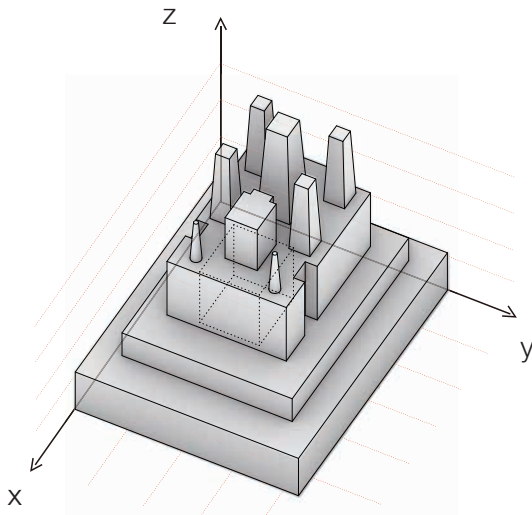
Topological Analysis



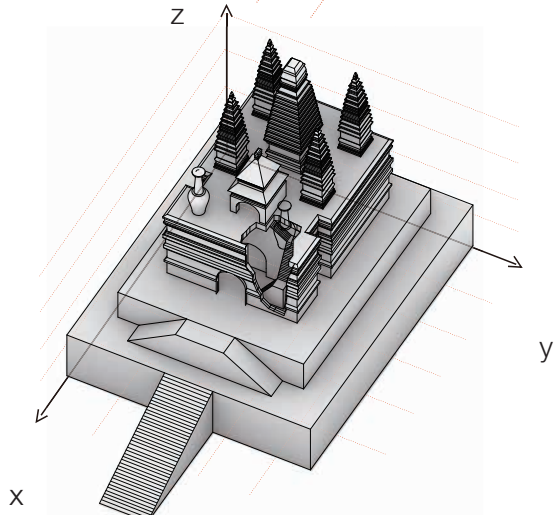
Typological Analysis

The height of CHIN-KANG-PAO-TSO T'A is thirty-four meters in general. Mainly divided into base platform, throne and tower body. The base has two floors. The first floor is climbed straight up. The second floor is divided into two sides

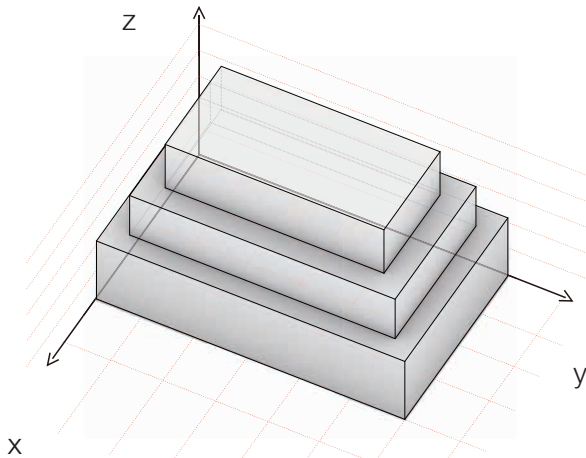
and then straight up to the throne arch. The throne is divided into two parts, and the tens of steps are taken to the top of the throne. The path of division and combination implies the realm of Dharma. Compared with the previous case, it



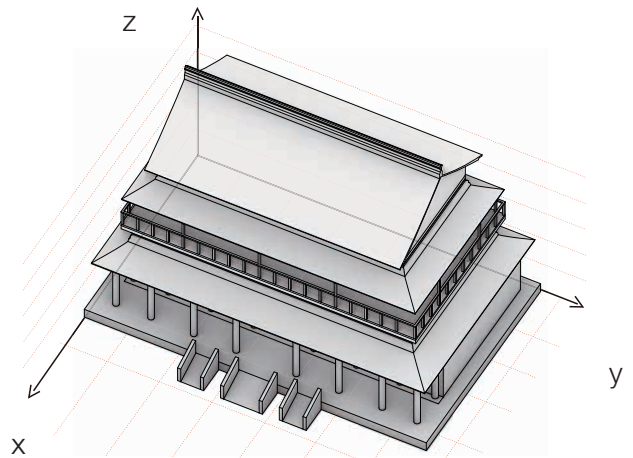
Geometrical Simplification



Morphological Analysis



Geometrical Simplification



Morphological Analysis

embodies the blending of Indian Buddhist architectural culture and Chinese architectural culture. The last case we are willing to introduce is the Library Building, Temple of Confucius. Kui Wen Pavilion is the name of this library Building. It is

a quite important building on the central axis of the Confucius Temple. It is located in front of the Dacheng Hall and is taller than the Dacheng Hall. and is taller than the Dacheng Hall. At the time of the initial construction, it was a library building that

collecting important books and documents for scholars to refer and borrow. The second floor is spacious and surrounded by a cloister with good ventilation and lighting. It is supposed to be used as a reading room. The collection of books is open for students to read and has the function of a public library. It is typical of ancient Chinese collections. The ancients were very careful about

the protection of books and documents. Different from previous examples, this building is a developed result from the prototype of multi-storeyed building. So you will find numerous characteristics which can really present the Chinese classical building. Initially, the different innovation of this building is that on the roof, there is no ceiling at all, it is clear to observe complicated roof structure.

Fig. 5.80  
Exploded model of Ying  
Hsien wooden pagoda  
Source: Made by authors

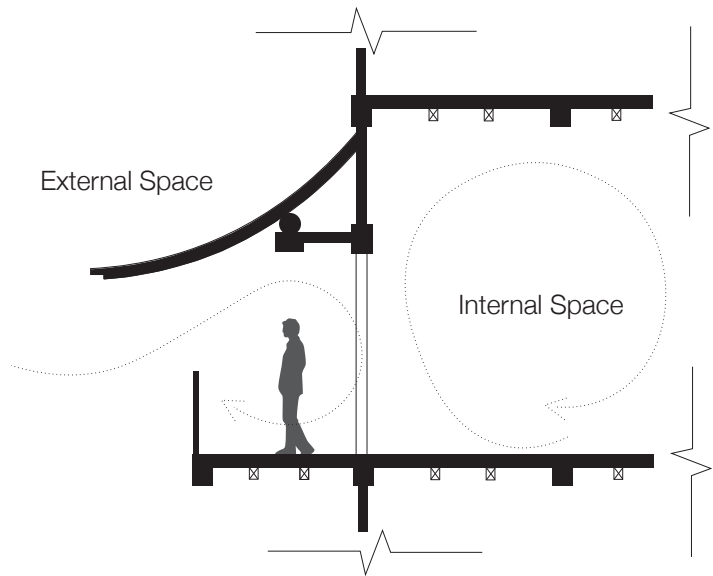
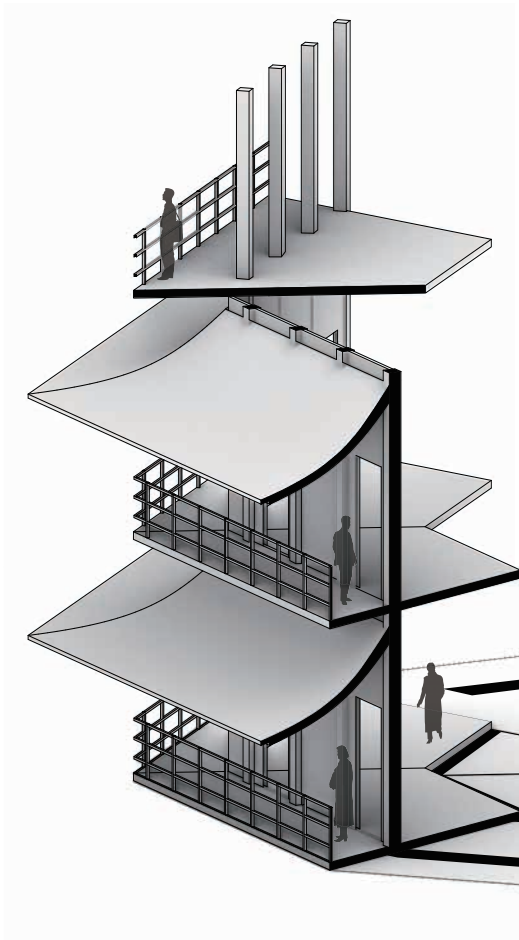


Fig. 5.81  
Analytical Section of Ying  
Hsien wooden pagoda  
Source: Made by authors

# 6

## Parametric Transcription for Vernacular Elements





1

Parametric

Transcription in

Urban Scale

Firstly, let us introduce the definition of parametric design in a general explanation. Parametric design is a process based on algorithmic thinking that enables the expression of parameters. Parametric design is a design by numbers in a general speaking. Under the background of architectural design in the information age, there is the great changes happened on the possibility of spatial forms. Digital technology has been widely into the design of various fields. The emergence of parametrized design for the urban planning, architectural design and industrial design, et cetera. As Ludger Hovestadt says in his book which about Architecture and Information Technology:

*' the fast-changing nature of technologies available allows us to treat contemporary architecture as an experimental discipline. Spectacular, daring, and attention-grabbing shapes and surfaces can, with the help of a computer, be designed more easily than ever before.'*<sup>1</sup>

The computer plays the significant role during design procedure. Whether it's the Big Data collection and analysis of the previous research, or the space composition design subsequently, the

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<sup>1</sup> ETH Zürich CAAD, Ludger Hovestadt. *Beyond the Grid – Architecture and Information Technology*. Birkhauser Verlag AG, Berlin, Germany. 2010.

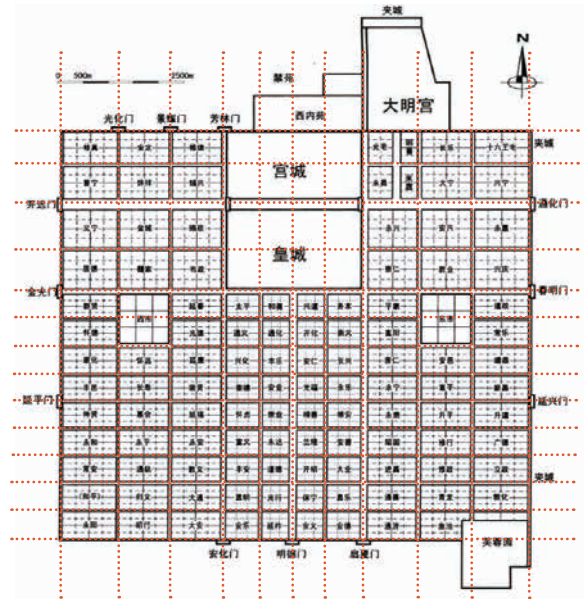
possibilities of the spatial design can be more comprehensive than the manual design by using parametric language. In this chapter we would like to introduce our parametric language applied on Chinese traditional architectures in modelling their characteristic form by computer. We situate Chinese vernacular architecture back in reality by contemporary architectural design methods. In other words, we are looking for changes, extensions and improvements to contemporary Chinese architectures practice. We put forward a hypothesis about the integration between parametric design method with Chinese architectures that something are traditional and vernacular to realize new architectural form for Chinese modern city nowadays. Subsequently, by providing architectural form models that generated by parametric language to demonstrate the possibility of our bold conception.

Our fearless attempt is starting from the urban scale, by make a theoretical city that is modern and high density oriented to experiment a scene in future about the integration between parametric urban pattern with representative Chinese buildings. We model three digital buildings that refers to three different typologies, and all of them

are equipped with traditional Chinese characteristics. Meanwhile, it is evident to find increased volume generation on them that is because we give us another premise of this bold experiment, the modern increased population and social demands need be reflected from the increased volume of architectures. By the way, we would explain them specifically in later chapter which about parametric transcription in architecture scale.

Following this, we abstract the tessellation urban fabric layout from China's most representative capital city, the ancient capital of Chang'an City. As we study before in the chapters of research part, ancient capital of Chang'an has the

Fig. 6.01  
Urban Materplan  
of Chang'an City  
Source: Congrong  
He. Ancient capital  
Xi'an. Tsinghua  
University Press,  
Beijing, July, 2012.  
Page 218.



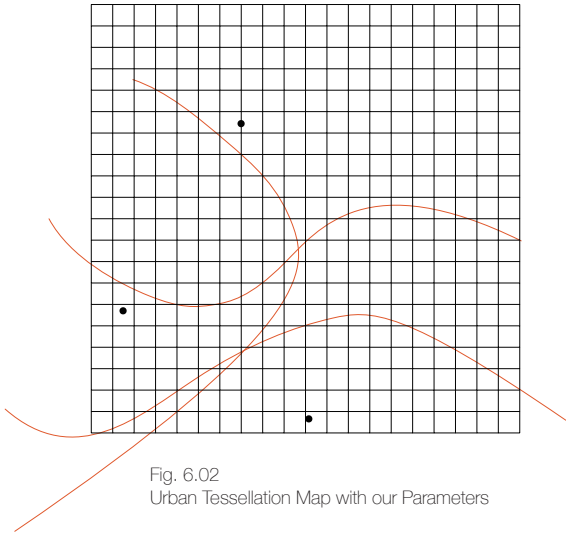


Fig. 6.02  
Urban Tessellation Map with our Parameters

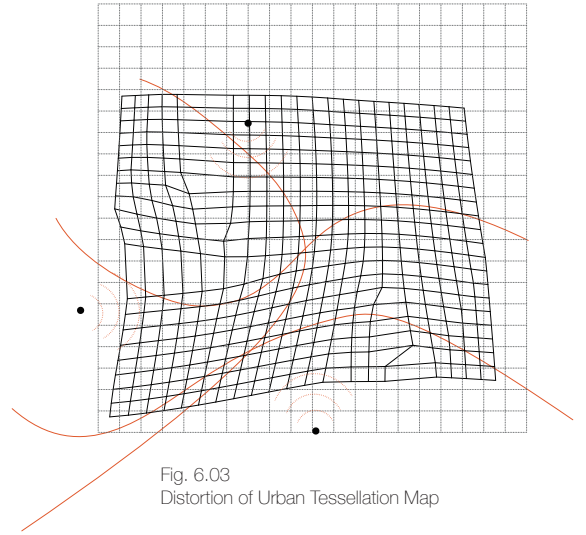
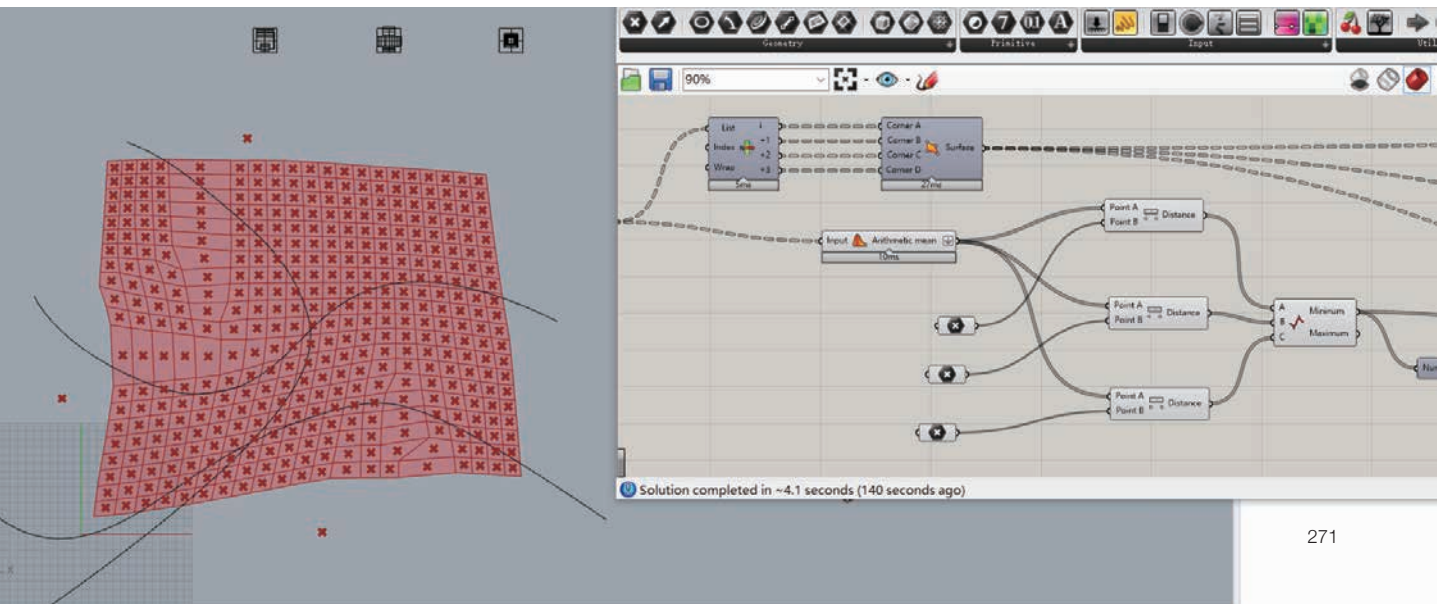


Fig. 6.03  
Distortion of Urban Tessellation Map

feature of grid urban texture, straight East-West and North-South thoroughfares were planned perpendicular to each other. The regular patterns are due to the management demands from Chinese ancient ruling class and emperor. However, this rigid urban fabric can not exist for a long period, and according to historical records, it was re-planned in the subsequent dynasty replacement. The history demonstrates that the urban fabric as Chang'an, with

the developing of urbanization and increased social demands from people, such a rigid context can not provide its appropriate functions to us. Thus, we put in the hypothetical conditions to our experimental urbanism simulation. In the Rhino Modelling, there are three linear elements represent urban important avenues and three points presents three important urban cores such as government centre, commercial centre and urban landmark.

Fig. 6.04  
Modelling Process of  
Parametric Urbansim  
Source: Modelling  
File from authors.



Experimental Modelling  
Urbanism

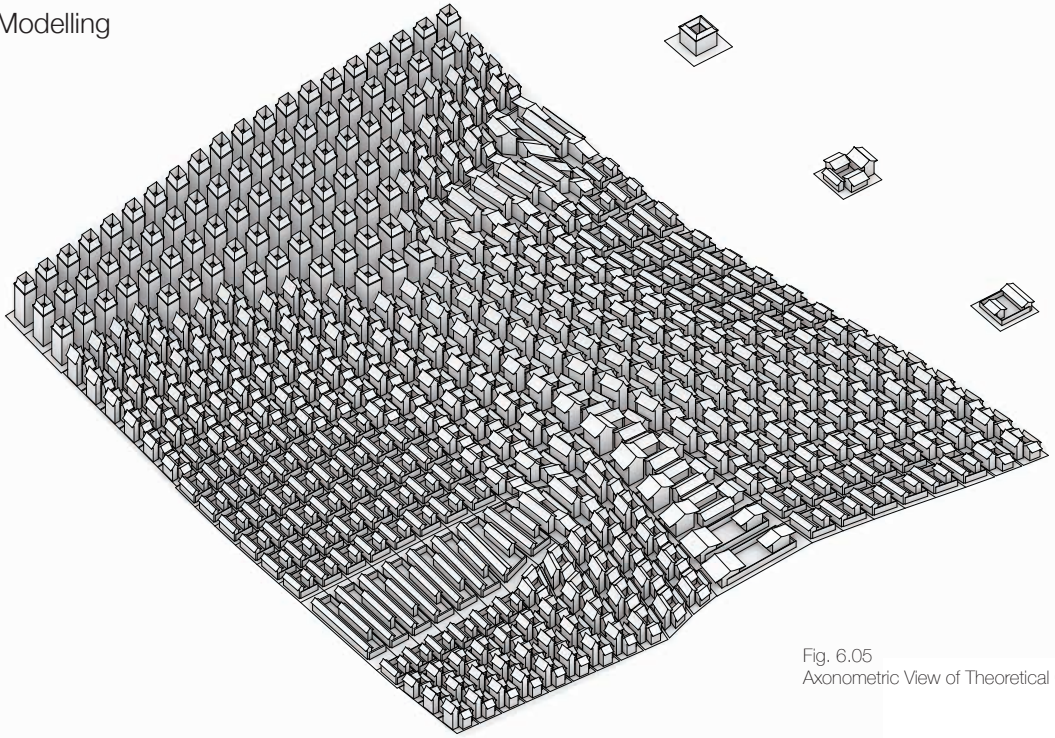


Fig. 6.05  
Axonometric View of Theoretical City Model

Fig. 6.06  
Perspective Top View of the City

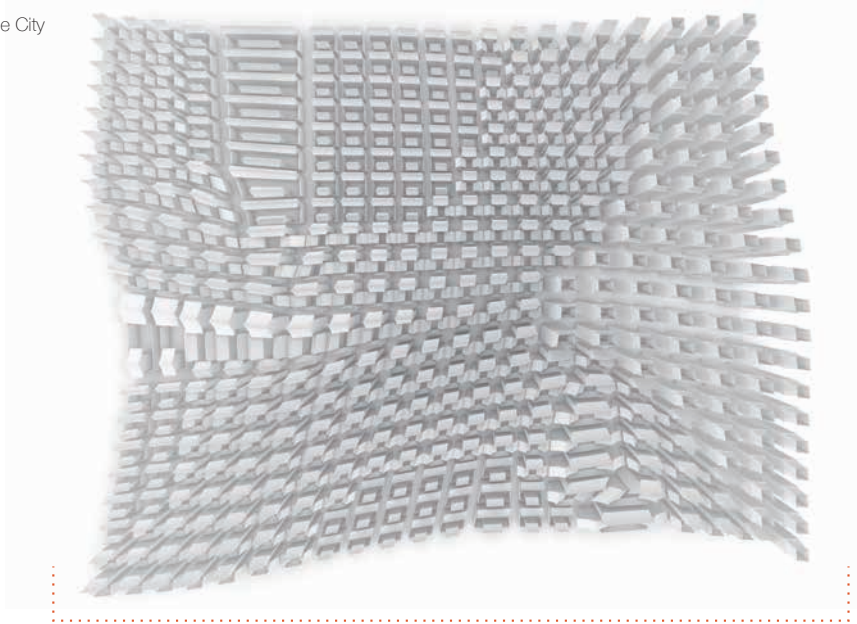


Fig. 6.07  
Bird View of the City

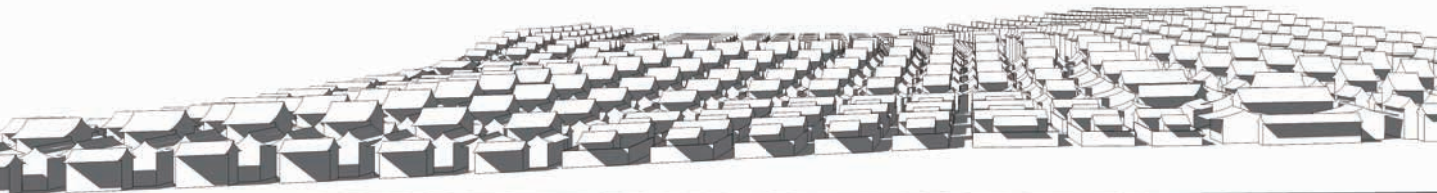


Fig. 6.08  
Photo of Sunken  
Courtyard,  
Yaodong,  
Source: [http://  
k.sina.com.cn/  
article](http://k.sina.com.cn/article).

Then we insert these model parameters into the parametric machine in order to in virtue of the algorithm from grasshopper to deduce that the urban fabric is organic and it is growing with time. During the parametric process of our experimentation in modelling, while the curves are going across to the city from west to east, the centroids of squares in grid are pulled and moving follow the tendency of curves, then the shape of squares have distorted. This dynamic effects are due to the attraction degree from these curves. And they are referring to important roads or urban infrastructures in reality. The same reasons for three parametric points we put, instead of the algorithm of attracting function, points are computerised as radiating function. So we observe three different regions which are distributed by buildings with three different typologies.

In summary, these urban elements born in the city and they will influence back to the city while their developing. Thanks for the help from grasshopper's algorithm, it is obvious to observe the distortion of the new urban fabric is different from the previous rigid pattern. As far as our concerned, from this urban modelling simulation, the result of this theoretical city model demonstrates that the city is an organism, she is not a constant.



Next phase, with considering the urbanization of modern cities, increased population required increased urban constructions. The artificial material like asphalt is covering urban land with low infiltration. This is a significant factor caused urban flooding disaster. Meanwhile, our great Da Vinci had proposed an underground city for seeking urban issues even in a very early time. The artwork above (Figure.6.08) was completed in pen and ink, circa 1487-1490. It can now be found at the Bibliotheque de l'Institut de France. Have the same effect, Italian master's artwork reminds us of our traditional Chinese

Fig. 6.09  
Artwork of Da  
Vinci's Ideal City  
Source: Ideal City  
[http://www.davinci-inventions.  
com/ideal-city.aspx](http://www.davinci-inventions.com/ideal-city.aspx)

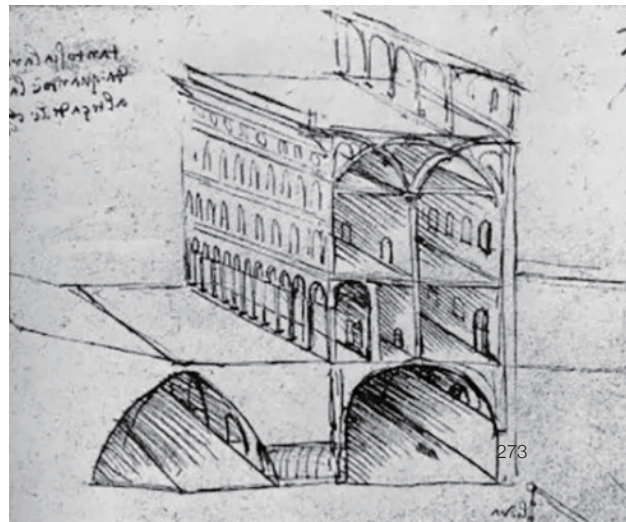




Fig. 6.10  
Bird View of  
Beiyong Village,  
Henan  
Source: www.  
people.Sunken  
Courtyards.  
com.cn.

underground dwelling system. With our study from Da Vinci's ideal city and the intelligence from residence who live in Yao Dong in China. Apparently, the underground dwelling of Yao Dong in China has its private function, its sunken courtyard has limitation for people communicating with city. But if it is possible to use the advantages of sunken courtyard from Yao Dong, applying it to concept of Da Vinci's idea city. Based on this hypothesis, we start to model a new parametric model that based on our previous urbanism to generate an underground system to our theoretical city.

As you can see from the photography above (Figure.6.10), traditional Chinese village Beiyong Cun, in Henan. Due to the peculiar soil constituent, local people extract their living space under the land,

then the typical sunken courtyard realized as you see from this photography. Each family has their sunken courtyard no matter the different size. But every sunken courtyard does not have any connection with other courtyards nearby. It is because of the specific function of residential, family's courtyards need to provide privacy for local residences. Hence, we are taken inspiration from this underground system to ruminate the possibility about its grafting to modern city nowadays.

Fig. 6.11  
Section of a  
family live in Yao  
Dong.  
Source:  
Wang Qijun,  
Vernacular  
dwellings, in  
Chinese Ancient  
Architecture.



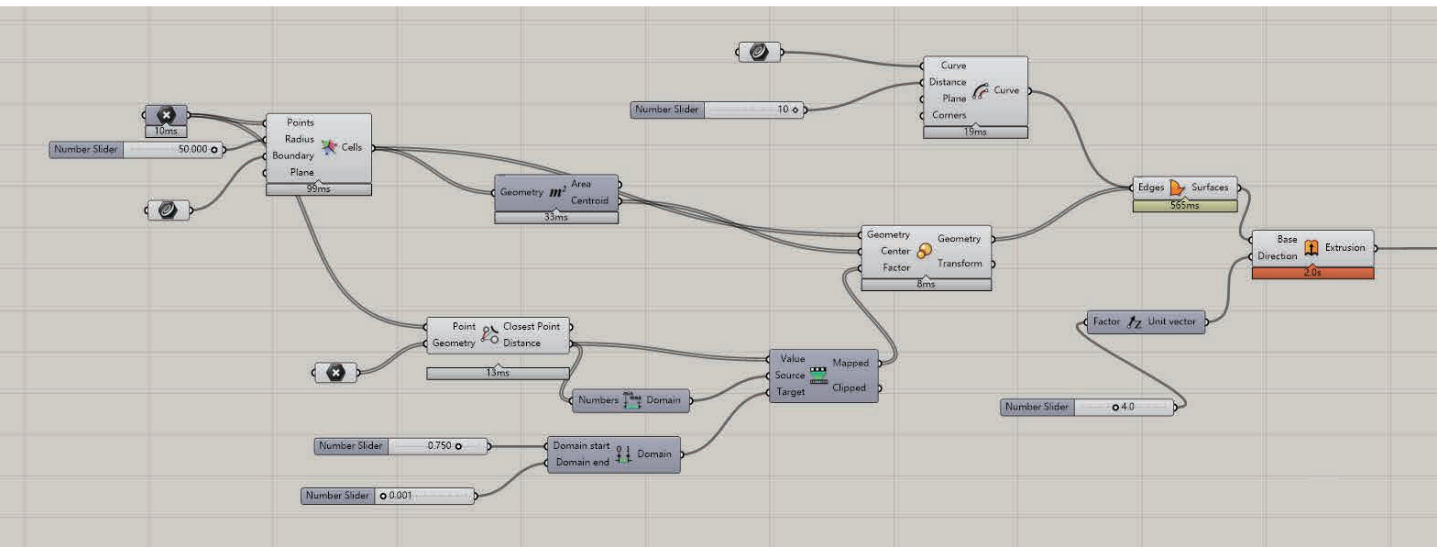
However, because of the pointed function they need for local residences, there is the limitation for the form of sunken courtyards in local. The demands of daily living, each family has not direction connections with their neighbourhoods on the underground level, and every sunken courtyard is independently providing the open space only for its family. Regardless we can find the solution to have linkages and make them in series, then the system of sunken courtyards can provide public function as open space for general cities.

Fortunately, after we have read the sketches by Leonardo da Vinci's which about his ideal city. Honestly, this invention focuses not just on a single area but combines da Vinci's talents as an artist, architect, engineer and inventor to create an entire city. And the idea that there are underground channels play the role of connection with different underground area. Hence, master's idea inspired us a lot, we can propose our typical sunken

courtyards which from Chinese traditional system in modern city nowadays perhaps, by using underground channel to connect each courtyard. For the reason that we want to make these courtyards serve for the general city instead of private users. Providing extra open space for people and mitigating urban runoff.

This bold attempt is depended on the algorithm of Voronoi Tessellation. The principle of this parametric method is starting from the points location in an area. Which means in our theoretical urban map, each unit of grid will be built a building. And we make centroid visible in each unit to represent the localization of the building referring to general city. The logic of Voronoi algorithm is about connection every point nearby with lines, and make centre bisectors on all the lines between centroid points. The centre bisectors are perpendicular to connected lines, and they are extending until the meeting with another centre bisector.

Fig. 6.12  
Modelling  
Process of  
Parametric  
Urbanism  
Source:  
Modelling File  
from authors.



# Origin of Ideas for Experimental Procedure Urban Underground System

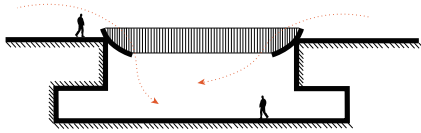


Fig.6.13 Section of Traditional Chinese Dwelling, YaoDong, Sunken Courtyard.

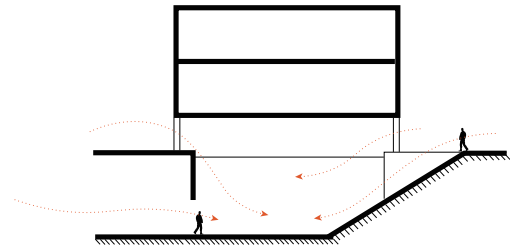


Fig.6.14 Section of our proposal to develop underground system inspired by Sunken Courtyard.

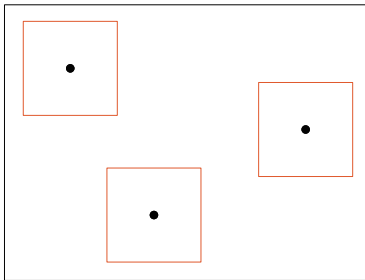


Fig.6.15 Colored outline presents the plan boundary of buildings, points are centroid of these boundaries.

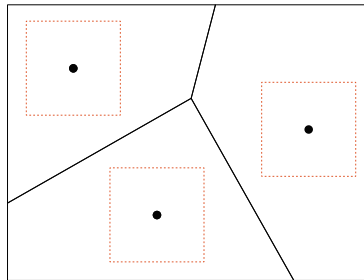


Fig.6.16 Based on these centroid of boundaries, we use Voronoi Tessellation to partition this area, the location of points generates Voronoi diagram.

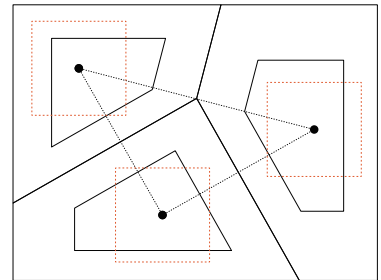


Fig.6.17 The straightline distance between two points is the shortest distance.

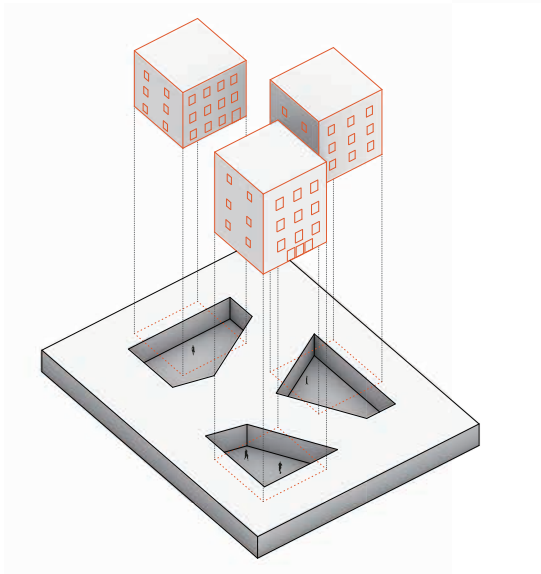


Fig.6.18 By offsetting the outline of Voronoi patterns, we obtain the area of our Sunken Courtyard.

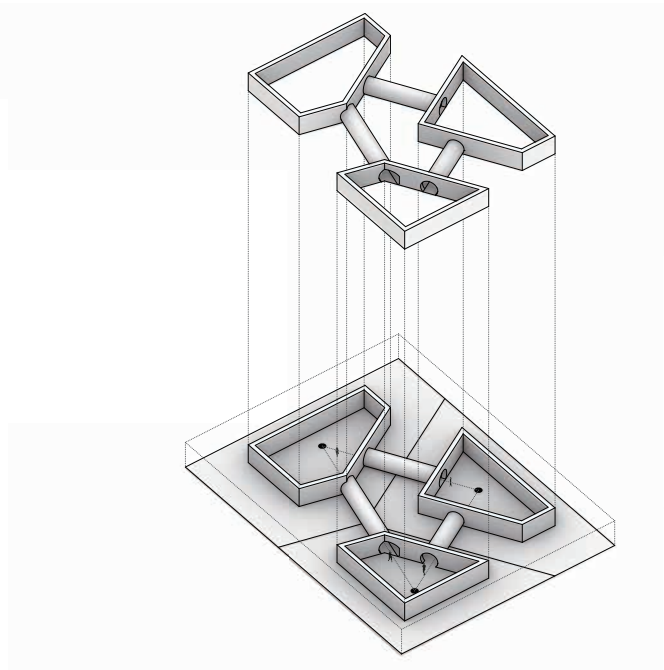


Fig.6.19 The nature of straight-line distance drives us to design underground channels between different Sunken Courtyard.



Then because of the property of mathematic about the shortest line between the highlights. We decide to design underground connection along these relevant lines. When it reflects to the reality, parametric machine helps us to find the shortest path to construct underground channel, that helps to avoid the unnecessary underneath construction and make project became more economic. Meanwhile, the shortest routes for urban run-off is the best solution for urban flood.

In the end, all centre bisectors will stop growing and generated the framework of Voronoi pattern finally. As you can find from above (Figure.6.xx), the process of grasshopper language presents the main parametric algorithm which is Voronoi marked as coloured icon. Below is the algorithm of attracting dynamic effects which we will explain it in following paragraphs. Before it, the random algorithm from grasshopper created all Sunken Courtyards in various sizes. We want to interpret there different from buildings on the ground, and in behalf of different needs from people in a city, the Sunken Courtyards must perform as different shape and various dimensions. See from our axonometric drawing on the next two page.(Figure.6.24)

According to our consideration, due to the real situation of a city, it is located on terrain in reality. Which means the topography reason will generate the principle route of urban runoff. When the precipitation of this region peaks on the highest point in a certain time. There is a principle runoff due to the topography reason in this basin. And we assume that is out postulated conditions in our theoretical city. Hence, we put a curve perform as S shape and it is going through to city centre. Then there will be four points that are playing the roles of significant urban nodes on this curve. Next step we put a curve and four points as our new parameters into grasshopper. Afterwards, the algorithm from grasshopper makes the four nodes on curve as attractors to attract and pull Sunken Courtyards near the curve. This result shows the phenomena that the Sunken Courtyards are becoming larger while they closing to curve. In the opposite, the sunken courtyards are shrinking when they stay away from the principle curve attractor. We believe that the result is in line with the scientific explanation. In a real city, it will be a great construction to excavate plenty of underground courtyards either for open space or urban runoff. From an economical and practical perspective

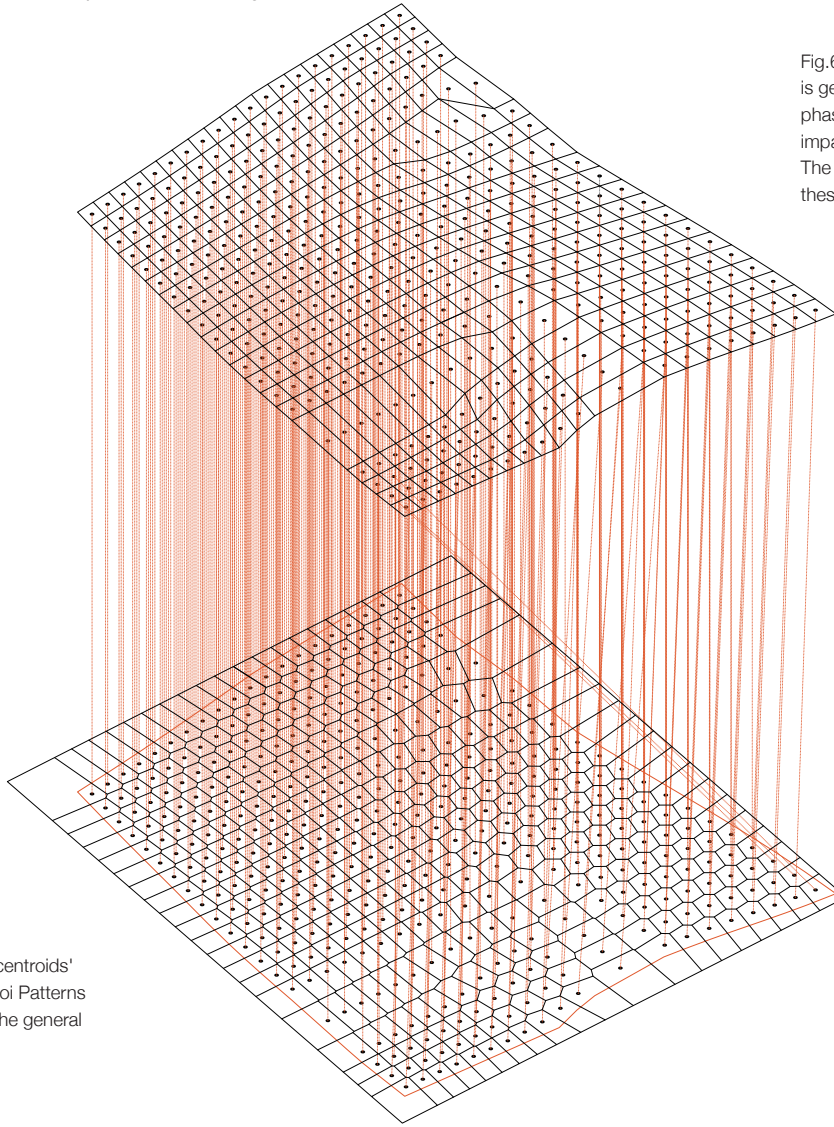


Fig.6.20 This grid map is generated in previous phase. Grids are distorted by impacting points and curves. The points are centroids of these grids.

Based on same centroids' partitioning, Voronoi Patterns is generated on the general map.

### Experimental Propose A.

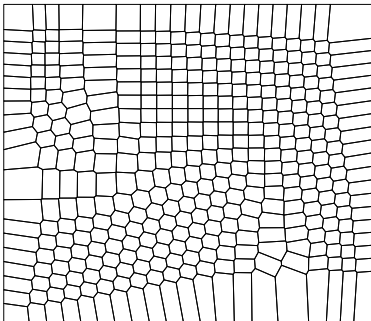


Fig.6.21 Map of the experimental city which designed by us and parametric method.

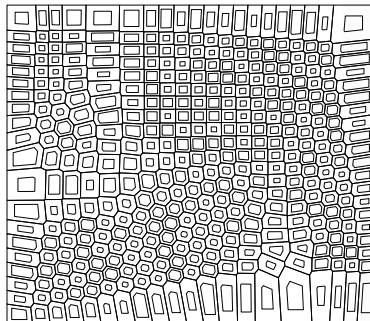


Fig.6.22 City is partitioning by Voronoi Tessellation.

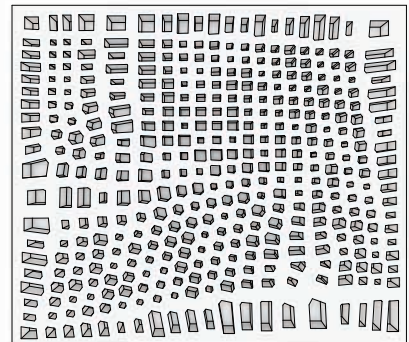
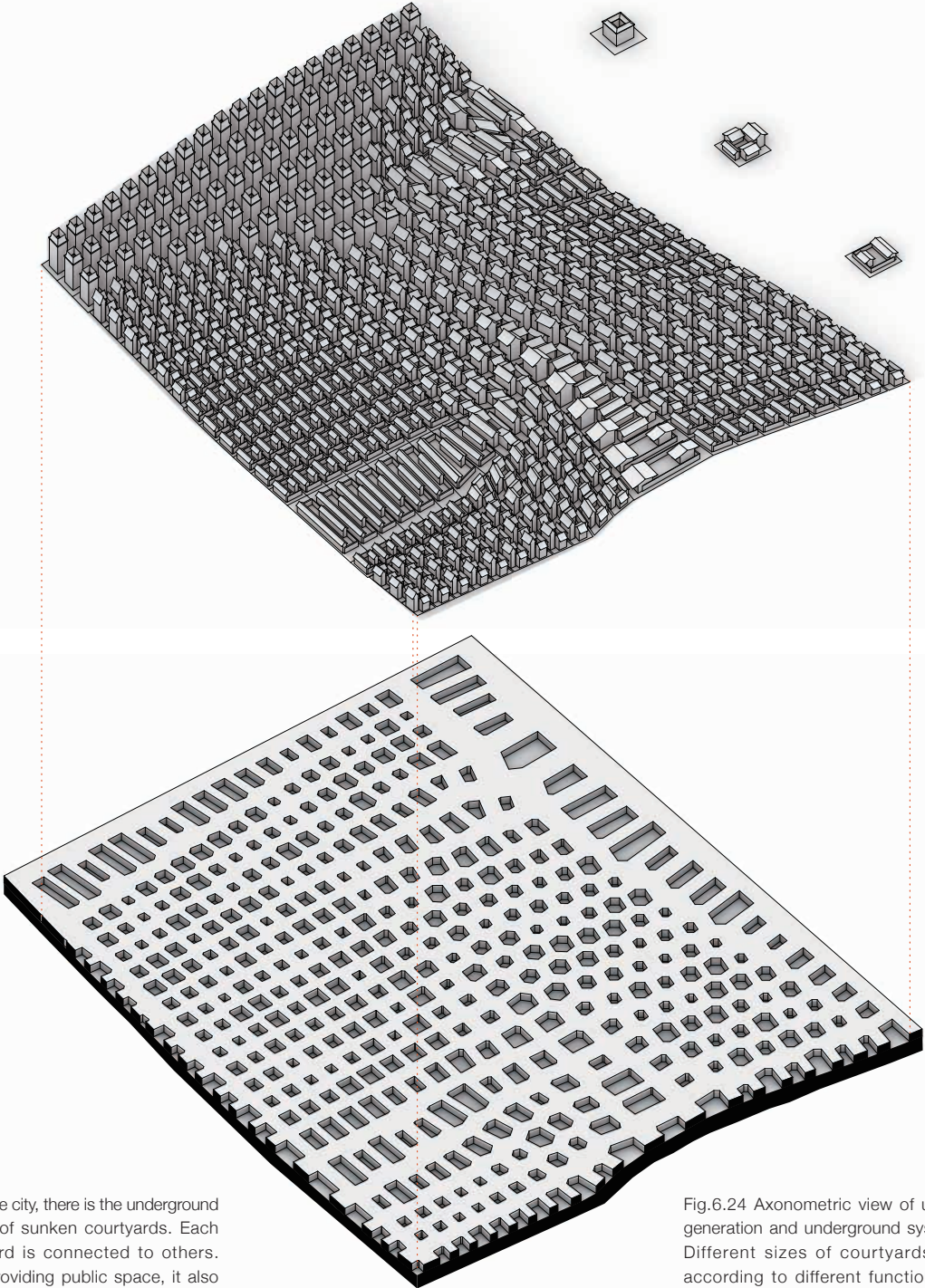


Fig.6.23 Offsetting Voronoi patterns to generate our Sunken Courtyards in the city.

Experimental Propose A.



Under the city, there is the underground system of sunken courtyards. Each courtyard is connected to others. While providing public space, it also eases urban drainage.

Fig.6.24 Axonometric view of urban generation and underground system. Different sizes of courtyards are according to different functions of buildings on the ground.

## Experimental Propose B.

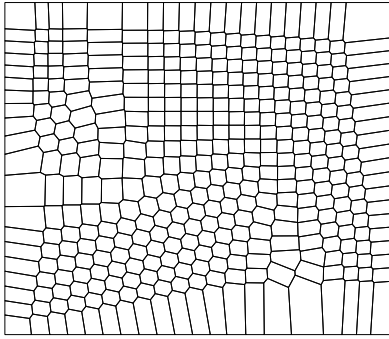


Fig.6.25 Map of the experimental city which designed by us and parametric method.

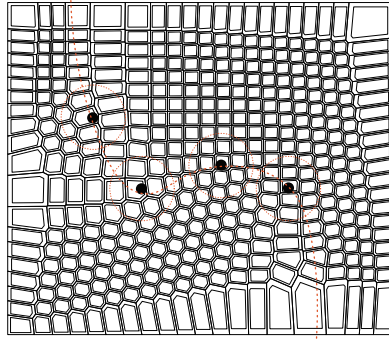


Fig.6.26 City is partitioning by Voronoi Tessellation. Because of the topography, red line presents the major urban drainage run off, and on the route of run off, there are four important city nodes.

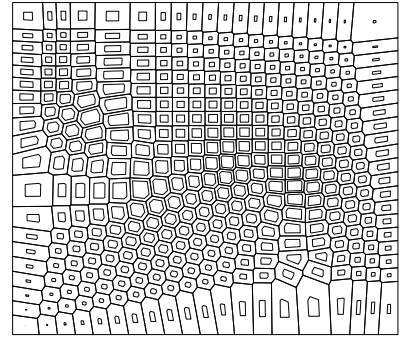


Fig.6.27 Offsetting Voronoi patterns to generate our Sunken Courtyards in the city.

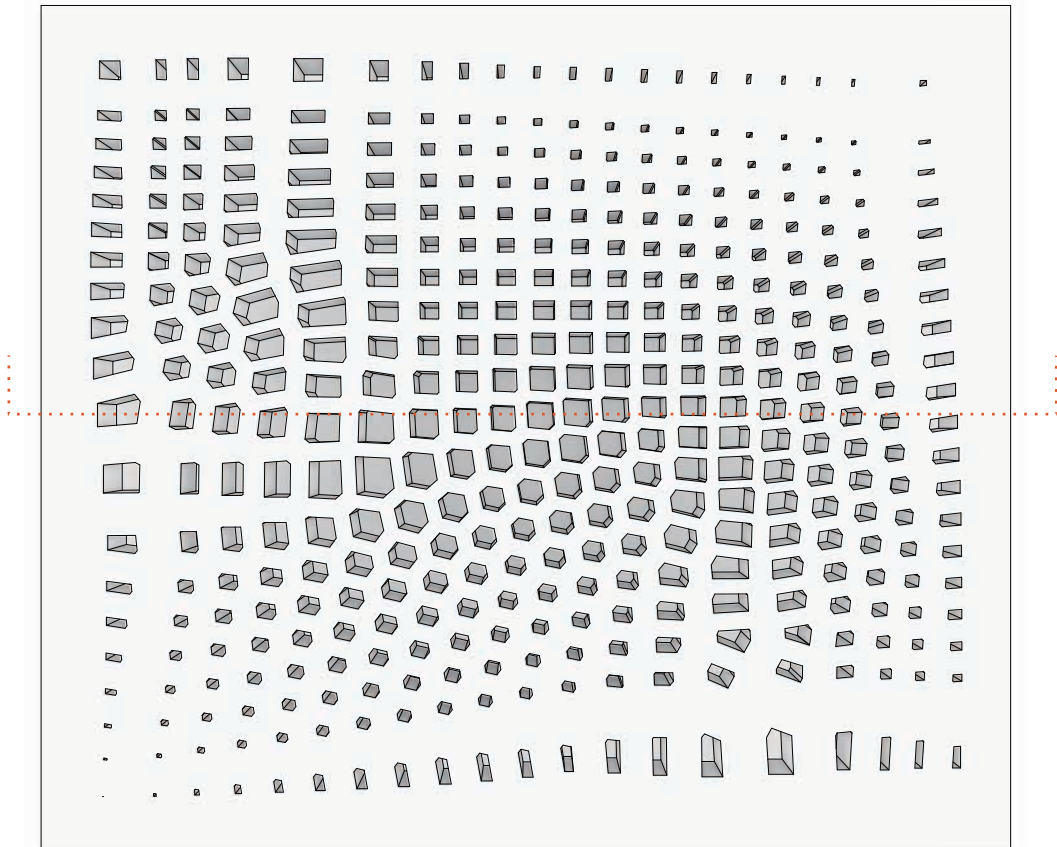
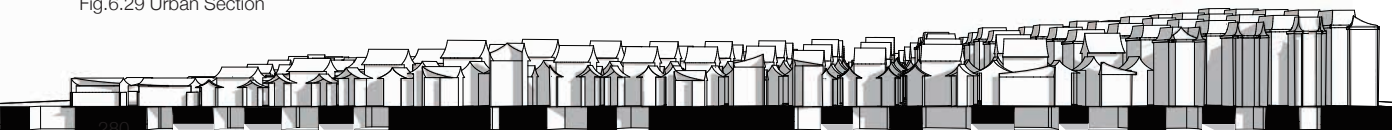
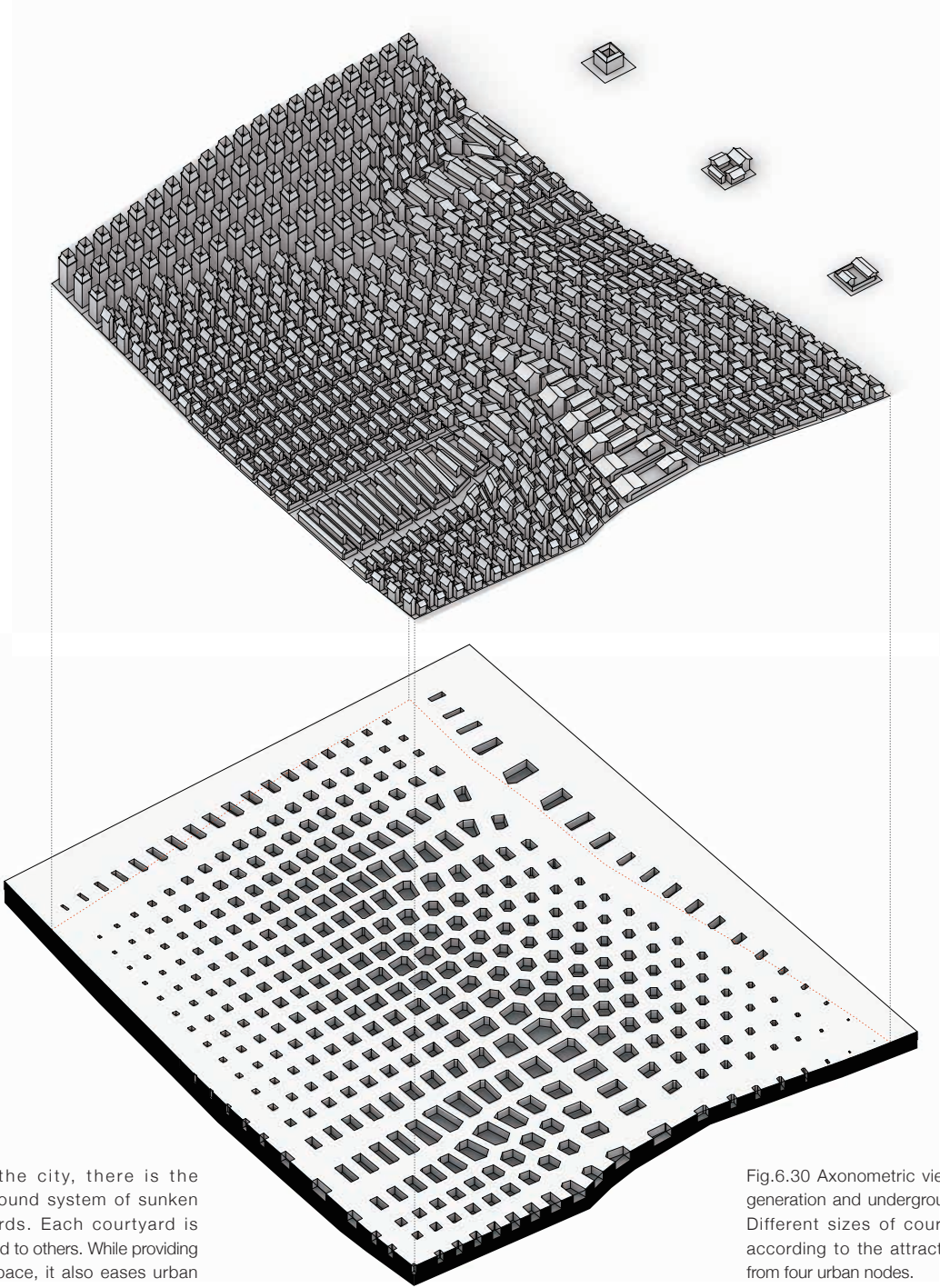


Fig.6.28 There are four important city nodes on the route of urban run off. And the area along the curve plays the main role of urban drainage in this basin. So the four city nodes have an important responsibility. In parametrical method, these four points are attracting Sunken Courtyards which are surrounding.

Fig.6.29 Urban Section



Experimental Propose B.



Under the city, there is the underground system of sunken courtyards. Each courtyard is connected to others. While providing public space, it also eases urban drainage.

Fig.6.30 Axonometric view of urban generation and underground system. Different sizes of courtyards are according to the attracting degree from four urban nodes.

## Experimental Propose C.

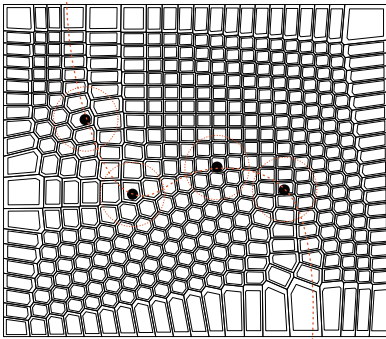


Fig.6.31 City is partitioning by Voronoi Tessellation. Because of the attraction from red line and four important city nodes, the sizes of Sunken Courtyards are different.

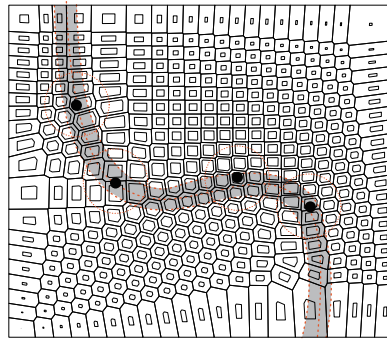


Fig.6.32 Then we offset the red line to a principle region of urban run off, the hatched area is permeating to courtyards nearby.

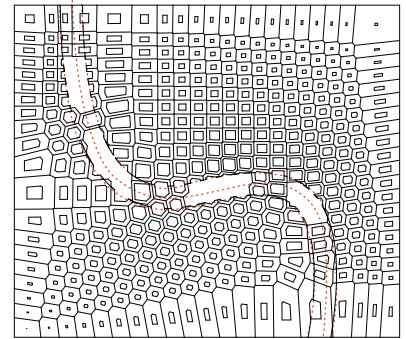


Fig.6.33 Finally, We take away extra solid volume from permeated area and design them as an urban public space and serve for people.

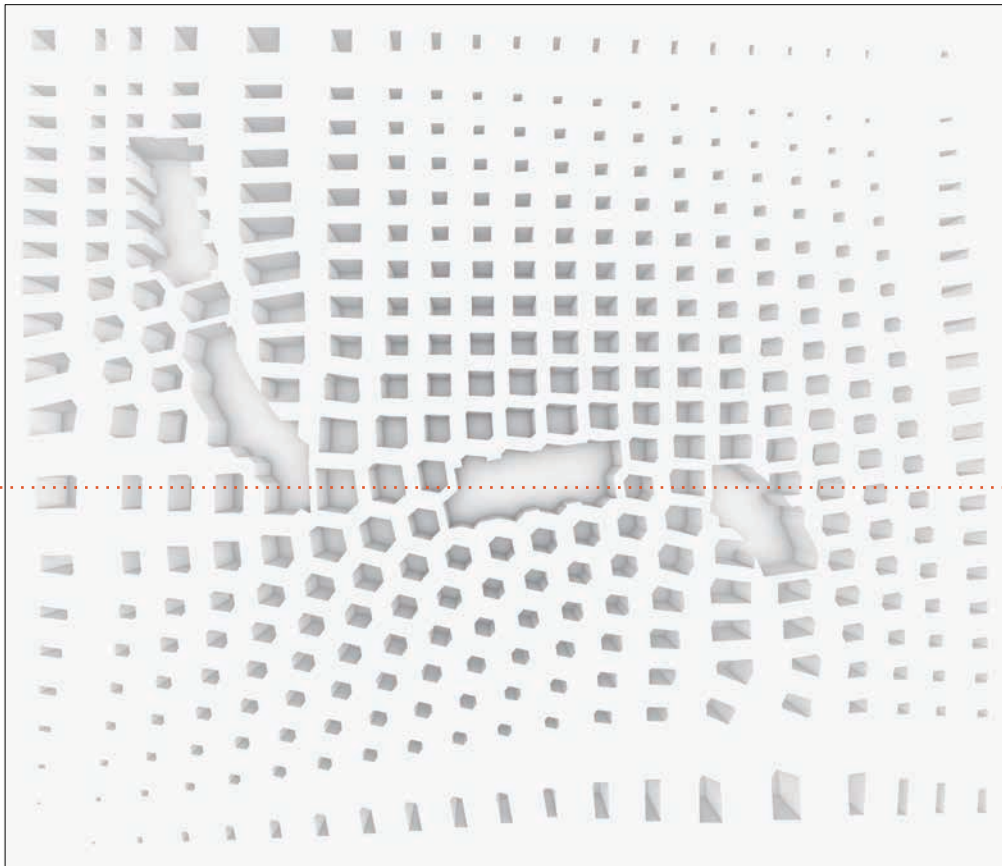
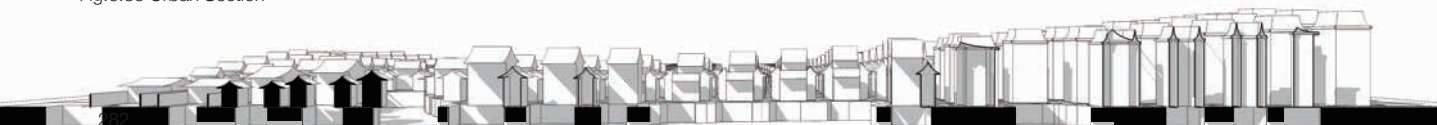
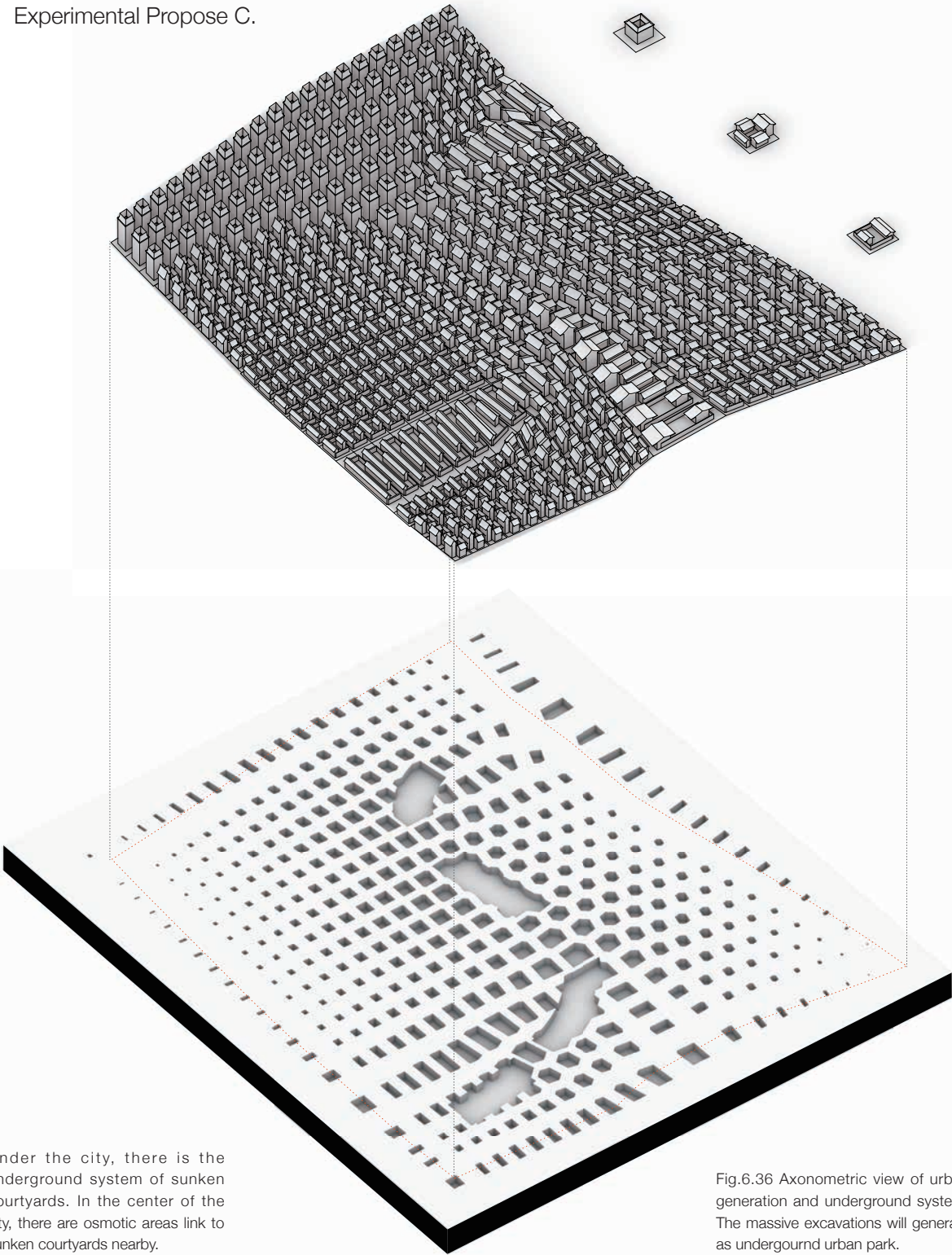


Fig.6.34 The permeating from offsetted region to Sunken Courtyards nearby generates four new underground open space, which could be used as underground urban park. Different scale of sunken space provide various functions for the city in order to face the social needs of people in a modern city.

Fig.6.35 Urban Section



Experimental Propose C.



Under the city, there is the underground system of sunken courtyards. In the center of the city, there are osmotic areas link to sunken courtyards nearby.

Fig.6.36 Axonometric view of urban generation and underground system. The massive excavations will generate as underground urban park.

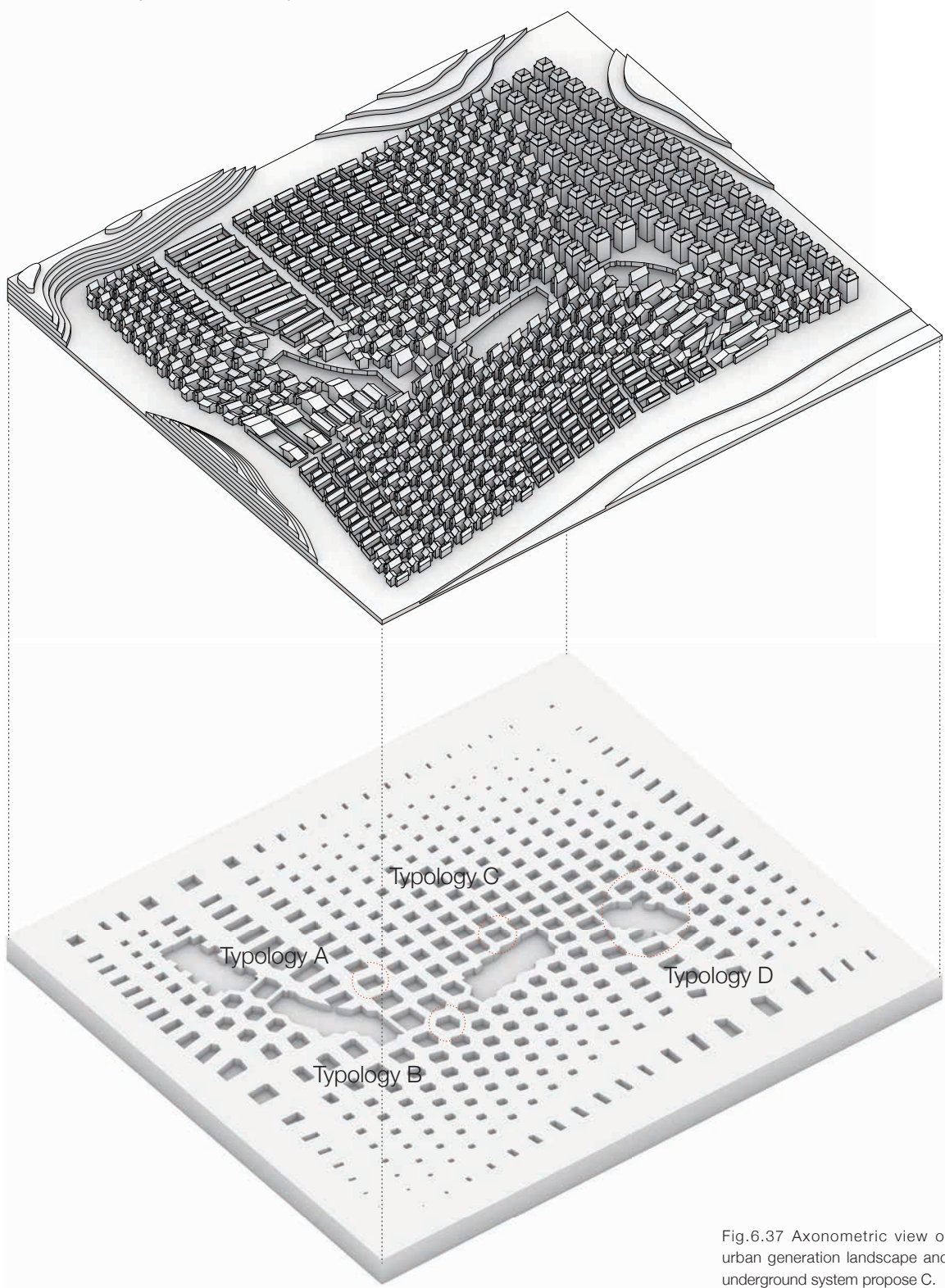


Fig.6.37 Axonometric view of urban generation landscape and underground system propose C.



Various Typology Application of the Sunken Courtyard System

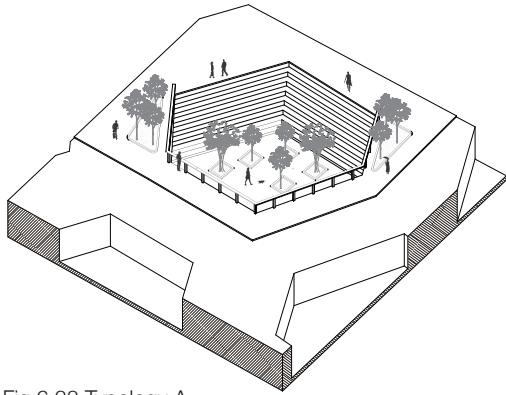


Fig.6.38 Typology A  
Urban Amphitheater

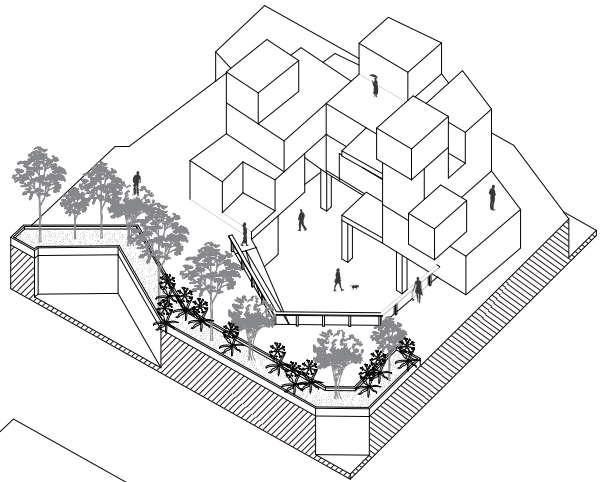


Fig.6.39 Typology B  
Urban Courtyard with Dwelling

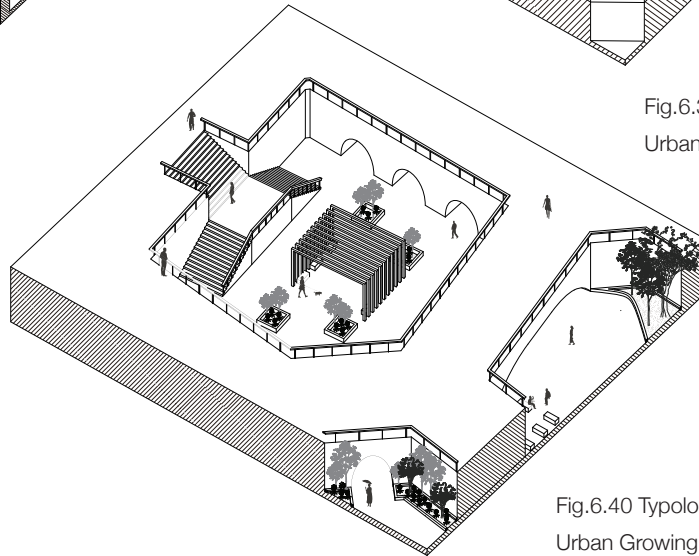
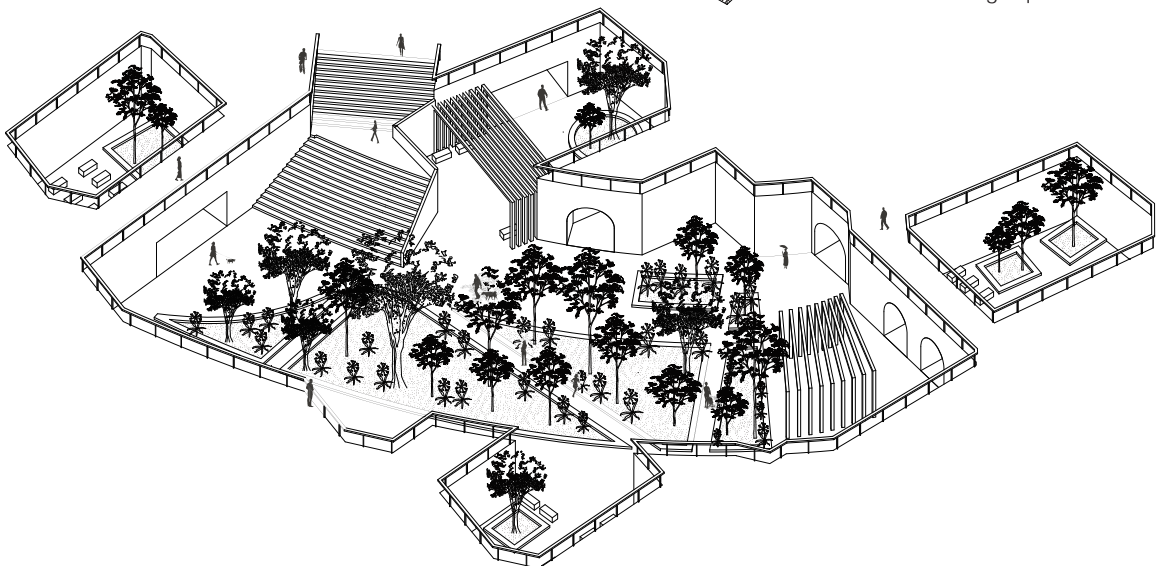


Fig.6.40 Typology C  
Urban Growing Square

Fig.6.41 Typology D  
Urban Park



view, the experimental propose B is more in line with the real situation. It is easier to implement this system in propose B, primary excavate sunken courtyards which along the principle urban runoff route. Besides that, we also discover this underground system in a much more practical way by using developed parameters. Offsetting the curve, the generated belt area is joining to surrounded courtyards, and then the new forms are realized. In the centre of belt zone, courtyards could permeate to other courtyards which are nearby. The new experimental simulation let us obtain new big scale sunken spaces. We confirm that these spaces are quite interesting to become urban park, such as urban green lung to improve air quality in the city and the increased urban public space will bring a better life for people.

In summary, our aim about the experimental modelling above that we introduced is to demonstrate there will be some possibilities to drive our cities become a more comfortable city to face the modern issues. And meanwhile, the sources we used for parameters in the parametric method are coming from our history and traditional culture. By taking typical Chinese architectures as the factor into parametric language in urban

scale could be a new mentality to plan our city in the future. Of course, all these results we presented are just showing the possibility and procedures of this bold mentality about urban design.

2

Parametric

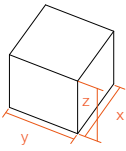
Transcription in

Architecture Scale

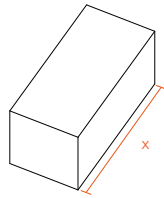
Nowadays, in modern Chinese cities, there are increased vernacular old buildings are replaced by modern architectures. And What is even more regrettable is that these Chinese characteristic buildings are erased completely by characterless or even the imitation from western architecture. We confirm that the old architectures should be renovated for contemporary cities due to the development of construction techniques, materials and increased of users' needs, even the contemporary aesthetic. Nevertheless, all of them are not in conflict with traditional culture and vernacular architectures that are specially owned by Chinese. And we believe that there is the integration between traditional and vernacular Chinese architectures and advanced design method in contemporary. In this chapter we are willing to present our experimental achievements to demonstrate the possibilities about the Chinese architectures' modern can co-existed with our vernacular manifestation.

As the same experimental procedure we applied for the simulation in urban scale, which is about theoretical city. Now we use the same concept to use parametric machine generate architectural scale model which still keep vernacular features.

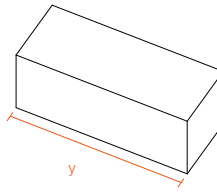
Fig.6.42  
Methodology of Controlling Variate



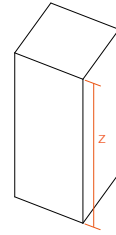
Three parameters x, y, z. Refer to length, width and height.



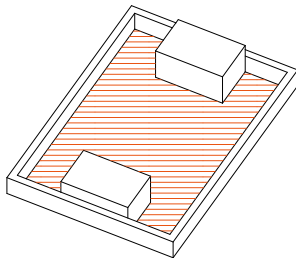
Variate is Length x. Width and height is constant.



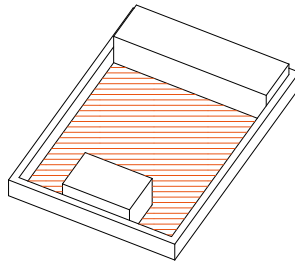
Variate is Width y. Length and height is constant.



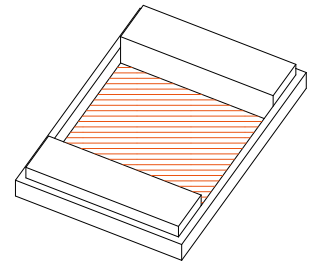
Variate is Height z. Length and width is constant.



Capacity Option A  
Plenty open space



Capacity Option B  
Decreased open space



Capacity Option C  
Narrow open space

In order to interpret some interesting possible solutions about vernacular manifestation in parametric language.

In preliminary attempt, we want to use vary fundamental parameters form traditional architectural forms and computing them in a simple algorithm. As you will see from the later pages. The first variate we apply is the length along Z direction, which means we increased the different height only along Z axis of original dwelling. Through parametric modelling, we could obtain several multifarious solutions based on changing

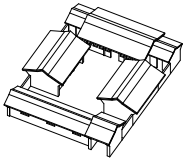
different numbers along Z axis. For example, the first research object we have is the prototype of Beijing traditional Quadrangle. Equivalent to doing the permutation, we can get different solutions about Beijing Quadrangle model by extruding the same height along Z axis on different side house. We know there are four buildings and an enclosed courtyard composed a Beijing Quadrangle. If we import one value of extruded height to act on its four buildings on by one, there are four solutions we can get in the end. The concept is controlling variable factor, and only make one parameter available.

If we considering a space with Cartesian Coordinate System, not only the number on Z direction, but also X and Y axes that referring to width and length of architectural form respectively. These three basic parameters algorithm in grasshopper help us generate sixteen models with the method of controlling other two variate, and only make one factor be available to modify. And all these sixteen results are come from the prototype we provide for theoretical city, the prototype is from Beijing Quadrangle. We keep as much vernacular elements as we can while we are modelling new experimental models from parametric machine. This is the first experimentation we used parametric modelling on vernacular manifestation in architecture scale, and it is mainly focus on the volume variation from parameters of length, width and height. These attempted models are telling us how the traditional quadrangle could be developed in order to face the population explosion in China.

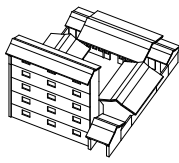
In the same way, we apply the same concept to the variation of courtyard. The second prototype is the one of three typologies we have provided on previous topic of urban scale. We modelled sixteen experimental models as well to study and compare the differences between them. We emphasize that it is quite

necessary to keep the representative elements of the prototype or at least keep its original function, then develop it by parametric modelling. We you check the fifteen experimental models and one sample in the beginning. You can find the first two row on the top are variation of courtyards' volume, or we call it as the capacity of courtyard, they are all computed from fundamental parameters such as length and width. But last two examples are the indication of the different partitioning of traditional courtyard. And these partitioning we can also find the similarities from traditional Beijing Quadrangle in reality. The third row we used parameter which is the boundary of courtyard. The different definition for its boundary will produce different shape or layout of courtyards. Obviously, this row presents our bold imagination for the propose about shaping courtyard. Then the last row presents the treatment of courtyard. Apparently, these attempts are bold as well, but they are reasonably modelled from the practical using point of view. After entering into the modern era, the increased needs from people requires more functions rather than only mononuclear function. So different functions are effecting different treatments for original courtyards in order to face the complex needs of reality.

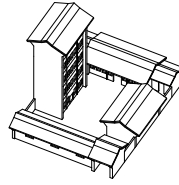
Fig.6.43 Volume Variation Parametric Generation in Architecture Scale



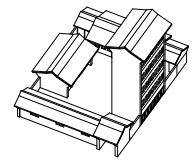
Prototype of traditional Beijing Quadrangle



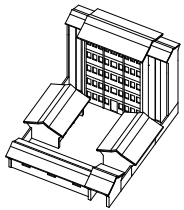
Increased height of southern building, keep other three buildings with original volume.



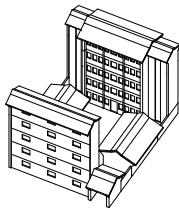
Increased height of western building, keep other three buildings with original volume.



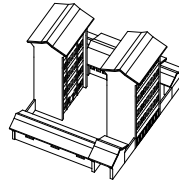
Increased height of eastern building, keep other three buildings with original volume.



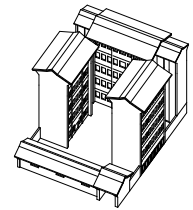
Increased height of northern building, keep other three buildings with original volume.



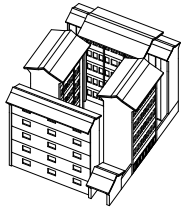
Increased height of northern and southern building, keep other two buildings with original volume.



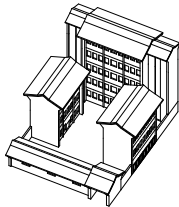
Increased height of western and eastern building, keep other two buildings with original volume.



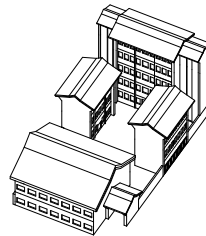
Increased height of three buildings, except the anterior building.



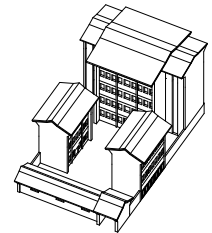
Increased height of four sides building. Adding side rooms to the principle building.



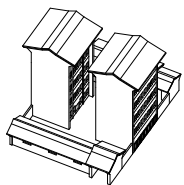
Increased height of three sides building except the anterior one. Adding side rooms to the principle building.



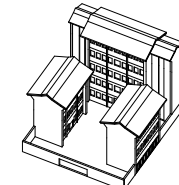
Increased width of the anterior building and keep other three buildings with increased height.



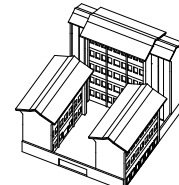
Increased width of the anterior building and keep other three buildings with increased height.



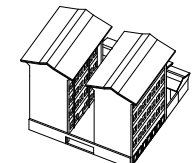
Increased width of the western and eastern buildings and keep other two buildings with original height.



Increased height of buildings except the anterior one and replace it to simple entrance wall.

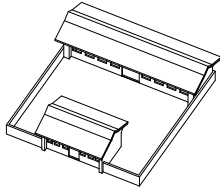


Increased length of western and eastern buildings till the entrance wall.

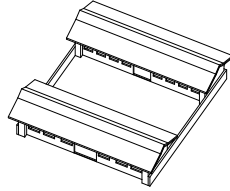


Increased height of buildings except the anterior one and replace it to simple entrance wall.

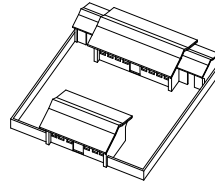
Fig.6.44 Courtyard Variation Parametric Generation in Architecture Scale



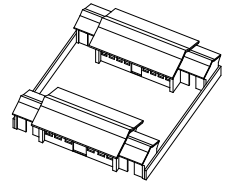
Prototype of classical Chinese courtyard dwelling.



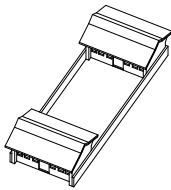
Decreased capacity of courtyard.



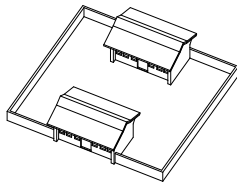
Increased capacity of courtyard and adding side rooms for principle building.



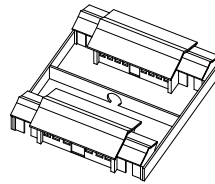
Decreased capacity of courtyard and adding side rooms for all buildings.



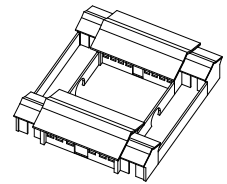
Decreased original courtyard to narrow courtyard.



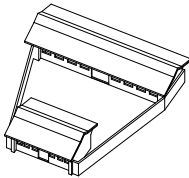
Enlarge the size of original courtyard to a great capacity.



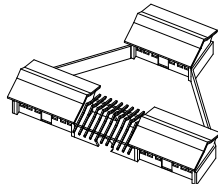
Divide original courtyard into southern and northern parts by a chinese wall.



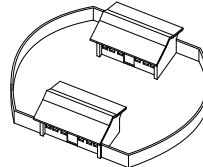
Divide original courtyard into main courtyard and two adjoining yards by two chinese walls.



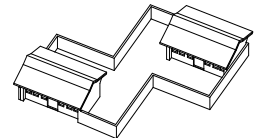
Redefine the boundary of original courtyard in shape A.



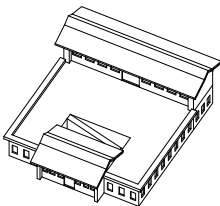
Redefine the boundary of original courtyard in shape B.



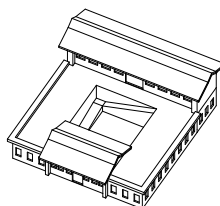
Redefine the boundary of original courtyard in shape C.



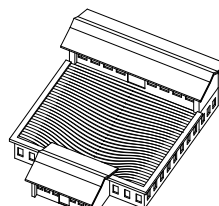
Redefine the boundary of original courtyard in shape D.



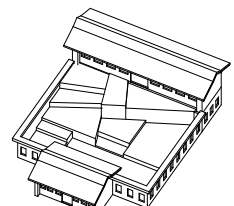
Redesign the function of original courtyard, provide two levels for courtyard. Adding a Sunken Patio.



Redesign the function of original courtyard, provide two levels for courtyard. Increased Sunken Patio.

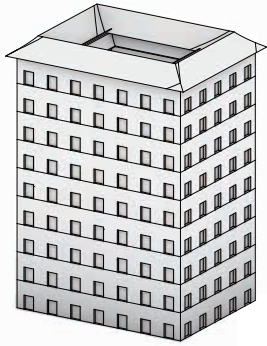


Redesign the function of original courtyard, make it as an bold organic natural slope.



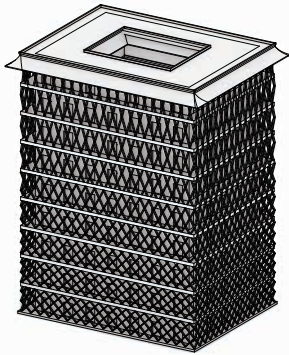
Redesign the function of original courtyard, partitioning it into various substrates.

Fig.6.45 Volume Variation Parametric Generation in Architecture Scale

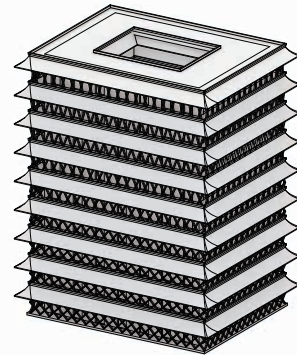


The theoretical Chinese tower in contemporary generated by our modelling.

The third experimental parametric modelling are based on the condition that high-rise building with Chinese vernacular architectural elements. By the necessary of the secondary skin applied for high-rise building in contemporary. We use the algorithm about skin generation from grasshopper to apply resultant skin solutions these Chinese towers. It is very interesting that we found the Chinese multi-eaves for each floor provide the obvious construction possibility to install the structure of the skin. The attempt result is realized by these experimental models as you see in following.



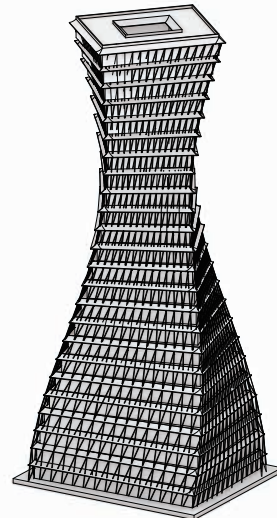
Experimental model about the secondary skin Propose A for single Chinese roof.



Experimental model about the secondary skin Propose A for Chinese multi-eaves roof.



Experimental model about the secondary skin Propose B for single Chinese roof.



Experimental model about the secondary skin Propose B for Chinese multi-eaves roof.



Fig. 6.46  
Bird View  
of Beijing  
Quadrangel  
Source:  
Beijing office  
of architectural  
design  
standardization.  
Architectural  
elements  
of Beijing  
Quadrangle

All of these experimental parametric models we present above are applied parametric method with fundamental parameters. Honestly, based on the theory of critical regionalism architecture we study during research, we understand the process we have interpreted is just keep the vernacular characteristics from traditional Chinese house, and import basic parameters into algorithm in a formalistic way. According to this mentality of integration, we should critique ourselves based on the theory from Luis Mumford who defined the critical regionalism architecture.<sup>1</sup>

Fig. 6.47  
Photo of Beijing  
Quadrangel  
Source:  
Beijing office  
of architectural  
design  
standardization.  
Architectural  
elements  
of Beijing  
Quadrangle

### Malposed Courtyard from Beijing Quadrangle

Honestly, the computational design provides us conveniences during the design phases,<sup>2</sup> but the important thing is to find the relevant resources and import them into the parametric machine. Only by doing so, the result from parametric modelling would not only present its vernacular on its skin, but also deliver the vernacular soul from our experimental models. After such considerations, we put the traditional Beijing Quadrangle dwelling as our first experimental modelling sample. In our opinion, the

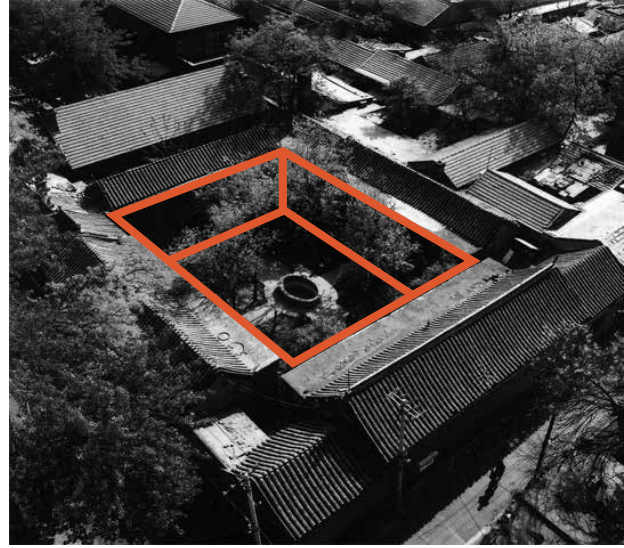
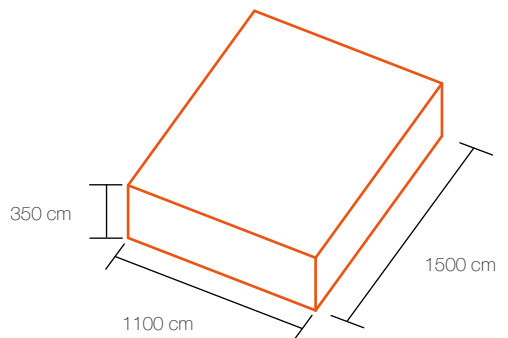


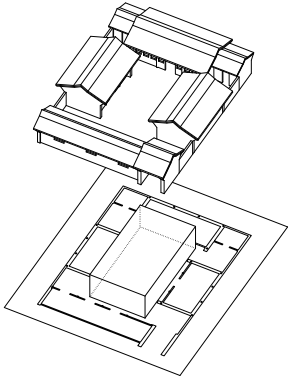
Fig. 6.48 Geometrical proportion of Enclosed Courtyard.



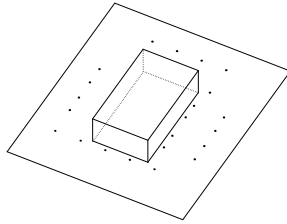
1 Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003.

2 Marco Hemmerling, Luigi Cocchiarella. *Informed Architecture. Computational Strategies in Architectural Design*. Springer International Publishing AG, Switzerland. 2018.

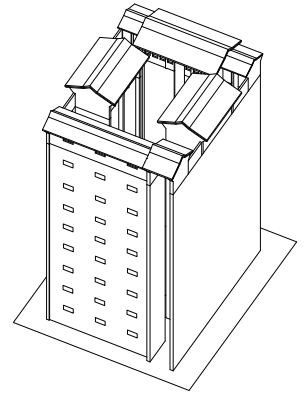
Fig.6.49 Analysis of Malposed Courtyard's Parametric Procedure



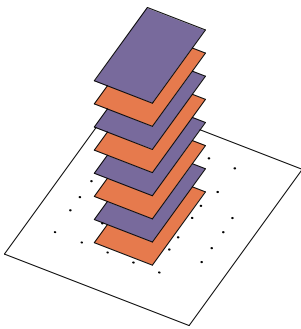
Emphasize target space



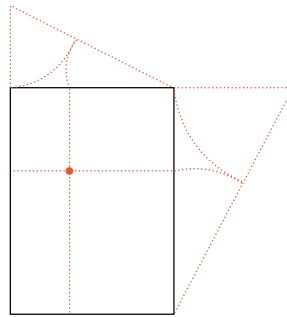
Relationship between courtyard and surrounded house



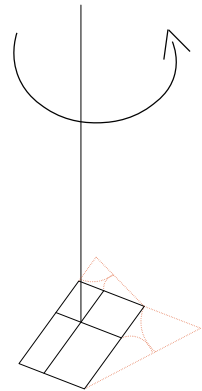
Increased volume of prototype along Z axis



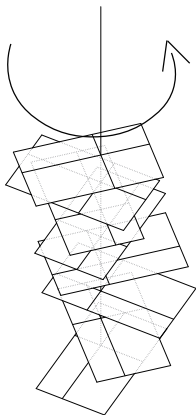
Lifted courtyard



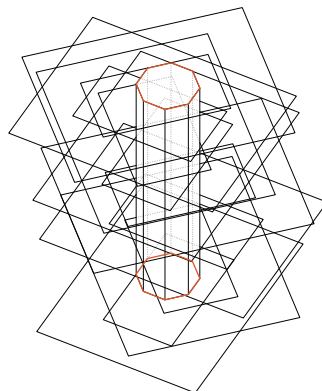
Define axis of rotation



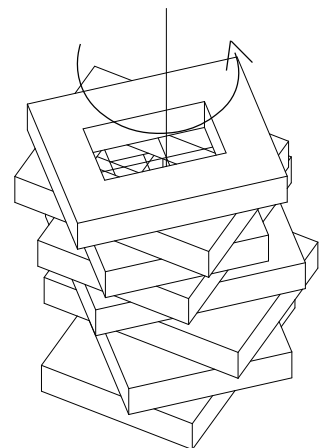
Rotate courtyard



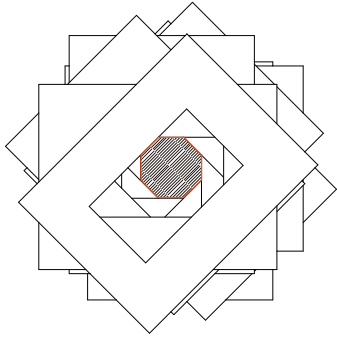
Rotate courtyards in series



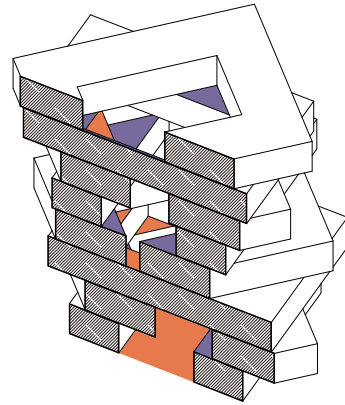
Evaluate the enclosed space after malposed rotation



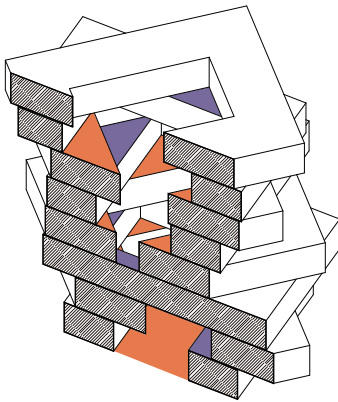
Model of rotation result



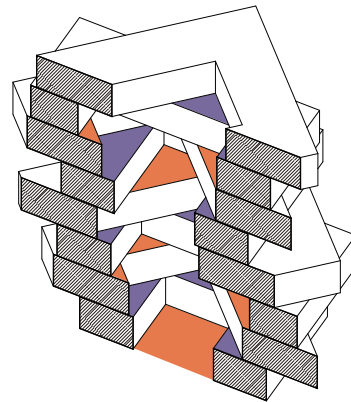
Top view of the Model



Section A of model



Section B of model



Section C of model

vernacular manifestation that generated from parametric language should not just stop as architectural envelope level, we could discover much more in depth. Likewise, the skin of a human introduces his characteristics undoubtedly. But the nature under the skin such as temperament can also show human

characteristics. And the skeleton is much more important for a human. Result from this, we start to study the architectural space from original Beijing Quadrangle. Firstly, from the highlighting the form of courtyard from two photographs above (Figure.6.46, 6.47). The red lines outlines the geometrical shape of courtyard space.

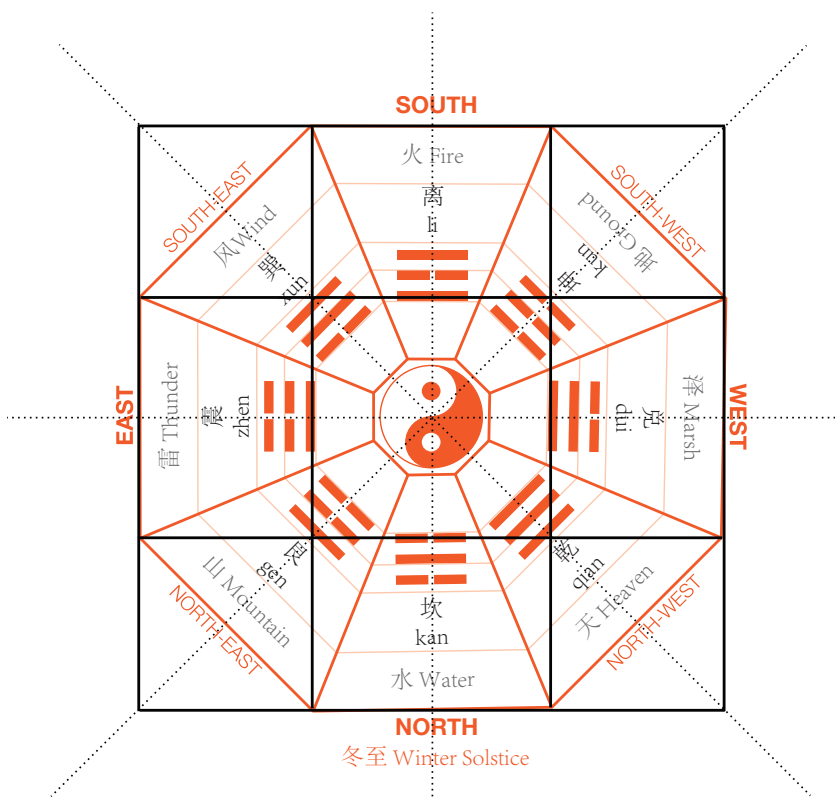


Fig.6.50 Chinese Ba Gua Diagram

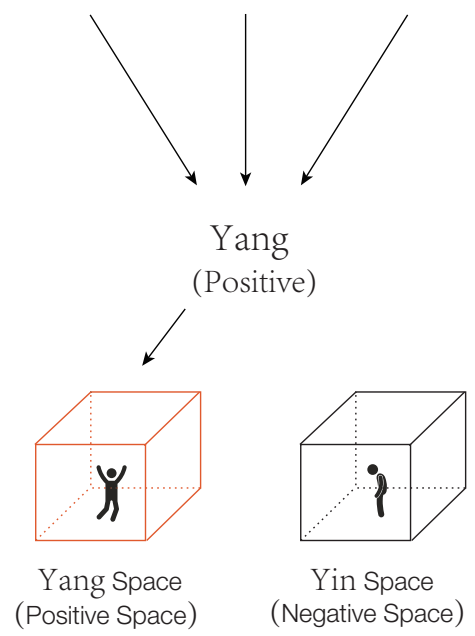


Fig.6.52 Interpretation of Yang and Yin Space

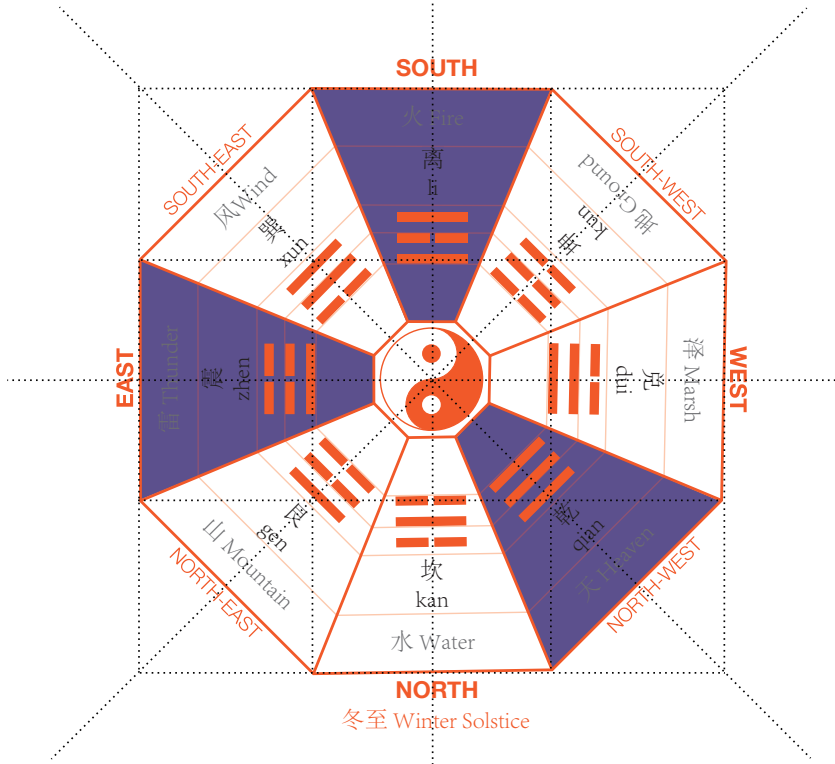


Fig.6.51 Selection of Rotation Axis

Eight-Diagram tactics expound the way how Chinese people perceive the whole world in ancient time. Shortly afterwards, the ruined capital was reconstructed and renamed Beijing, the North Capital, known to Westerners as Peking. It has been, except for two short intervals, the capital of China ever since. The Beijing had the national liberation from the capital of an absolute monarchy in 1949. It took its final shape in the year he Zhouli. The Beijing had the national liberation from the capital of an absolute monarchy in 1949.

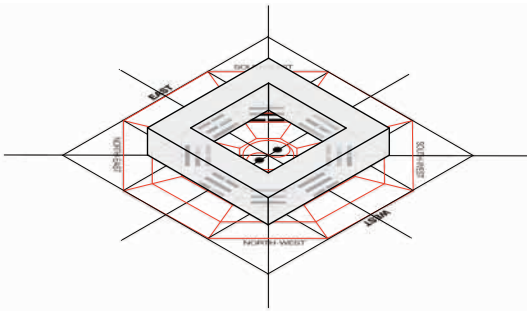


Fig.6.53 Enclosed around centroid axis

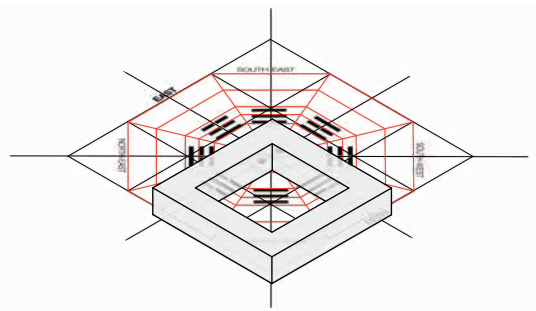


Fig.6.54 Enclosed around 乾 (qian) axis

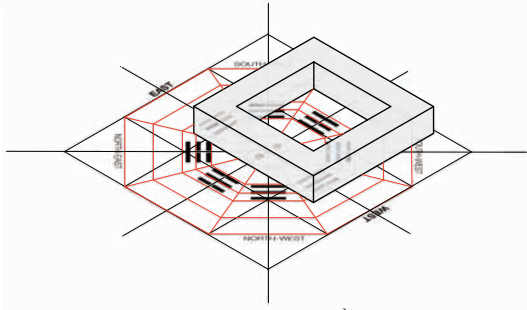


Fig.6.55 Enclosed around 离 (li) axis

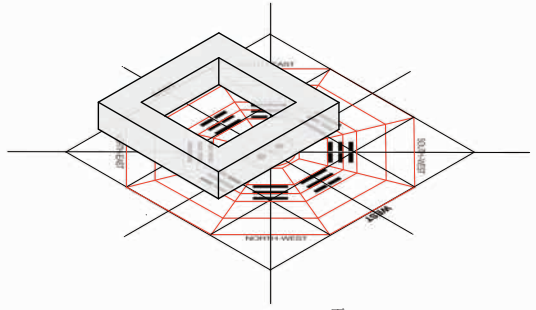


Fig.6.56 Enclosed around 震 (zhen) axis

Fig.6.57

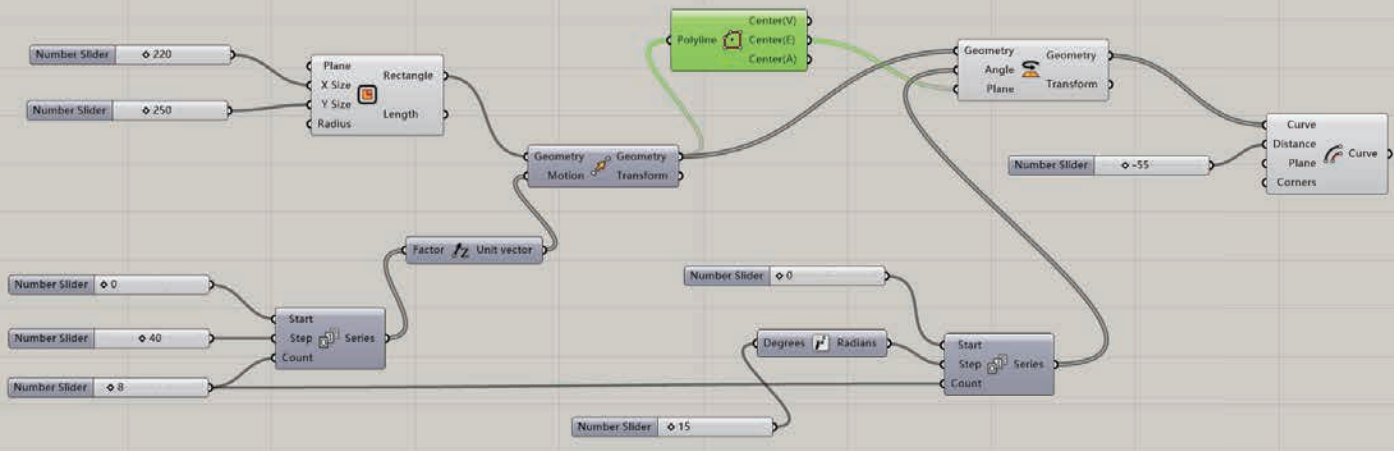


Fig.6.58 Every plan curve is moving along Z axis in series.

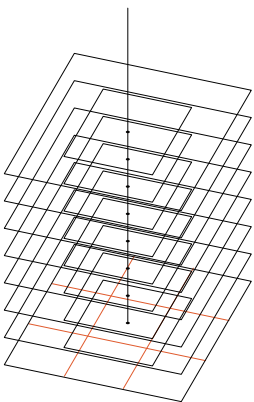


Fig.6.59  $\theta = \alpha^\circ$   
( $\alpha = 15^\circ/30^\circ/45^\circ/90^\circ$ )

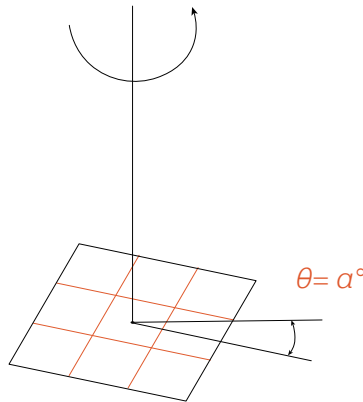


Fig.6.60 Every plan curve is rotating around Centroid axis in series with 15° each step.

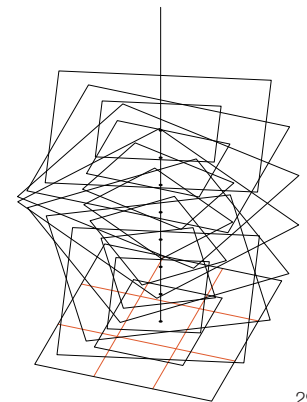
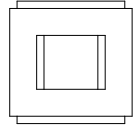
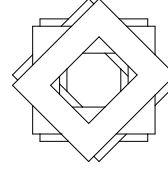
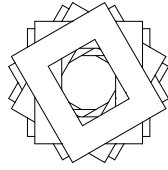
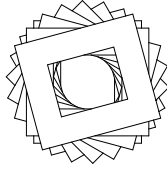
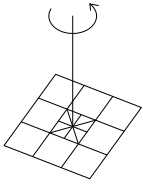


Fig.6.61 Malposed Courtyard Parametric Plan Study



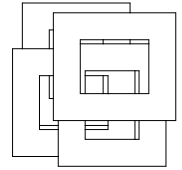
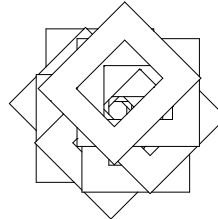
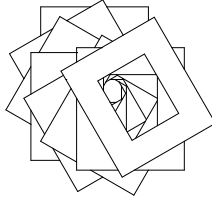
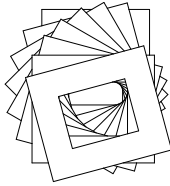
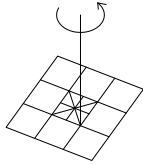
● 中  
(centroid)

Plan View, objects are rotating along centroid axis, and each rotated step is 15°.

Plan View, objects are rotating along centroid axis, and each rotated step is 30°.

Plan View, objects are rotating along centroid axis, and each rotated step is 45°.

Plan View, objects are rotating along centroid axis, and each rotated step is 90°.



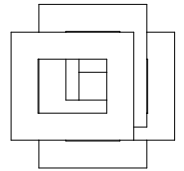
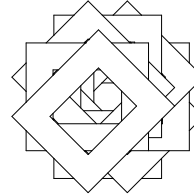
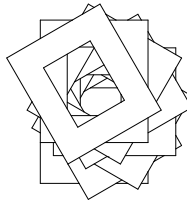
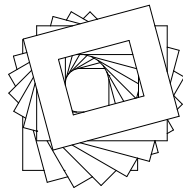
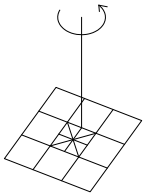
☰ 乾  
(qian)

Plan View, objects are rotating along 乾 (qian) axis, and each rotated step is 15°.

Plan View, objects are rotating along 乾 (qian) axis, and each rotated step is 30°.

Plan View, objects are rotating along 乾 (qian) axis, and each rotated step is 45°.

Plan View, objects are rotating along 乾 (qian) axis, and each rotated step is 90°.



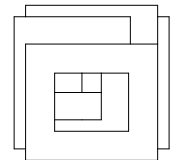
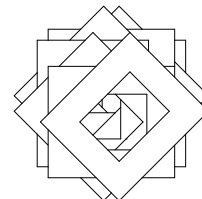
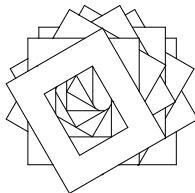
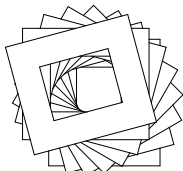
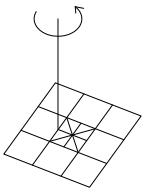
☲ 离  
(li)

Plan View, objects are rotating along 离 (li) axis, and each rotated step is 15°.

Plan View, objects are rotating along 离 (li) axis, and each rotated step is 30°.

Plan View, objects are rotating along 离 (li) axis, and each rotated step is 45°.

Plan View, objects are rotating along 离 (li) axis, and each rotated step is 90°.



☳ 震  
(zhen)

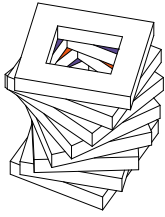
Plan View, objects are rotating along 震 (zhen) axis, and each rotated step is 15°.

Plan View, objects are rotating along 震 (zhen) axis, and each rotated step is 30°.

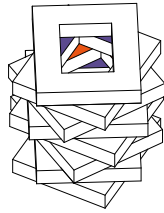
Plan View, objects are rotating along 震 (zhen) axis, and each rotated step is 45°.

Plan View, objects are rotating along 震 (zhen) axis, and each rotated step is 90°.

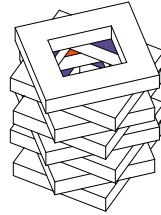
Fig.6.62 Malposed Courtyard Parametric Model Study



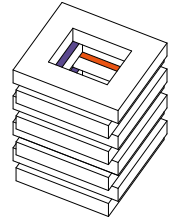
Axonometric View, objects are rotating along centroid axis, and each rotated step is 15°.



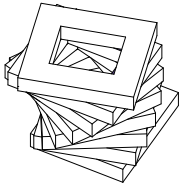
Axonometric View, objects are rotating along centroid axis, and each rotated step is 30°.



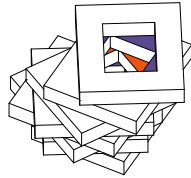
Axonometric View, objects are rotating along centroid axis, and each rotated step is 45°.



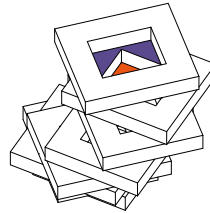
Axonometric View, objects are rotating along centroid axis, and each rotated step is 90°.



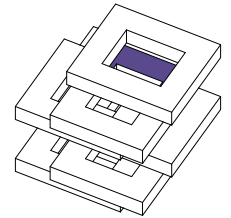
Axonometric View, objects are rotating along 乾 (qian) axis, and each rotated step is 15°.



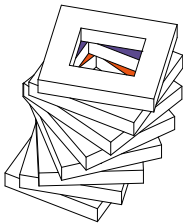
Axonometric View, objects are rotating along 乾 (qian) axis, and each rotated step is 30°.



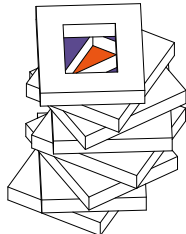
Axonometric View, objects are rotating along 乾 (qian) axis, and each rotated step is 45°.



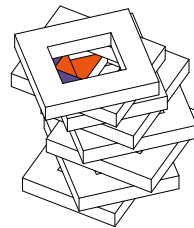
Axonometric View, objects are rotating along 乾 (qian) axis, and each rotated step is 90°.



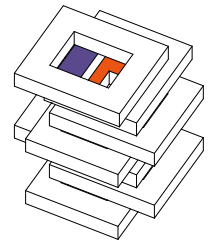
Axonometric View, objects are rotating along 离 (li) axis, and each rotated step is 15°.



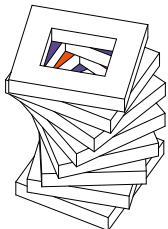
Axonometric View, objects are rotating along 离 (li) axis, and each rotated step is 30°.



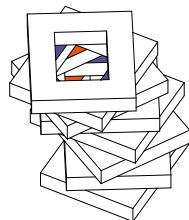
Axonometric View, objects are rotating along 离 (li) axis, and each rotated step is 45°.



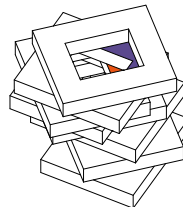
Axonometric View, objects are rotating along 离 (li) axis, and each rotated step is 90°.



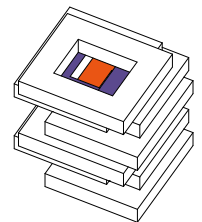
Axonometric View, objects are rotating along 震 (zhen) axis, and each rotated step is 15°.



Axonometric View, objects are rotating along 震 (zhen) axis, and each rotated step is 30°.



Axonometric View, objects are rotating along 震 (zhen) axis, and each rotated step is 45°.



Axonometric View, objects are rotating along 震 (zhen) axis, and each rotated step is 90°.

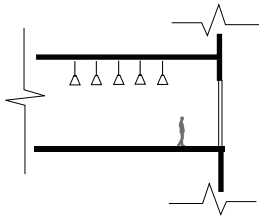


Fig.6.63 Partial Section A

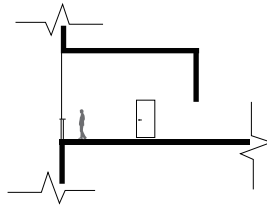


Fig.6.64 Partial Section B

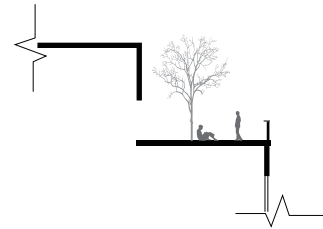


Fig.6.65 Partial Section C

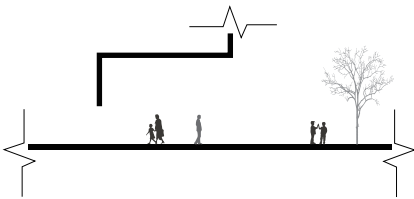


Fig.6.66 Partial Section D

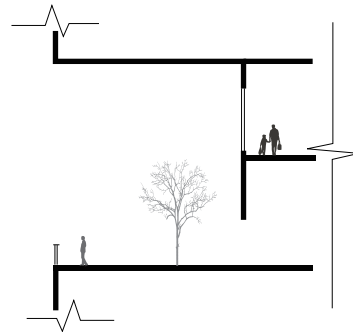


Fig.6.67 Partial Section E

The traditional proportion of courtyard is more or less around 1100cm X 1500cm X 350cm (Width; Length; Height). Check the simplification diagram we made above. (Figure.6.48). The first step we introduce the position of courtyard, indicate the relationship between courtyard with buildings around on the second step. As you can see from the process diagrams, while the increased of architectural volume along Z direction. The bases of enclosed courtyards are impending except the one on the ground floor. We want to remain the traditional space in spite of the growing of building.

By applying malposed rotation to realize malposed space for each floor. We can rotate every floor in series but with the same rotated degree around the rotation axis that we can define as new parameters. Of course, in this concept of experimentation, we make the prototype courtyard as the important constant parameter. By changing the variable parameters which will influence the shape of original courtyard space. Next step, we are planning to use traditional Chinses Ba Gua Diagram to define our rotation axes. Because we think the different axes will also affect the different shape of



Fig. 6.68  
Photography  
of Stilt style  
architecture  
Source: Hemudu  
dry-column  
architecture: a  
masterpiece  
of water town  
architecture.  
<http://www.sohu.com>

malposed courtyards. As we explain by drawings, there are some symbol placements in Ba Gua Diagram are referring to Yang Space, which means positive space in architectural fields. Then after overlaying the Sudoku on Ba Gua Diagram and the plan layout of Beijing Quadrangle as well. We immediately find Zhen (震), Li (离) and Qian (乾) these three symbols location present Yang. So we extending the lines from centroid to these three location, then we obtain three intersection points on the layout that we can use for parametric rotation axes. You must have questions about the shape from the attempted results from our experimental models. The fragmented spaces generated by malposed rotation are quite different from the original courtyard's shape. But in our consideration, even through we did not keep the original geometrical shape of traditional courtyard, but we remain the dynamic formation of traditional yard space and we also emphasis the feature of enclosed from traditional space. The vernacular manifestation could realize from different mentality.

Fig. 6.69  
Photography  
of Stilt style  
architecture  
Source: Hemudu  
dry-column  
architecture: a  
masterpiece  
of water town  
architecture.  
<http://www.sohu.com>

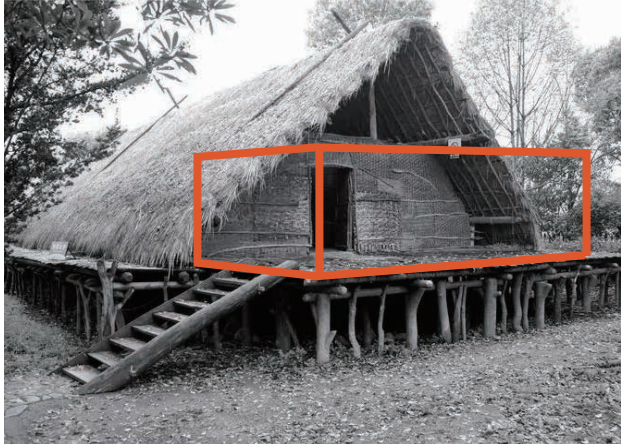
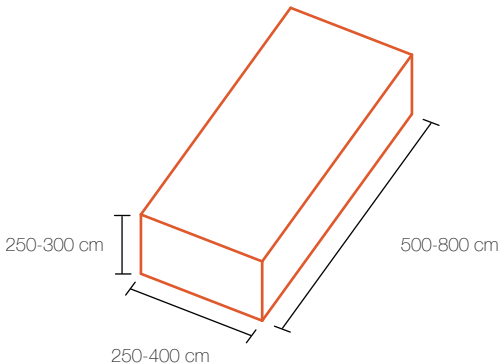


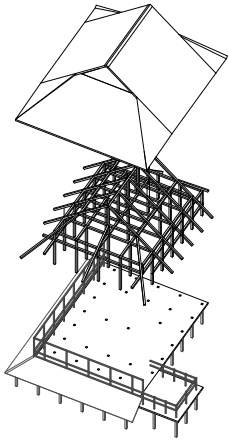
Fig. 6.70 Geometrical proportion of Outspread Terrace.



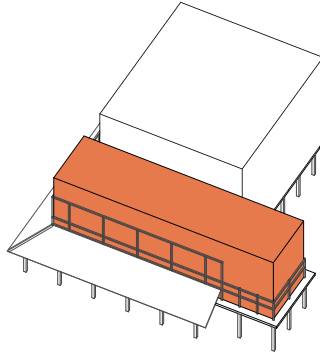
**Outspread Terrace  
from Stilt style architecture**

The second sample is the stilt style archit-

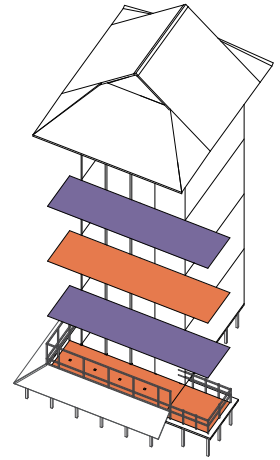
Fig.6.71 Analysis of Outspread Terrace Parametric Procedure



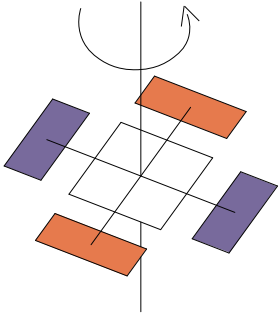
Exploded view of prototype



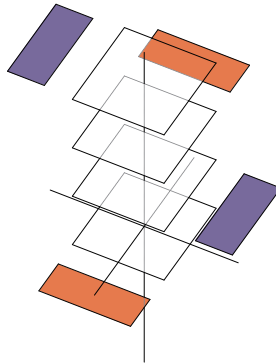
Emphasize target space



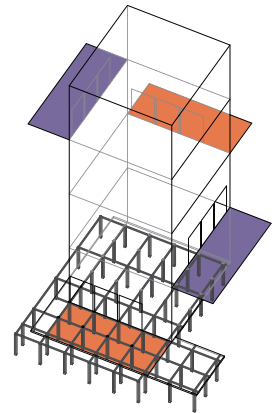
Lifting Terrace along facade



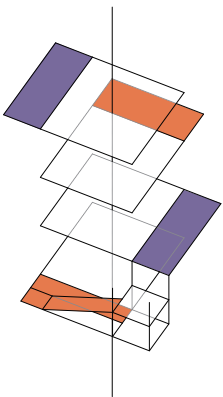
Rotate terraces around the plan



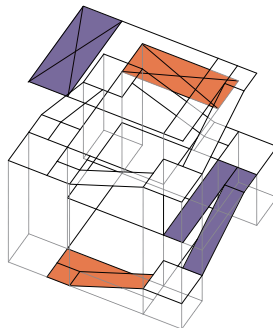
Rotating and elevating



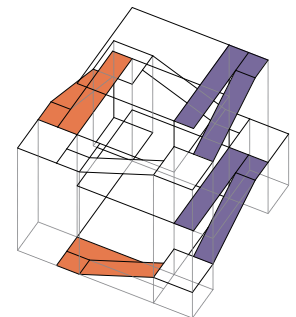
Apply on architectural space



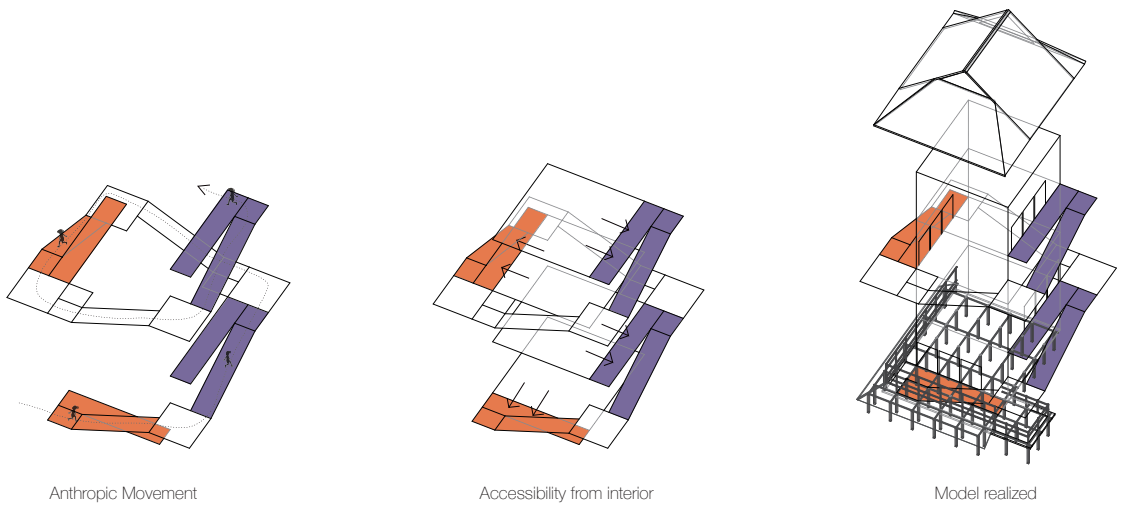
Design a ramp for terrace



Delete inadaptable terrace



Circulation system

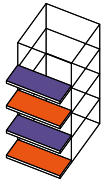


ecture. Using the same methodology from the case of Beijing Quadrangle. We want to discover some significant space which is belong to local traditional culture. After researching the information from chapter four. We understand very well of the appearance of the stilt style architecture in specific region. This typology architecture is generated from local culture and topography, meanwhile influenced from regional climate. Year-round precipitation and often humid weather make this type of building overhead through the wood columns. Which make us exciting is that based on study from photographs and literature, we found the characteristic space the stilt style architecture has solely. Local residents often built a terrace on the first floor due to the demands of open space

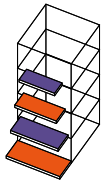
and natural sun light, and this kind of extending platform can keep indoors dry and comfortable to some extent. Based on the outline from photography and relevant documents, the abstraction from original terrace is summarized by us. (Figure.6.70) The ordinary dimension of stilt house's terrace is approximately around 350cm x 700cm x 300cm (Length, Width, Height). No matter there are fluctuant sizes for different houses, but the proportion we can use to import the space as a parameter into grasshopper machine.

As we present the experimental models in following, the lifted terraces are arraying along the one side façade while the increased volume of original architectural prototype. Trying to make these outspread

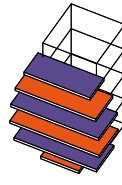
Fig.6.72 Outspread Terrace Parametric Model Study



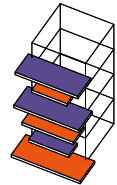
Axonometric View, terraces are moving along Z direction in sequence.



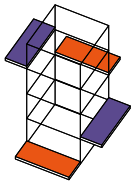
Axonometric View, terraces are moving along Z direction in sequence and their area are decreasing progressively.



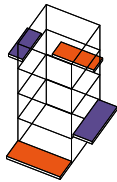
Axonometric View, terraces are moving along Z direction in sequence and Scaling with Sin Function.



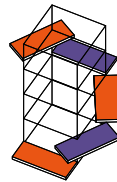
Axonometric View, terraces are moving along Z direction in sequence and Scaling with Sin Function.



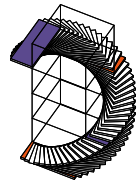
Axonometric View, terraces are rising with spirial tendency.



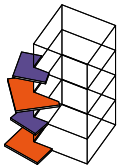
Axonometric View, terraces are rising with spirial tendency and their area are decreasing progressively.



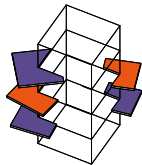
Axonometric View, terraces are rising with spirial tendency and increase quantity.



Axonometric View, terraces are rising with spirial tendency and increase quantity to their fullest.



Axonometric View, terraces shaped and fragmented randomly.



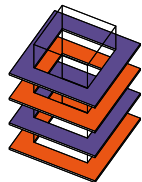
Axonometric View, terraces shaped and fragmented randomly along two sides.



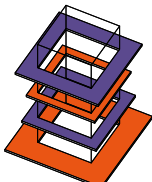
Axonometric View, terraces shaped and fragmented randomly along three sides.



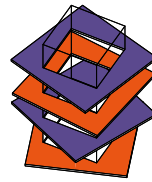
Axonometric View, terraces shaped, fragmented, rising spiral randomly.



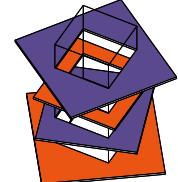
Axonometric View, surrounded terraces rising along Z direction.



Axonometric View, surrounded terraces rising along Z direction and scaling with Sin Function.



Axonometric View, surrounded terraces rising along Z direction and rotating.



Axonometric View, surrounded terraces rising along Z direction, rotating around centroid axis and scaling with Sin Function.

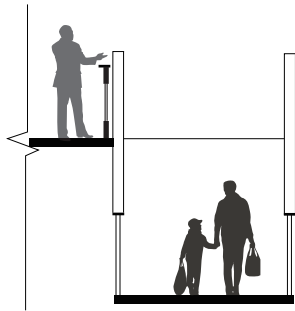


Fig.6.73 Partial Section A

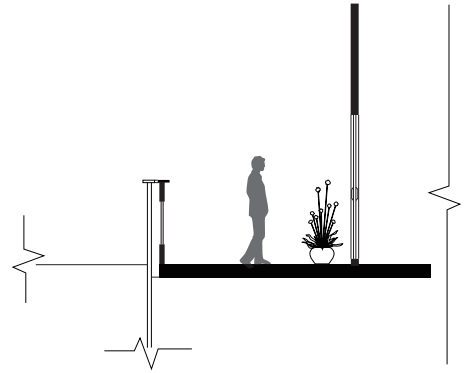


Fig.6.74 Partial Section B

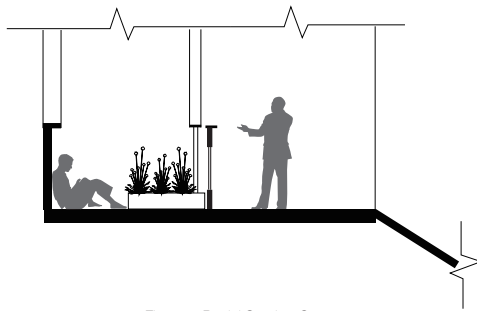


Fig.6.75 Partial Section C

terraces distributed on all side of building instead of one façade. Then if we make a centre axis of the building, we could drive these terraces climbing and rotating, like rising in spiral tendency. After that, the solution provides appropriate natural light and ventilation for users. Then we think in reality, there should equipped with connection from different terraces. We apply ramp connection to active circulation that create an experience

of promenade space. We are willing to make the experimental models from grasshopper is not a geometrical form study, it is a understandable spatial model. And the propose of the outspreading terrace both has the function for moving and function for staying. According to this logical process we explained above, we start to choose different other parameters that are influencing our constant parameter for grasshopper algorithm. The first row we get from parametric modelling are mainly indicate the four possibilities we can make for outspread terrace only equipped on one side façade. In the last two experimental models, the dynamic changing of terrace are based on trigonometric function of Sin, but we choose two different wave bands. The second row indicates the scene of increased quantity of terrace. Third row interpret the fragmented variable terraces

we could have. Finally, the attempted models describe the surrounded terrace solution that we could apply for modern residence towers in practical cases. Two experimental models in the beginning show the offsetting shape of surrounded terrace and the variant size possibility. The last two parametric models introducing the rotating dynamic in series generate the different orientation of outspread terrace. The final attempted model is telling us the extreme situation of increasing the width of outspread area based on previous step of terraces' rotation in series.

### Extracted Patio from the Bamboo House

The subsequent practice sample is the prototype from Guang Zhou region, the bamboo house. Different from the big courtyard of traditional Beijing Quadrangle, there is another size of courtyard we have in the southern part of China. Instead of calling them courtyard, we always call it as patio. Because its narrow layout with double floor height. Completely two different experience when you stay in Patio and courtyard. Although, they are all enclosed by surrounded buildings. But in precise speaking, the from generation of patio space from the bamboo house has the dynamic movement of extracting

more than the forming trend of enclosure. In our opinion, the spatial generation process and its different ratio of space are the main conditions to distinguish patio from courtyard. Of course, they also have similarities in the enclosure point of view.

The preceding step of this fresh experimental parametric modelling is tracing the outline of target space which is the extracted patio. We are tracing red lines to provide the image of outline for patio seeing from scheme above. (Figure.6.75,76) The general size of vernacular patio is 400cm x 300cm x 700cm (Length; Width; Height) And we believe if we control our constant parameter of this spatial sample, we could still remain the vernacular experience through parametric generation. The spatial prototype we take from the bamboo house is showing in the diagrams we provide as following. With consideration of modern architectures. The massive volume such as a big cube is always come to our eyes, the explosion

Fig. 6.76  
Photography  
of Patio from  
Bamboo House  
Source: Old  
house in the  
past, there is  
a patio. [http://  
www.sohu.com](http://www.sohu.com)

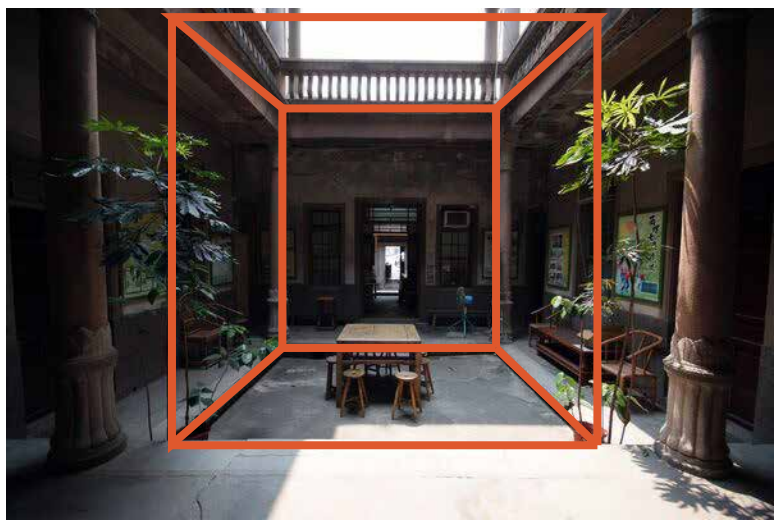
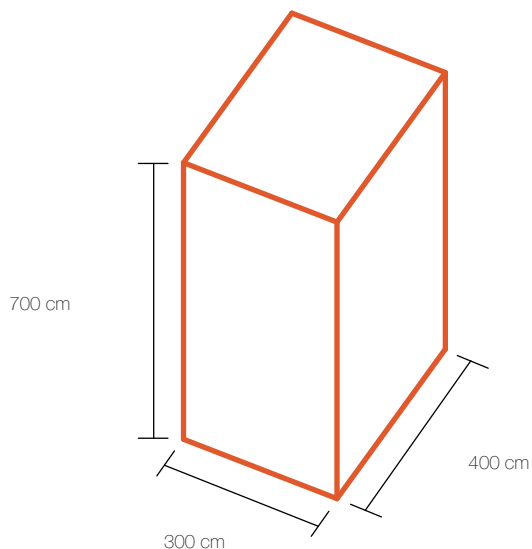




Fig. 6.77  
Photography  
of Patio from  
Bamboo House  
Source: Old  
house in the  
past, there is  
a patio. [http://  
www.sohu.com](http://www.sohu.com)

Fig. 6.78  
Geometrical proportion of Extracted Patio.



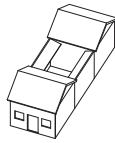
of population drives buildings become bigger and bigger. The great body provide well equipment of electricity and air conditions indoors. But what makes us upset is that the lack of natural sunshine and natural ventilation, this kind of buildings keep people far away from environment they are staying. And then responding to the aim of vernacular renaissance through local patio, we would like to perform extracted patio as an extracting space that we can excavate from the massive building.

The goal we want to achieve is to create an environment like this, even through you living in a complete contemporary house and it is hard to recalls your memory about local traditional taste from the modern skin. However, when people entering to the building, there are plenty of extracting spaces which have the same spatial proportion of vernacular patio. The similar form brings endless memories of your hometown. The modern skin carries a vernacular skeleton will provide you a new but familiar experience while you are staying in this space. Regardless the constant parameter we import into the grasshopper algorithm, we still have some variable parameters that could generate various solutions or experimental models. When we reflect this experimentation to

Fig.6.79 Volume Variation Parametric Generation A for Bamboo House



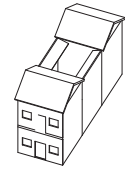
Original state, single volume with a patio



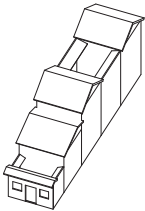
Double volume with a patio



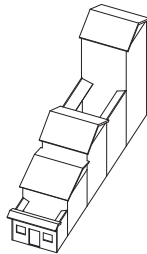
Double storey single volume with a patio



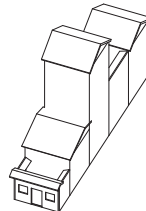
Double storey double volume with a patio



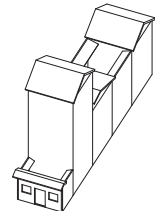
Mature form, three volumes with two patios



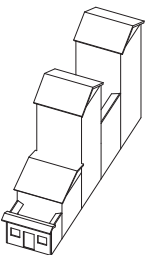
Double storey of the bottom volume with two patios



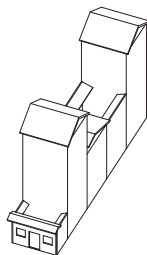
Double storey of the middle volume with two patios



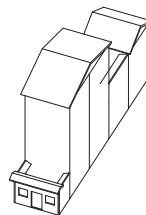
Double storey of the front volume with two patios



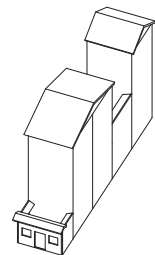
Double storey of the middle and bottom volumes with two patios



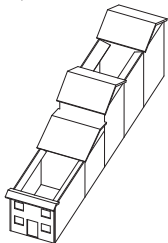
Double storey of the front and bottom volumes with two patios



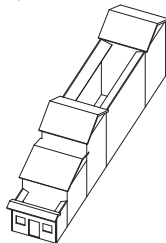
Double storey of the front and middle volumes with two patios



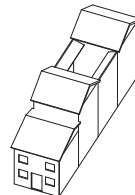
Double storey of the three volume with two patios



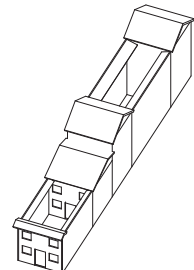
Larger the front patio with original three volumes of mature form



Larger the inner patio with original three volumes of mature form



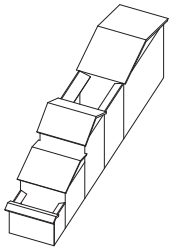
Eliminate the front patio with original three volumes of mature form



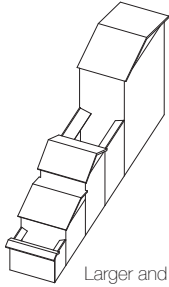
Larger two patios with original three volumes of mature form



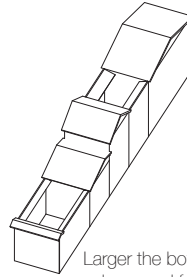
Fig.6.80 Volume Variation Parametric Generation B for Bamboo House



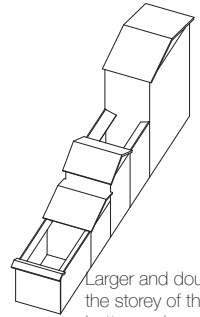
Group origin, larger the bottom volume



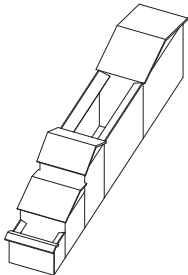
Larger and double the storey of the bottom volume



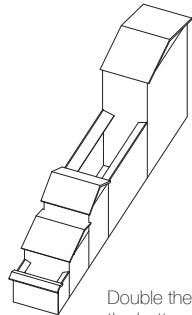
Larger the bottom volume and front patio



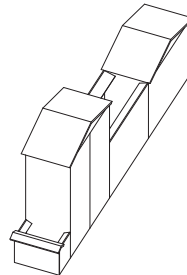
Larger and double the storey of the bottom volume and front patio



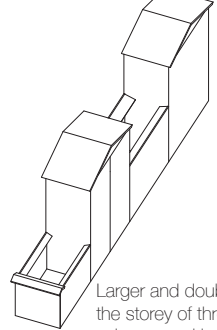
Group origin, Larger the bottom volume and the inner patio



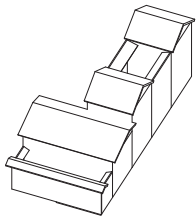
Double the storey of the bottom volume



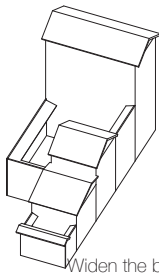
Larger and double the storey of the front two volumes



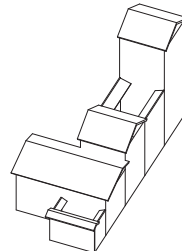
Larger and double the storey of three volumes and larger the front patio



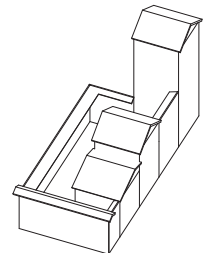
Widen the front volume and patio



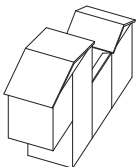
Widen the bottom volume with double height and the inner patio



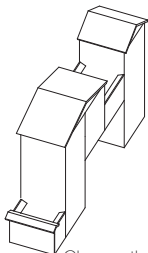
Widen the front volume and double the storey of bottom volume



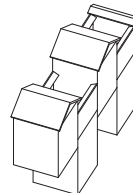
Double the storey of bottom volume and enlarge the two patio



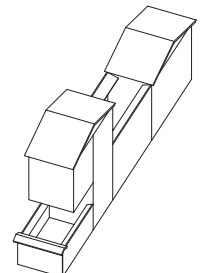
Change the shape of front two volume



Change the shape of middle volume and pull up front and bottom volume

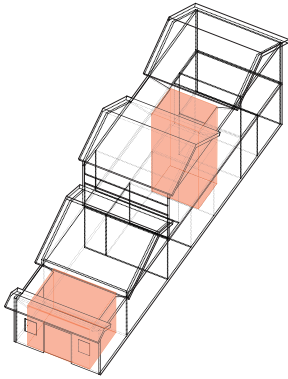


Change the shape of front volume and define new patio space

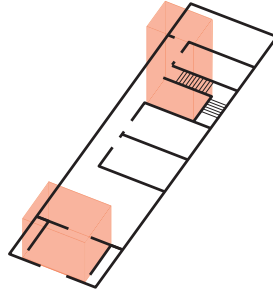


Change the shape of front volume, larger bottom volume, pull up middle volume, enlarge both patio

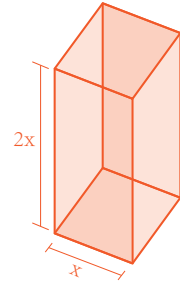
Fig.6.81 Analysis of Extracted Terrace Parametric Procedure



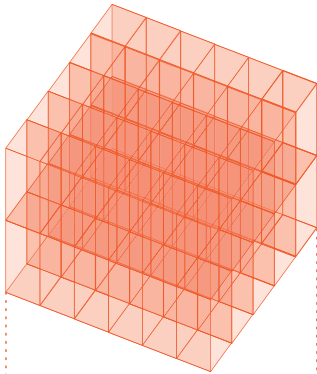
The patio inside the Bamboo house form a significant space of this architecture.



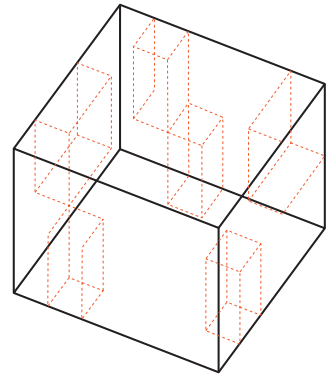
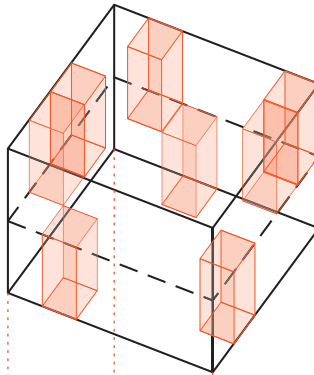
Abstract the characterized space from the original volume.



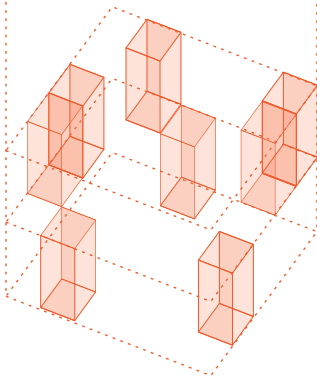
General dimension feeling for human to experience space of the patio.



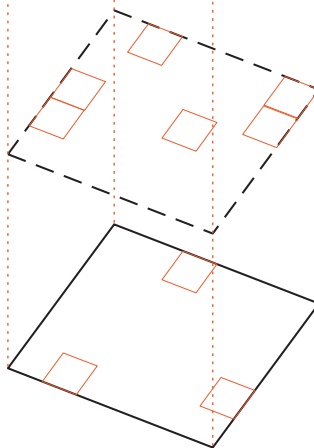
Simulate the big volume of modern building with target element.



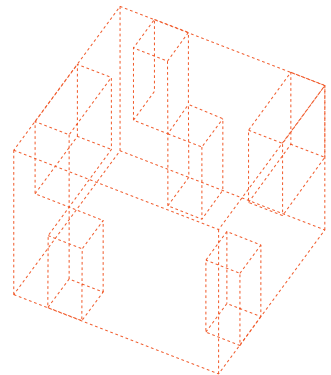
Original volume can be joint to be potential to form different space.



The abstracted space represent a void inside the solid volume.



Every floor can come out different void after randomly take away the space.



In the contrary, the void and the solid can be switched.

reality, depending on different needs, the patio space can be different size for which just need to simply change the numbers of dimension from extracted patio. using the principle algorithm in grasshopper which is Octree to compute different distribution of point cloud. And the point cloud are geometric centres of each patio unit. Generally speaking, we are changing the size of seeds under the same condition to get the different construction of cubes. And then when we increasing the group commend in grasshopper, which you can see from the grasshopper algorithm procedure (Figure.6.xx) if you drag the number slider that control the parameter form Group commend, the increased number will affect the bigger cells from the target cuboid.

Planning excavated spaces from different level of cuboid creates several solutions about proposes of space organization. But before that, we still make another fundamental attempt about parametric modelling depending on basic parameters such as the volume variation due the changing form original dimension. Just like permutation and combination, first we start from the very basic formation of Bamboo house with one hall and one patio that generated by a hall and an entrance

wall. Then changing the mononuclear hall to double hall, and the patio space is excavated from the centre of the Bamboo House. In the same language, we increase number of hall and excavate more than one patio space from generated models, by varying the quantity of patio space and halls for Bamboo House to achieve different compound modes. Even to the next steps, we tried to alter the shape of patio space which are quite different from original size. The enlargement attempt result shows the geometrical transformation would happen to face the unprecedented complexity of the real world. In the last row, some experimental models illustrate the elevated level of halls and extracting patio space in traditional Bamboo House. What we have to emphasis here is that although we used method of algorithms-aided design<sup>1</sup> on vernacular architecture with unlimited parameters. But we insist the respect from the original proportion of Bamboo House, we keep all parametric models in a long and narrow form to represent their vernacular manifestation. The current stage of parametric modelling from the experiment is useful to explore a potentially unlimited number of design propose.

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1 Marco Hemmerling, Luigi Cocchiarella. *Informed Architecture. Computational Strategies in Architectural Design*. Springer International Publishing AG, Switzerland. 2018

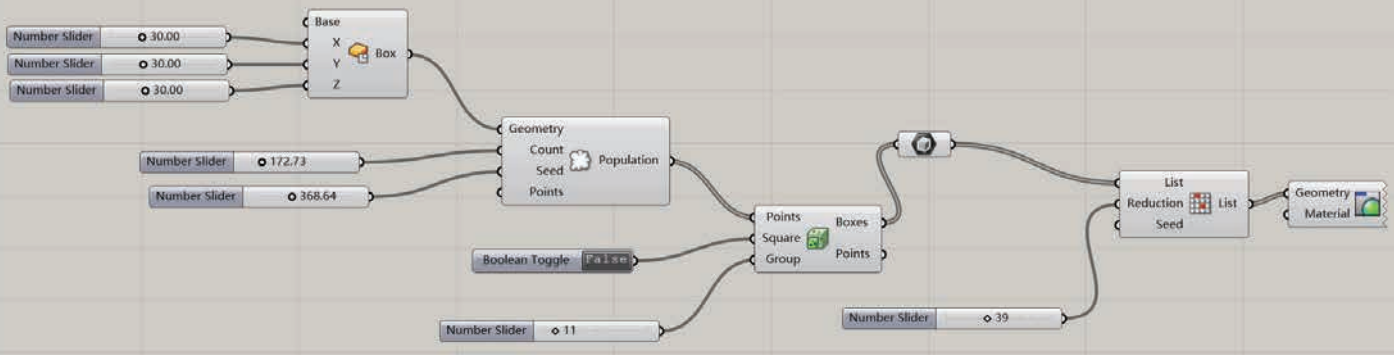
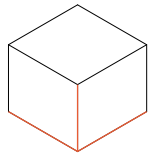
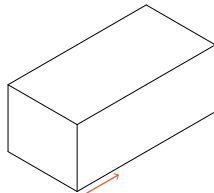


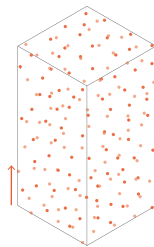
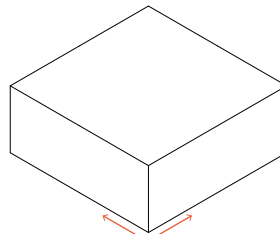
Fig. 6.83  
Procedure of Parametric Experimentation



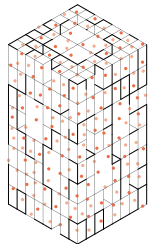
The simply parametric to define the shape of the space you would like to extract.



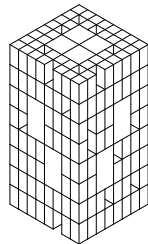
According to the needs, the space can be different space, for which just need to simply change the number of its length, width and height.



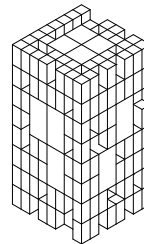
Second step is to randomly spread the points in the box, by Octree function



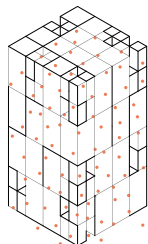
By changing the "Count" and Seed can receive different point spreading



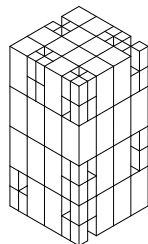
Octree can divide the original box according to the distribution of point cloude.



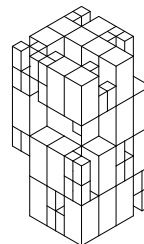
Under same condition only change the seed will get the diffrent construction of boxes.



By increasing the "Group" and reducing the number of points, the box will have fewer segmetation.



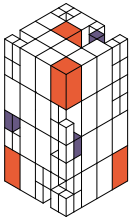
The box will appear the deficiency itself.



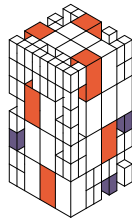
Controlling the parameter of reduction in random battery, we can get many results. But it will be adjust by practical situation.

Fig. 6.82  
Process of Grasshopper Algorithm

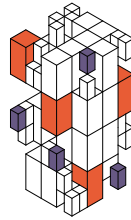
Fig.6.84 Extracted Patio Parametric Model Study



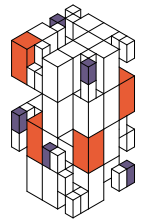
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 520, seed in 300, group in 12, reduction density 5.



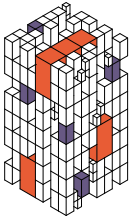
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 600, seed in 300, group in 12, reduction density 10.



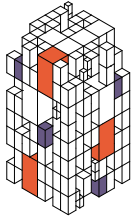
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 550, seed in 350, group in 10, reduction density 20.



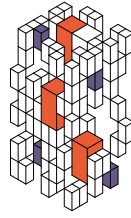
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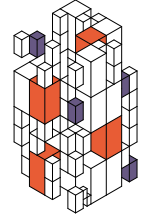
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 200, seed in 200, group in 3, reduction density 10.



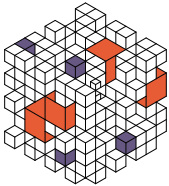
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 200, seed in 250, group in 3, reduction density 20.



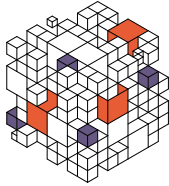
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 200, seed in 300, group in 3, reduction density 40.



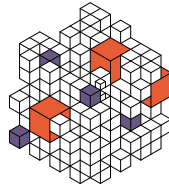
Axonometric View, length and width =  $x$ , height =  $2x$ , point population count in 200, seed in 350, group in 3, reduction density 70.



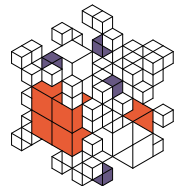
Axonometric View, length = width = height =  $x$ , point population count in 200, seed in 200, group in 3, reduction density 10.



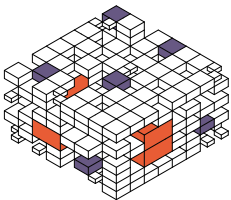
Axonometric View, length = width = height =  $x$ , point population count in 200, seed in 250, group in 3, reduction density 20.



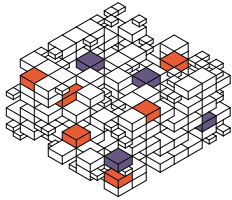
Axonometric View, length = width = height =  $x$ , point population count in 200, seed in 300, group in 3, reduction density 40.



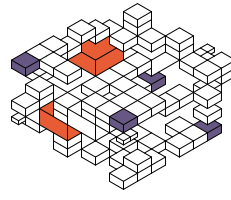
Axonometric View, length = width = height =  $x$ , point population count in 200, seed in 350, group in 3, reduction density 70.



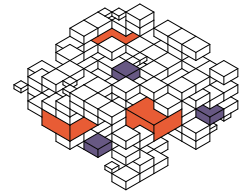
Axonometric View, length = width =  $2x$ , height =  $x$ , point population count in 200, seed in 200, group in 3, reduction density 10.



Axonometric View, length = width =  $2x$ , height =  $x$ , point population count in 200, seed in 250, group in 3, reduction density 20.



Axonometric View, length = width =  $2x$ , height =  $x$ , point population count in 200, seed in 300, group in 3, reduction density 40.



Axonometric View, length = width =  $2x$ , height =  $x$ , point population count in 200, seed in 350, group in 3, reduction density 70.

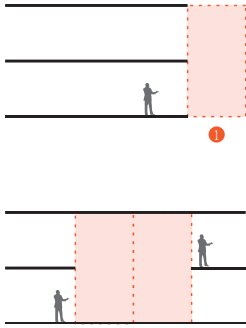


Fig.6.85 Partial Section A

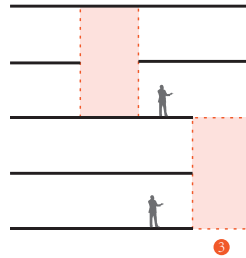


Fig.6.86 Partial Section B

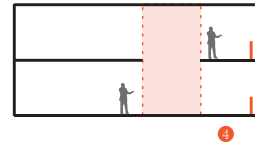


Fig.6.87 Partial Section C

By understanding the last stage of variation of parametric excavation models, we could study from these sixteen models to reality that the overcoming from the limitations of these excavated space by manual, the algorithms-aided design process could resolve the issues which are beyond the human manual ability. There are different size of excavated patio and various excavated spatial organization from these parametric models. But we are clear to know this is just the tip of the iceberg we provide from parametric machine. Unlimited solutions will be generated from the algorithms-aided process from grasshopper, the thing what we have to do is choose the appropriate solutions which have potential ability to be developed as a real architectural space. For example, the experimental model that has small unit be excavated we can use it for individual

patio, that allow the private function for official building. The officers who working in the room still have their own open space to breath fresh air during nervous work. The intermediate scale of excavated patio could design as a sharing space both for users and visitors but it can still provide a certain privacy for people who stay in this space. And the large scale of excavated space we can propose it as a completely public space, to construct a cave-like public space in the sky. That will bring a totally new experience when people stay in. Meanwhile the special space formation can also evoke of perception of affiliation while people are feeling this space and tasting its typical vernacular representation. As a consequence, no matter the variation of shape, people could still feel familiar to these architectures due to the constant spatial nature.

## Flowing Corridor from Hakka Tulou

Fig. 6.88  
Photography of  
Corridor from  
Hakka Tulou  
Source: <http://www.china.backpacker.info>

The last spatial sample for our parametric experimentation is the corridor in Hakka Tulou. The most common tulou standing today are of rectangular and circular shapes. Most of them are found within the county of Yongding. Yongding County; of which about 360 are circular shaped. The rectangular tulou is an earlier design whereas the circular ones are newer. Rectangular tulou is direction-oriented and has different lighting and ventilation characteristics often resulting in damp and dark corners. Hence these are slowly replaced by the circular design. Both designs are built around a central courtyard that allows in light and ventilation and to house livestock. Some of the circular tulou's also has an inner circular single level building within the compound. They also have wells and complex drainage systems. The outer walls are normally a meter thick with slits for rifles. The entrance is bolted with heavy door. In this parametric experimentation we would choose the representative space which is the circle corridor facing to its inner courtyard from the circular Tulou as target spatial prototype, and import it as the constant parameter to grasshopper algorithm.

Fig. 6.89  
Photography of  
Corridor from  
Hakka Tulou  
Source:  
Photograph  
from the author  
Guo Jinyi



Fig. 6.90  
Geometrical proportion of Flowing Corridor.

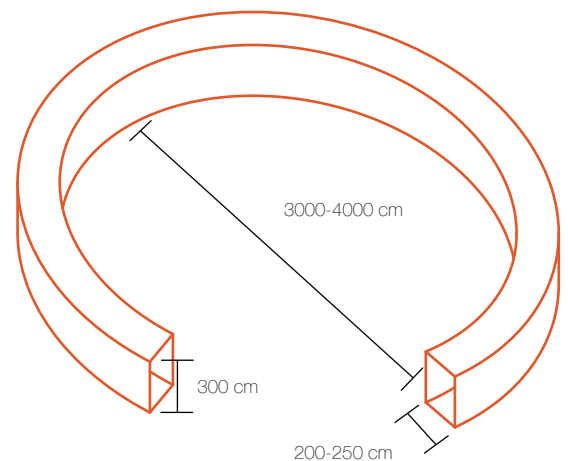
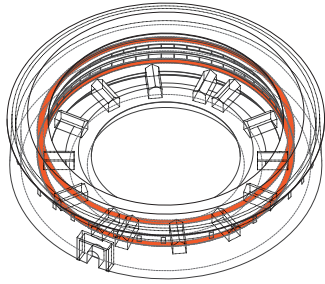
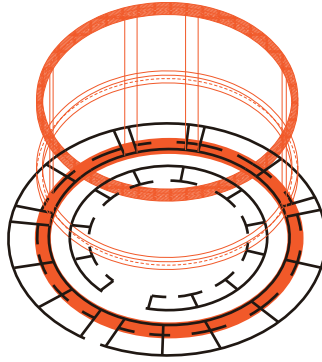


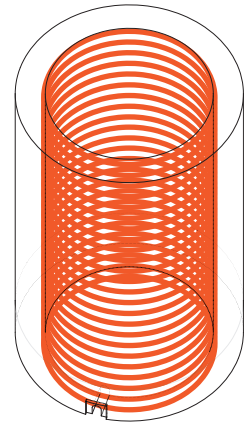
Fig.6.91 Analysis of Flowing Corridor Parametric Procedure



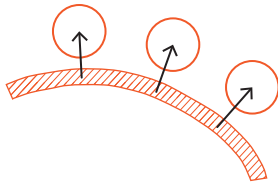
The corridor inside the Tulou have been considered as its representative element.



The corridor provides an occlusive circulation of each level.



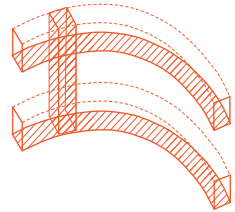
The corridor provides an occlusive circulation of each level.



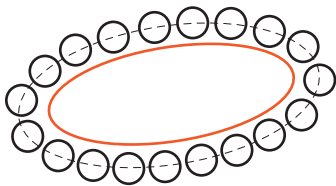
The corridor connected all the independent single space.



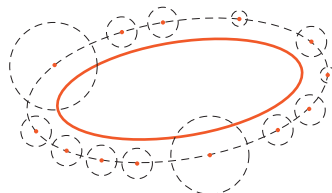
The original dimension for the corridor will give us the impression of narrow.



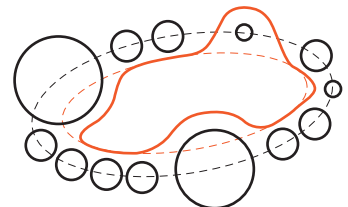
There are vertical connections with each other which could be a node of different functional space crossover.



The original form and every connected space are with the same dimension.



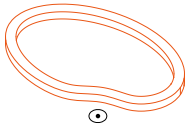
The occupied space might be larger according to its function.



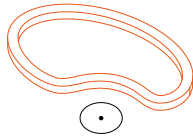
The shape of the corridor will change by following the functional space but with fixed dimension of corridor space.



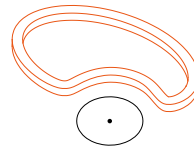
Fig.6.92 Flowing Corridor Parametric Model Study



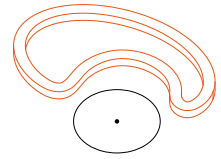
Axonometric View, corridor is deformed due to  $R1 = 100$  intensity radiated space.



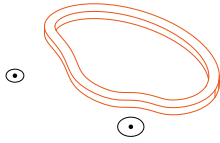
Axonometric View, corridor is deformed due to  $R1 = 250$  intensity radiated space.



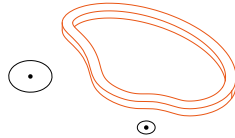
Axonometric View, corridor is deformed due to  $R1 = 500$  intensity radiated space.



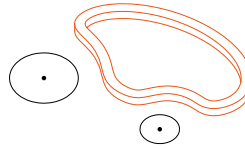
Axonometric View, corridor is deformed due to  $R = 1000$  intensity radiated space.



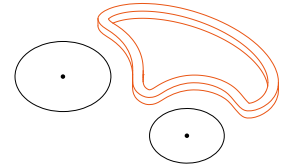
Axonometric View, corridor is deformed due to  $R1 = 100$ ,  $R2 = 300$  intensity radiated spaces.



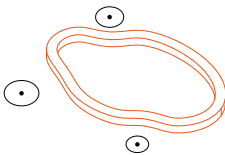
Axonometric View, corridor is deformed due to  $R1 = 100$ ,  $R2 = 500$  intensity radiated spaces.



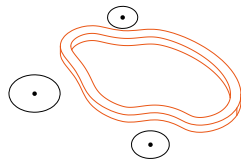
Axonometric View, corridor is deformed due to  $R1 = 250$ ,  $R2 = 500$  intensity radiated spaces.



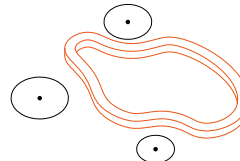
Axonometric View, corridor is deformed due to  $R1 = 500$ ,  $R2 = 800$  intensity radiated spaces.



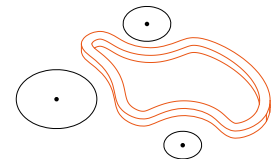
Axonometric View, corridor is deformed due to  $R = 100$ ,  $R = 200$ ,  $R = 150$  intensity radiated spaces.



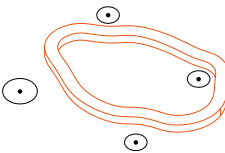
Axonometric View, corridor is deformed due to  $R1 = 200$ ,  $R2 = 300$ ,  $R3 = 150$  intensity radiated spaces.



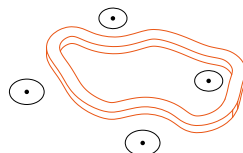
Axonometric View, corridor is deformed due to  $R1 = 200$ ,  $R2 = 400$ ,  $R3 = 300$  intensity radiated spaces.



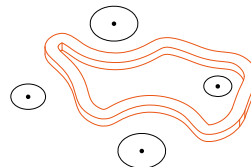
Axonometric View, corridor is deformed due to  $R1 = 200$ ,  $R2 = 600$ ,  $R3 = 400$  intensity radiated spaces.



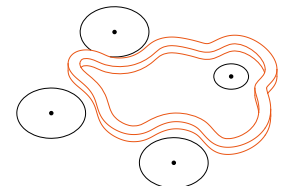
Axonometric View, corridor is deformed due to  $R1 = 100$ ,  $R2 = 200$ ,  $R3 = 100$ ,  $R4 = 100$  intensity radiated spaces.



Axonometric View, corridor is deformed due to  $R1 = 200$ ,  $R2 = 200$ ,  $R3 = 150$ ,  $R4 = 150$  intensity radiated spaces.



Axonometric View, corridor is deformed due to  $R1 = 300$ ,  $R2 = 200$ ,  $R3 = 300$ ,  $R4 = 150$  intensity radiated spaces.



Axonometric View, corridor is deformed due to  $R1 = 500$ ,  $R2 = 500$ ,  $R3 = 500$ ,  $R4 = 200$  intensity radiated spaces.



Fig.6.93 Partial Section A



Fig.6.94 Partial Section B

In this stage we put forward the concept of shape transformation to spatial prototype that will be affected by different referring rooms. In simple terms, in our parametric experimentation we are willing to deduce there are interesting transformations of this local corridor space due to the different sizes of rooms' influence. In realistic situations, the variable demand drives the different functions of the interior space that is near the corridor, and there will be different sizes of rooms to change the boundaries of the corridor. Thanks to the role that the target corridor is playing, it links all rooms on the circular plan, the corridor is like a shared space, not only providing the function of connection and movement, but also letting people stay for communication with their neighbours. And also the feature of this corridor is facing inside the buildings, to the inner courtyard, and this advantage of its position lets people see the scene that is happening in their inner courtyard. So this vernacular space

became our preference to be imported as the constant parameter into the algorithmic procedure. Primarily, in order to remain the vernacular experience when people stay in this space, we have to keep the spatial proportions of Tulou's corridor, closing to the traditional corridor in Hakka Tulou. The size is shown above from our study diagram. The width is 250cm to 300cm, height is equal to a one-level floor. Because the corridor is the space for amalgamated dwelling. The diameter of the corridor is about 30m to 40m long. Then keep this vernacular proportion of our spatial import, the concept of grasshopper algorithms is generating certain circles to simulate as rooms nearby, using the point charge algorithm to apply a repulsive force on our spatial sample. In order to simulate the radiant effect from a specific function room in a realistic situation. Thereby obtaining a variety of deformation possibilities of the Flowing Corridor due to the parametric experimentation modelling.

3

Various

Integrations of

Experimental

Samples in

Architecture Scale

The experimental parametric model results deduced above interpret the possibilities that happening depend on their spatial samples respectively. Each spatial sample is our work of simplification and abstraction from local vernacular architecture. The selected spatial samples are presenting different local culture, topography and climate factors in their respective region. However, the real life is meeting some issues that are far more complicated than these factors we mentioned. Under the guidance of our instructor, we started another bold idea and vision in this chapter.

After the rumination for complexity in the real city, the experimental model that generated from mononuclear parametrical space sample will has certain limitations when if facing the variegated demands in a contemporary city. Naturally, it is necessary that the appropriate spaces will interfacing with each other to realize a new commanding heights. We decide to simulate these integration experiment with the concept of algorithmic function, we have four architectural sample we experimented in previous phase. And in the attempt, we are going to think of their four architectural prototypes as function variates. Let us assume an architectural formula. And all of four prototypes will be

Fig.6.95 Functional Equation of the Integration

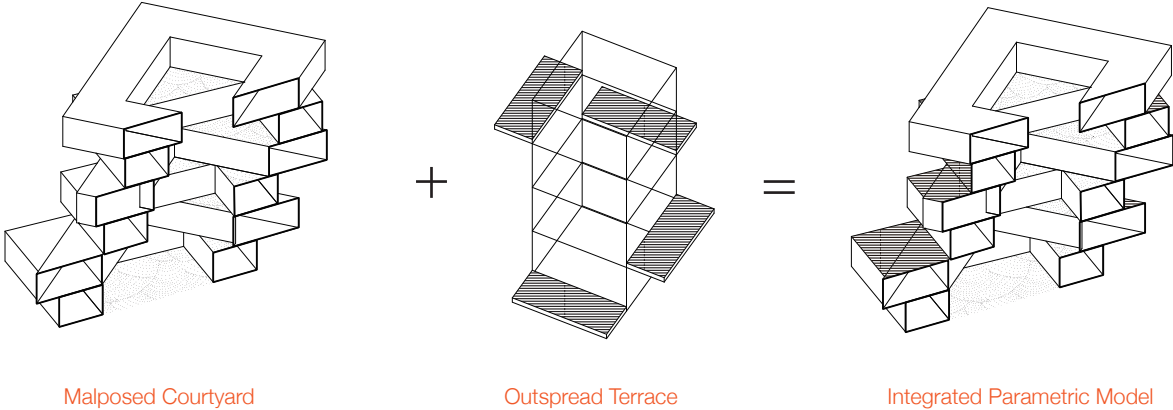
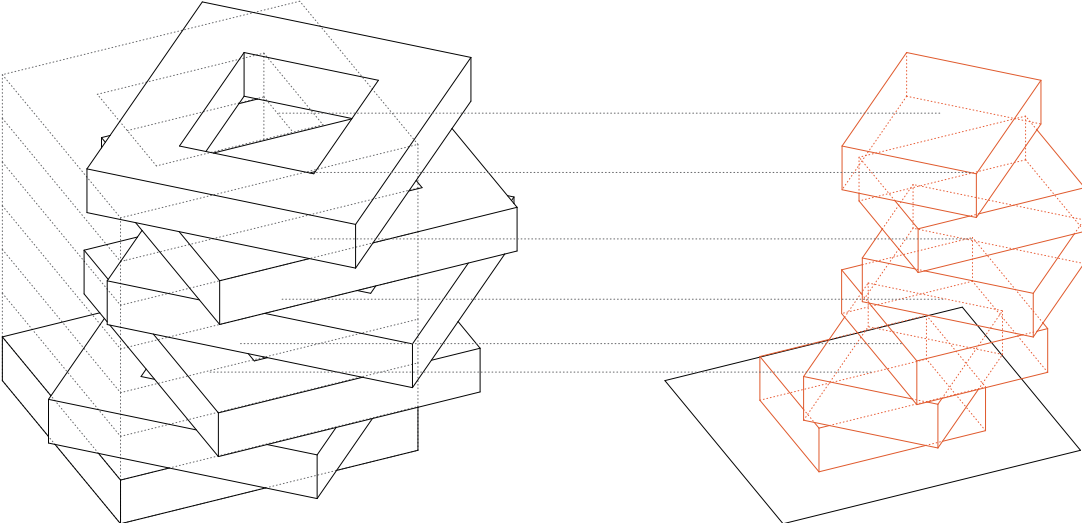


Fig.6.96 Conceptual Diagram



imported into this formula by us, for receiving different combinations.

In the first integration we dedicate the combination of Malposed Courtyard and Outspread Terrace. The reason why we choose Malposed Courtyard integrate with Outspread Terrace is because we found the intercommunity between these two spatial prototypes. In the beginning, the prototype of Malposed Courtyard is classical Beijing courtyard. The generation of this space is coming from the encirclement dynamic tendency. And it stays in the centre of the building. And the traditional Beijing enclosed courtyard is an introverted space in the definition of space. Nevertheless, the prototype of Outspread Terrace is a balcony from local stilt style architecture in northern region. But the generation of this type of space is quite different from enclosed courtyard. In an opposite way, the formation of these kind of balconies is due to the dynamic trend of outward extension and expansion from principle building, and it is extroverted space. Thus, it is apparently to find the differences between these two spatial prototypes. For example, we can describe the distinctions between these two spaces by people's experience while they are staying in space. When people stand in the enclosed courtyard, they are

feeling the perception of affiliation created by the surrounding buildings. The scenery that people can enjoy is the facade of the building that surrounds them. Different from the above, if people stand on the balcony, they are feeling the spacious of sense and communications with context. By using the results from malposed rotation, both surfaces facing inside and surfaces facing outside we could design for lifted courtyards and outspreading terrace. Then we applied common vernacular element from Beijing Quadrangle and the Stilt style architecture which are representative Chinese eaves on every floor we have from experimental parametric model. Finally, the instalment of solid handrails for outspread terrace to provide the security for people when they stay on terrace. Designing light structural handrails for malposed courtyards in order to keep the vertical visual connection for users while they are standing in their courtyards. This setting is for remaining the communication function when people use this space, they will not lose the original experience that they had in traditional Beijing Quadrangle. We want to use the architectural presentation to deliver our propose that this experimental parametric model has its possibility to develop as a real architecture that we can use in contemporary.

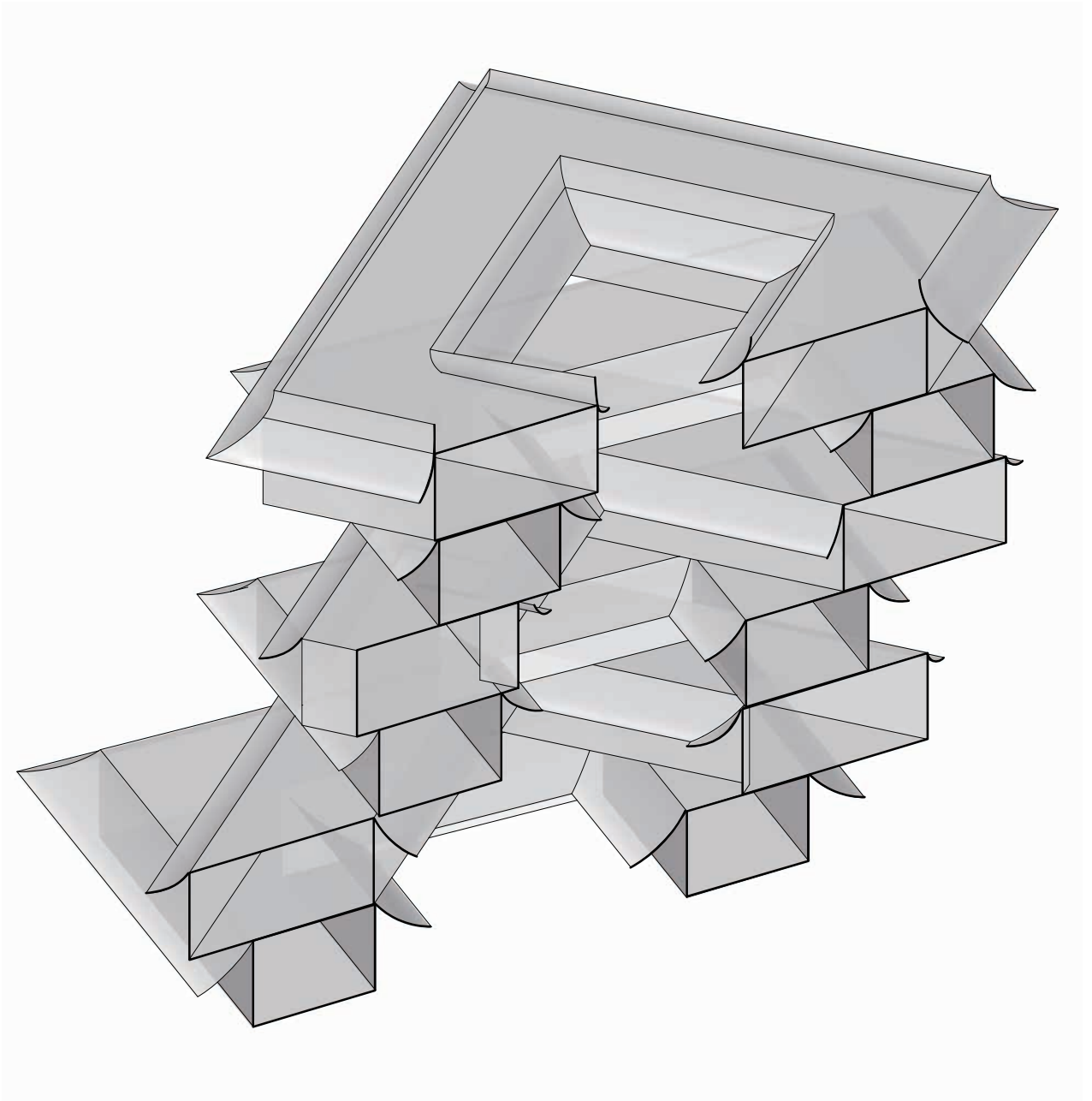


Fig.6.97 Perspective Section of Polysurface Model

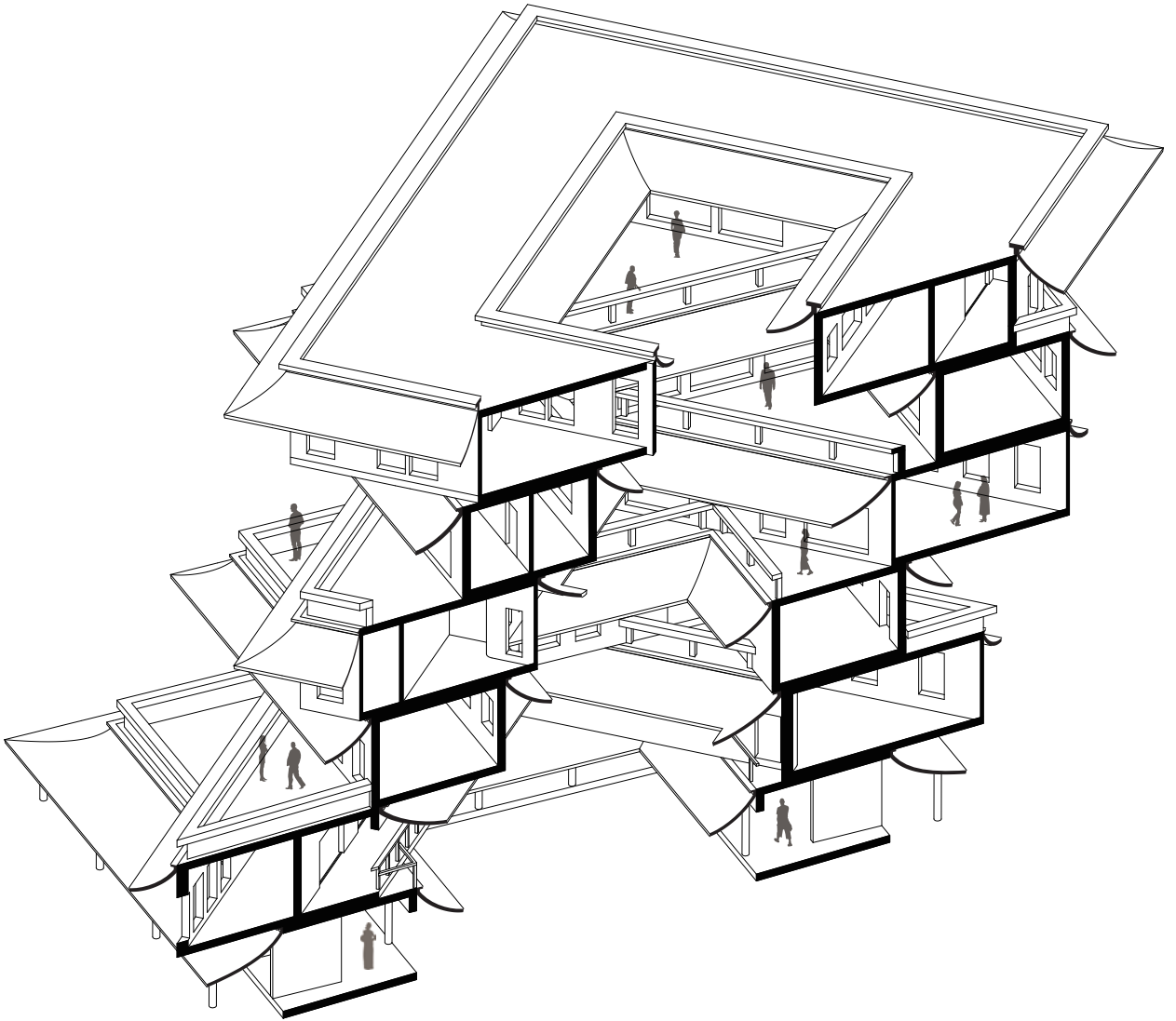


Fig.6.98  
Perspective Section of the Integrated  
Parametric Model



Fig.6.99 Functional Equation of the Integration

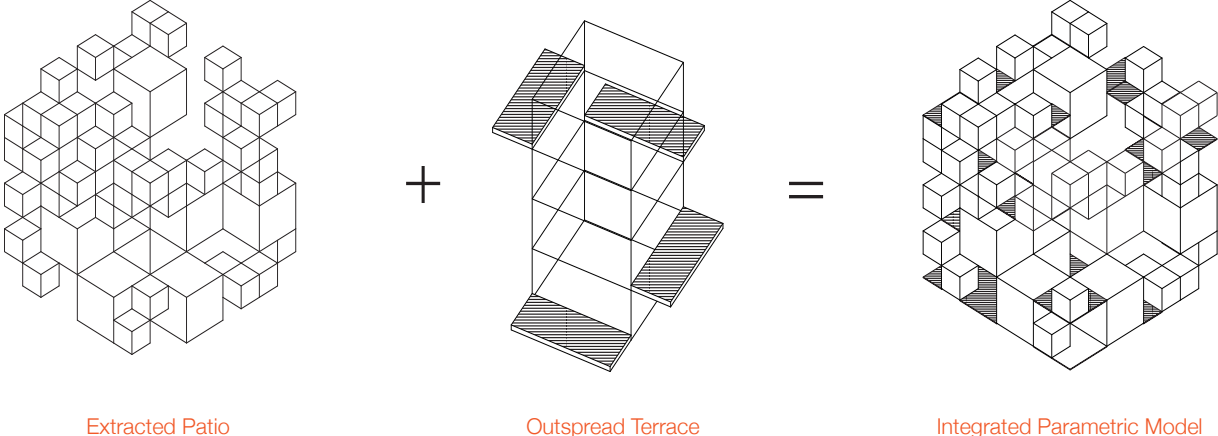
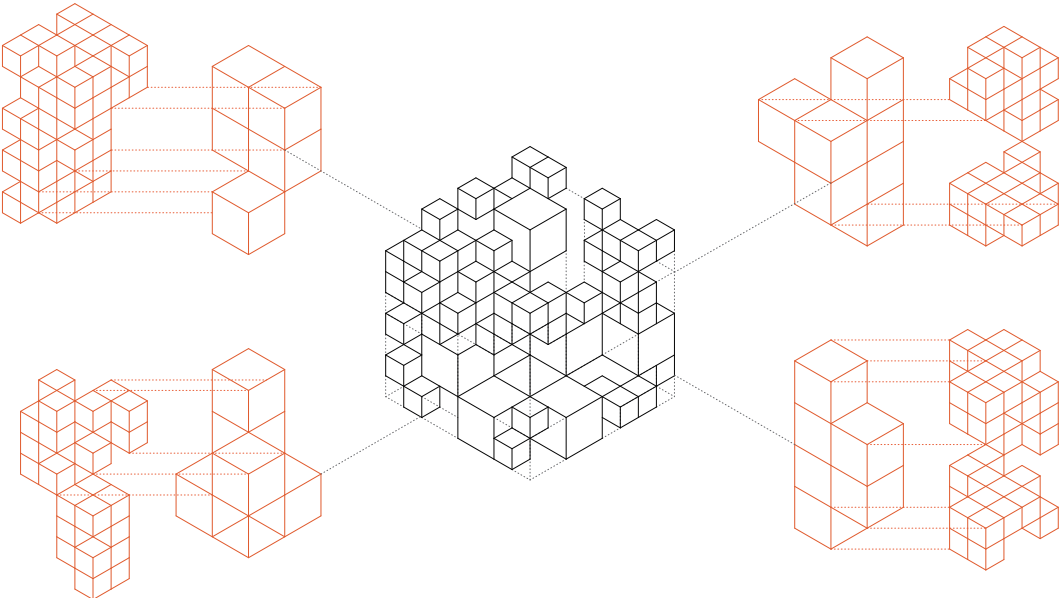


Fig.6.100 Conceptual Diagram





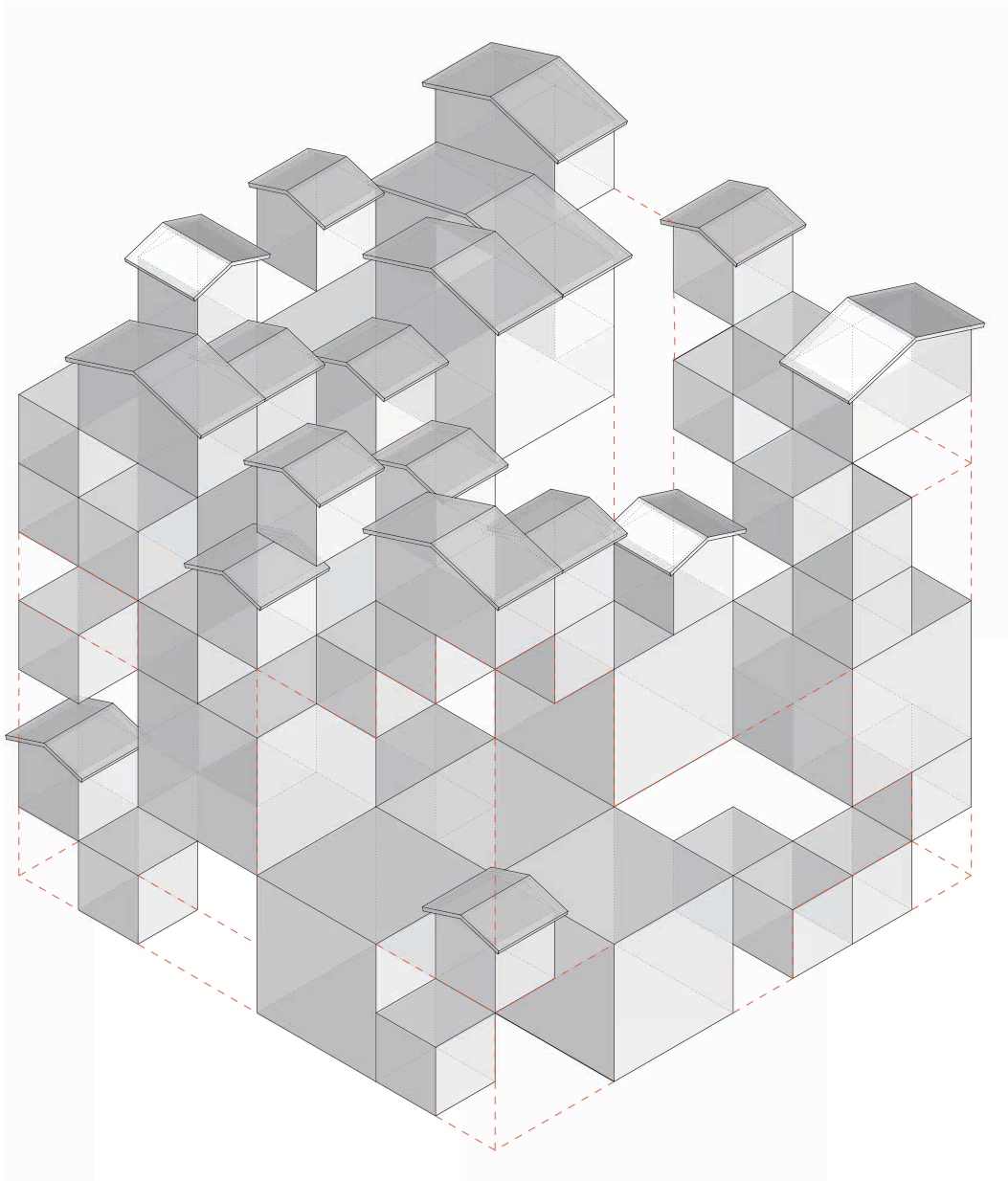


Fig.6.101 Perspective Section of Polysurface Model

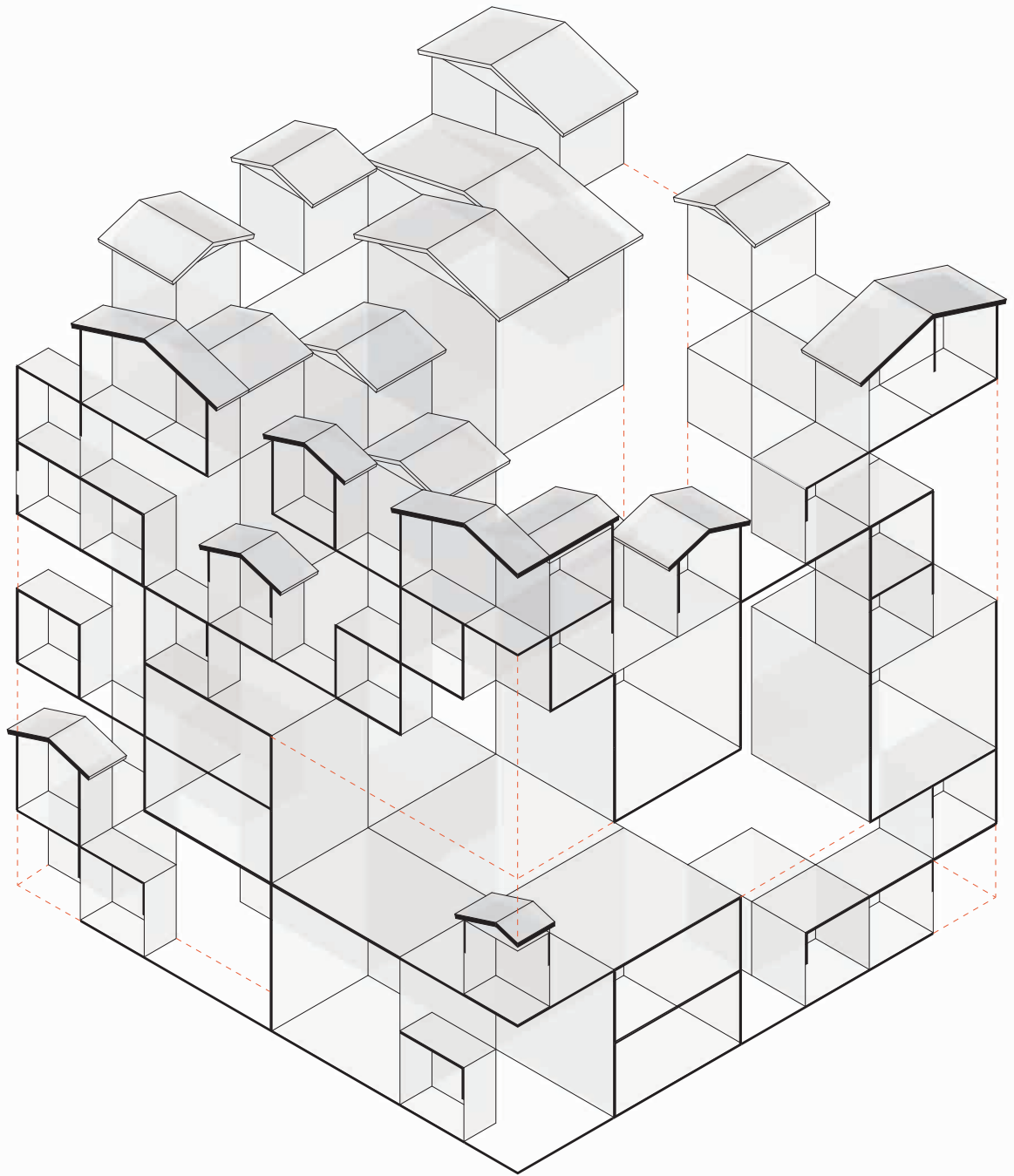


Fig.6.102 Perspective Section of Polysurface Model

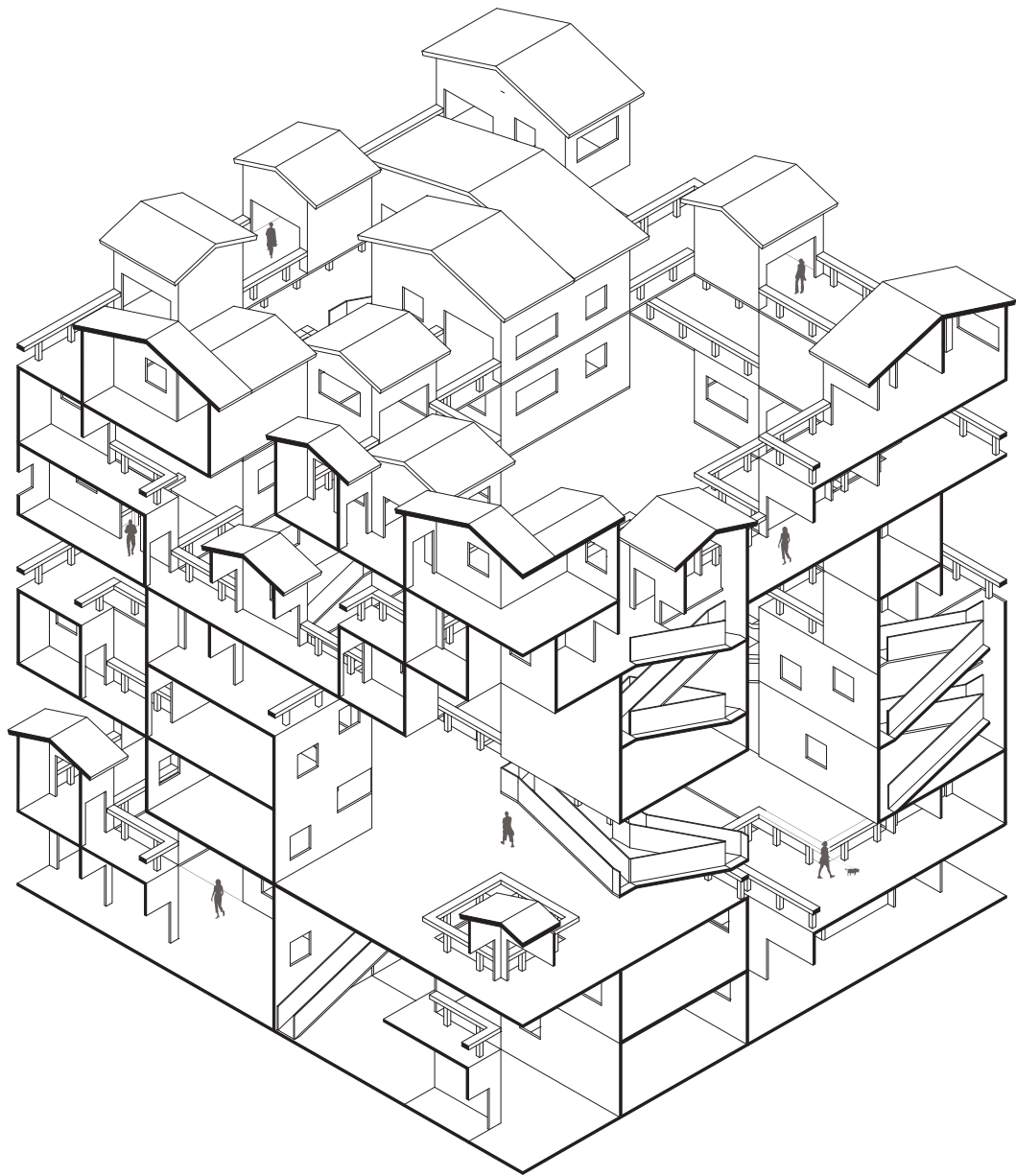


Fig.6.103  
Perspective Section of the Integrated  
Parametric Model



Fig.6.104 Functional Equation of the Integration

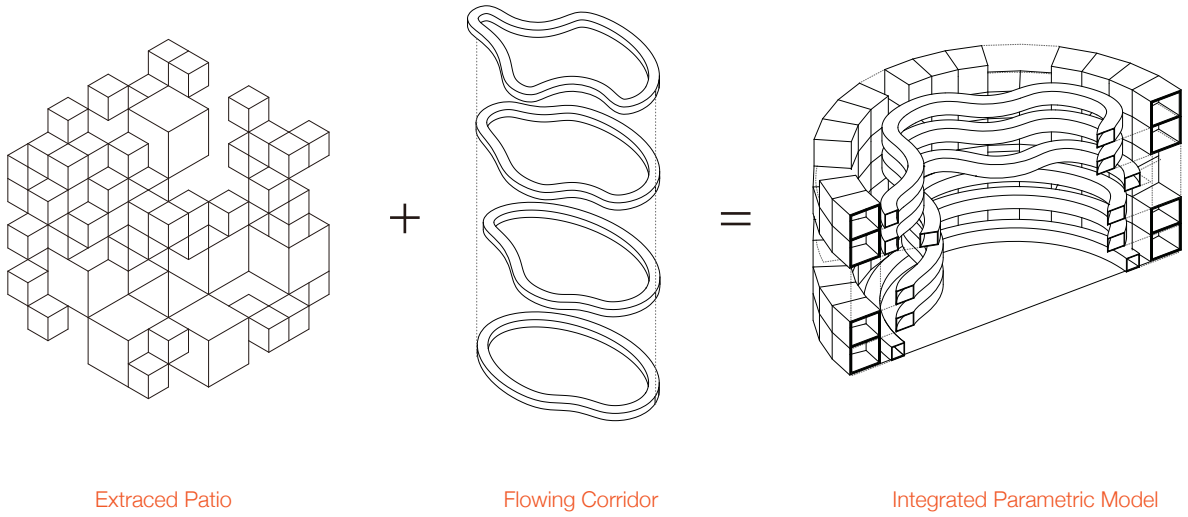
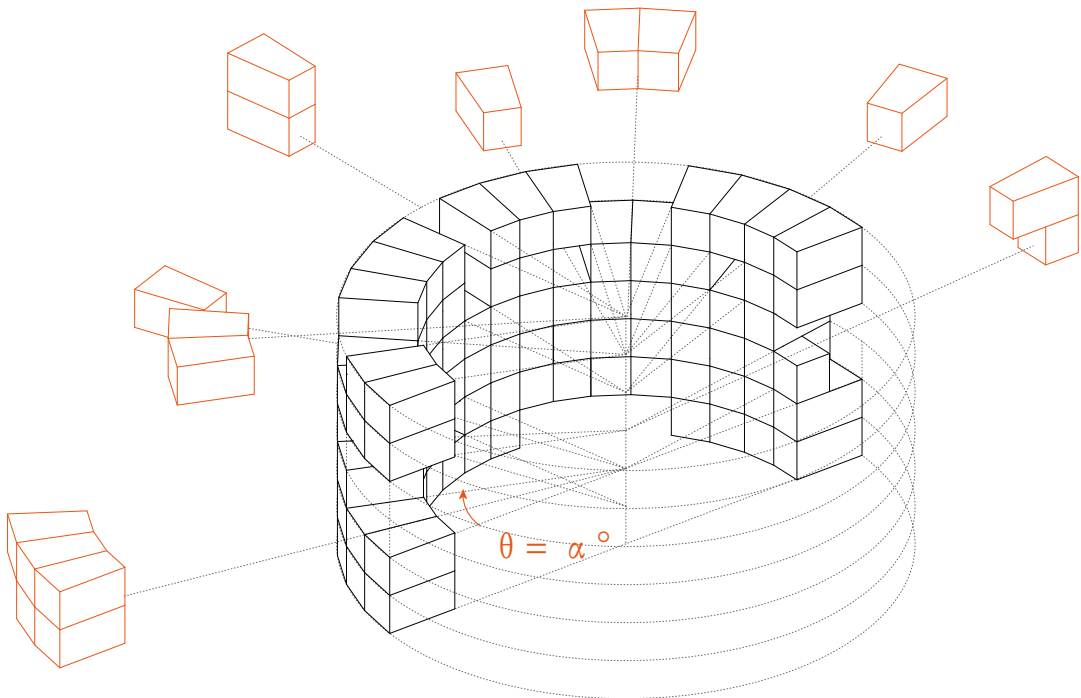


Fig.6.105 Conceptual Diagram



The second parametric experimental test of integration is the organic composition with Extracted Patio and Outspread Terrace. The most important character of Extracted Patio is that the spaces inside the massive volume which are segmented after parametric algorithm process, are random in reduction or in the real case that it will be reduced by some given factors. In other words, it means that the space inside its body will be void somewhere. As we are doing the experiment on the simulation of the reality situation, that the original property of that selected space of Outspread Terrace will be one of the perfect cooperation. The reason is that there will be some place not perfectly practical by the generation from the purely mathematic calculation. For example, there will be the spaces hanging in the air, and at this moment, the function of the Outspread Terrace is that it can be flexibly filling up the gap between the existing spaces. The parametric results of Outspread Terrace are the further possibilities to enrich the quality of these evacuated spaces, which can be transformed by following the algorithm calculation, including but not only, extending, indenting, rotating or arraying and so on. As a result, the Outspread Terrace can be joint with Extracted Patio under any kind of cases. For this reason,

they can be the bridge, corridor, traverse, aisle, balcony or terrace and so on. And it also provides more possibilities between interior and exterior spaces.

The last parametric experimentation of integration topic is the integration between Extracted Patio and Flowing Corridor. In this algorithms-aided modelling we must get a deep control and understanding of dynamic generation of these two spatial prototypes. Firstly, different from the excavation patio from cuboid, so we received regular geometrical shape of extracted patio in the building. However, in this simulated stage, we have to combine the principle of extracting dynamic formation from Bamboo House with the circular body of Hakka Tulou. Undoubtedly, it is necessary to keep the circular form of Flowing corridor, and it should also face to inner circular courtyard. Then the geometrical concept is different from excavating of cuboid. Instead of using perpendicular grid to cut the target geometry, we have to follow the shape of target ring, offsetting the perimeter and generate diameters to cut the volume, the process you can find below (Figure.6.104). This procedure that we used is in line with the method mentioned in critical regionalism by Luis Mumford.<sup>1</sup>

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<sup>1</sup> Liane Lefaivre, Alexander Tzonis. *Critical Regionalism: Architecture and Identity in A Globalized World*. University of Michigan, Prestel. November, 2003.

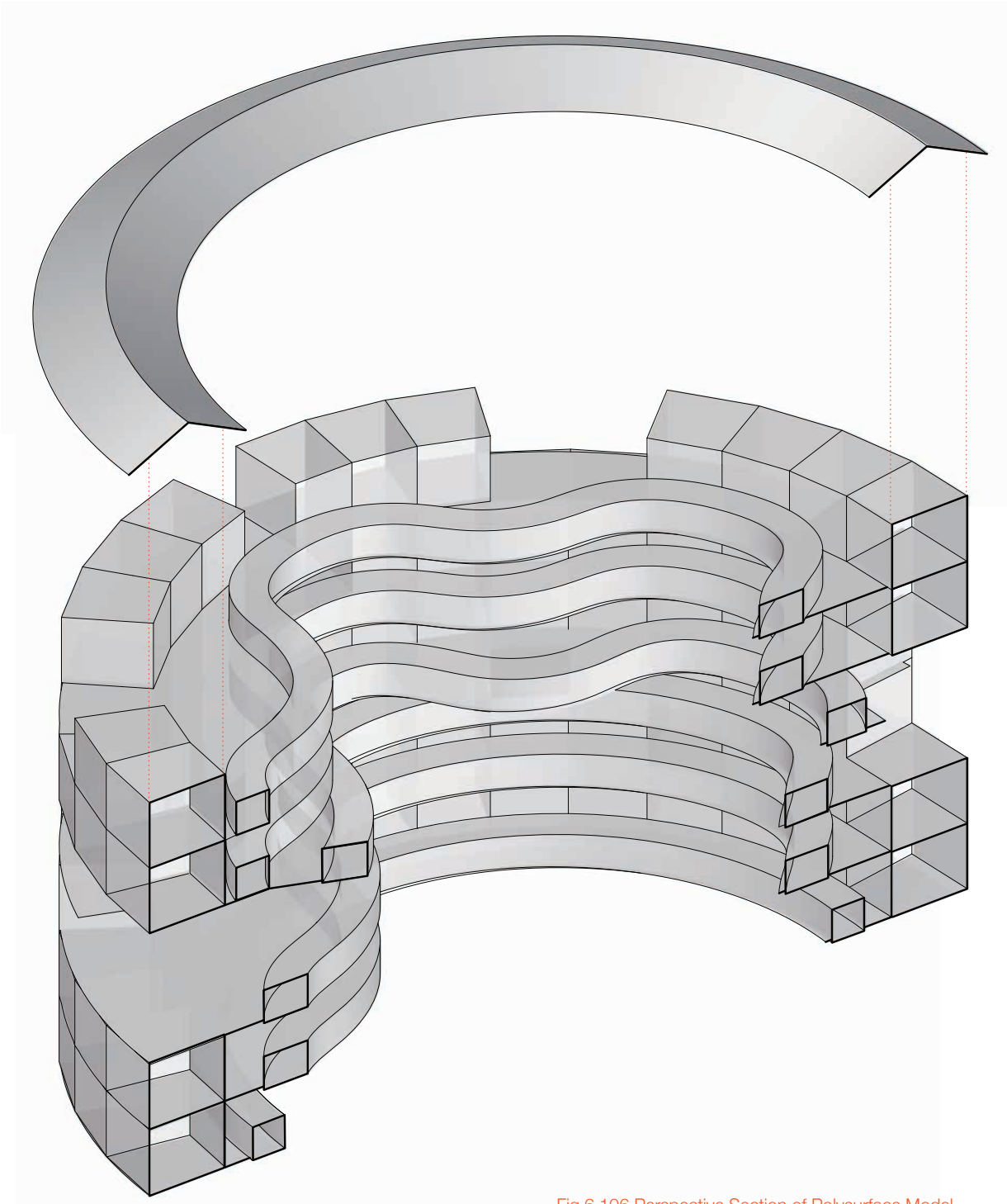


Fig.6.106 Perspective Section of Polysurface Model

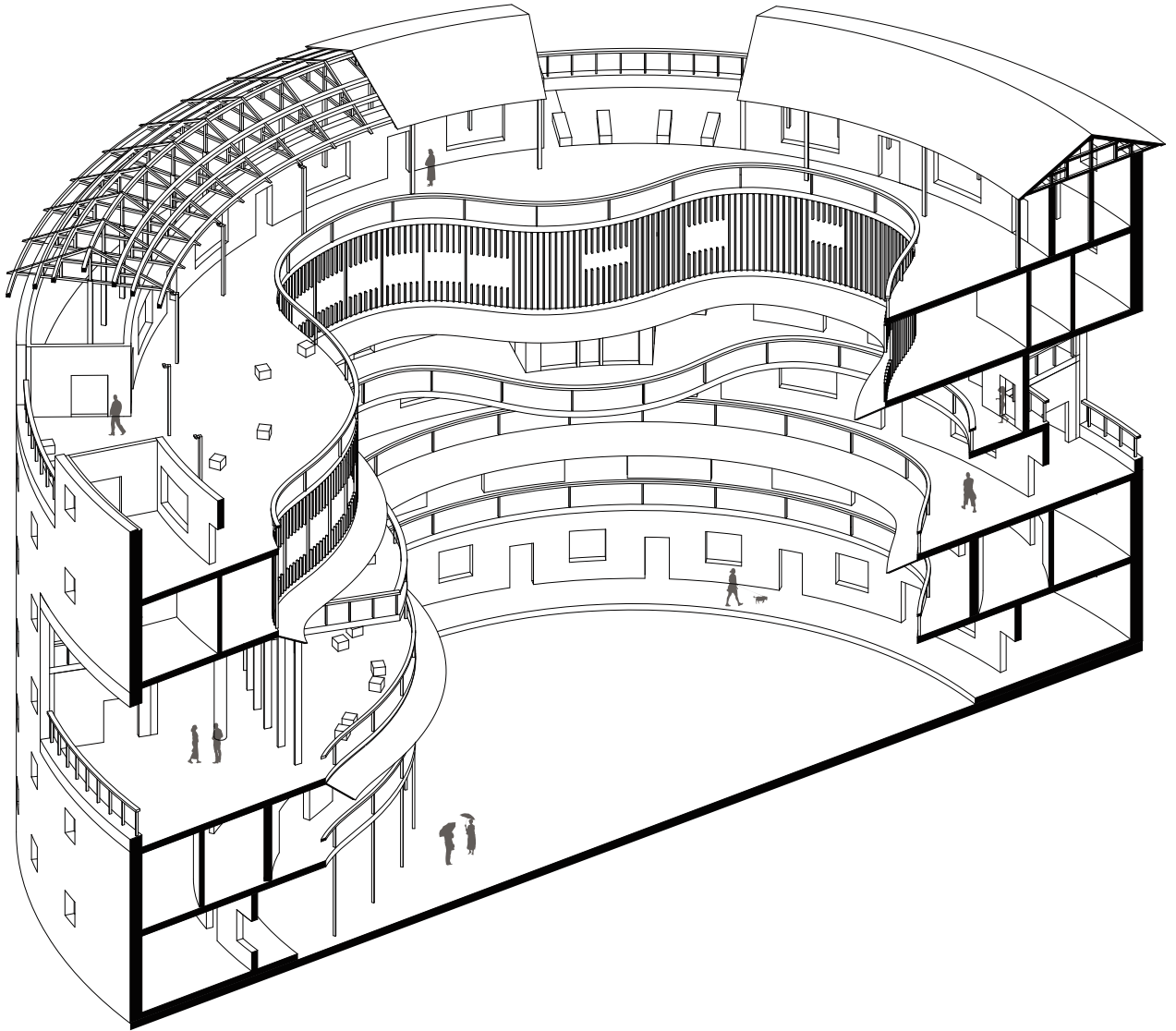


Fig.6.107  
Perspective Section of the Integrated  
Parametric Model



There are prominent differences from the primary stage of fundamental parametric modelling in this stage. When we control the datasets and parameters, we are rigorous to import the constant parameter and choose the variates appropriately. We have always maintained the vernacular features and representative characteristics of spatial samples during the parametric modelling experimentation. Whether the malposed rotation or the deformation of original shape, we still respect the soul of this spatial space that is based on our understanding of their background. As well as the fusion from four spatial typologies that are generated from parametric experimentation. During the process of combination we emphasis the traditional space's experience to precede our digital modelling.

### **Application of an Integrated Model with Underground Urban System**

Now when we back to our real world, we need to consider the combination between our parametric experimentations both in urban scale and architectural scale to test if our theoretical models could face the issues in a realistic situation. In the process of Chinese modern urban development, the probability of urban flooding increases year by year.

According to the official statistic from La NASA, National Aeronautics and Space Administration. The main reason for this increase is the global warming and large area increase of artificial surface on earth. As an architect we need to take responsibility to mitigate this negative effect due to urban development.

Thus, it is apparent to propose an urban drainage system to prepare for future disasters. As we have introduced the result from parametric modelling, the under ground system could become a positive strategy for this issue. And here we interpret the relationship between underground system and integrated project in a realizable way. By comparing four architectural typology A, B, C and D on the right side we present. Typology C is a perfect architectural typology that integrate with underground system. The typology C is coming from the parametric generation from Bamboo House. The extracted patio space provides rich overhead layers for the architectural form. That means the rich overhead layers has satisfied condition for good ventilation and natural light. Because the sunken courtyards are underneath, this system requires sufficient positive space for light and ventilation to carry the role of public space for people in the city.



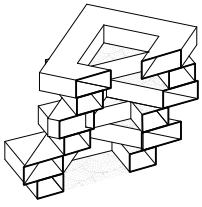


Fig. 6.108  
Architectural Typology A

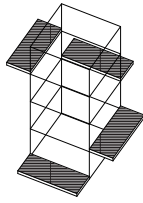


Fig. 6.109  
Architectural Typology B

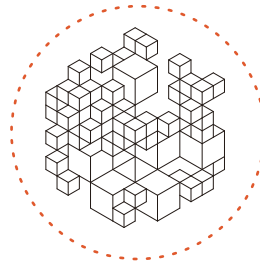


Fig. 6.110  
Architectural Typology C

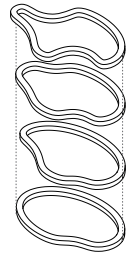


Fig. 6.111  
Architectural Typology D

Fig. 6.112  
Masterplan

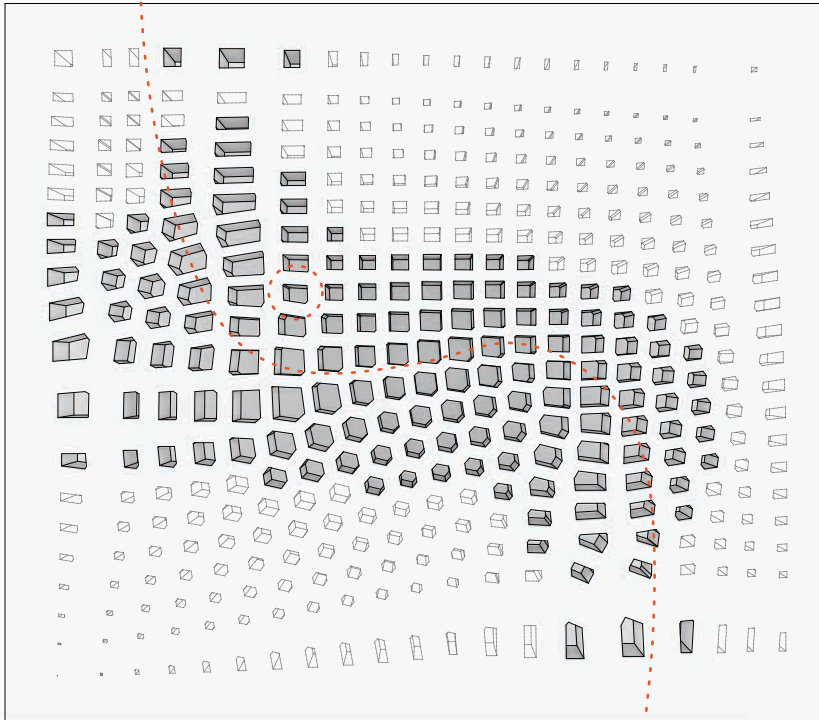


Fig. 6.113  
There are rich overhead layers

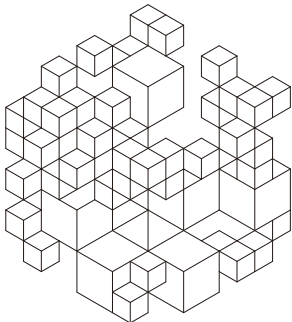
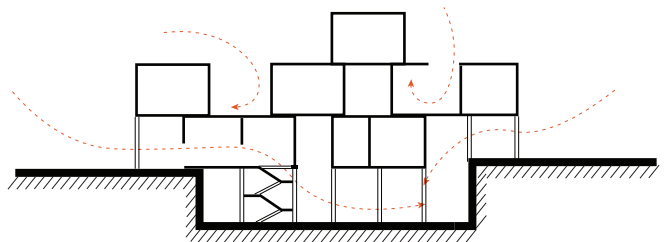


Fig. 6.114  
Rich overhead layers, good ventilation and natural light. It is our preference to make Typology C integrated with Sunken Courtyard.



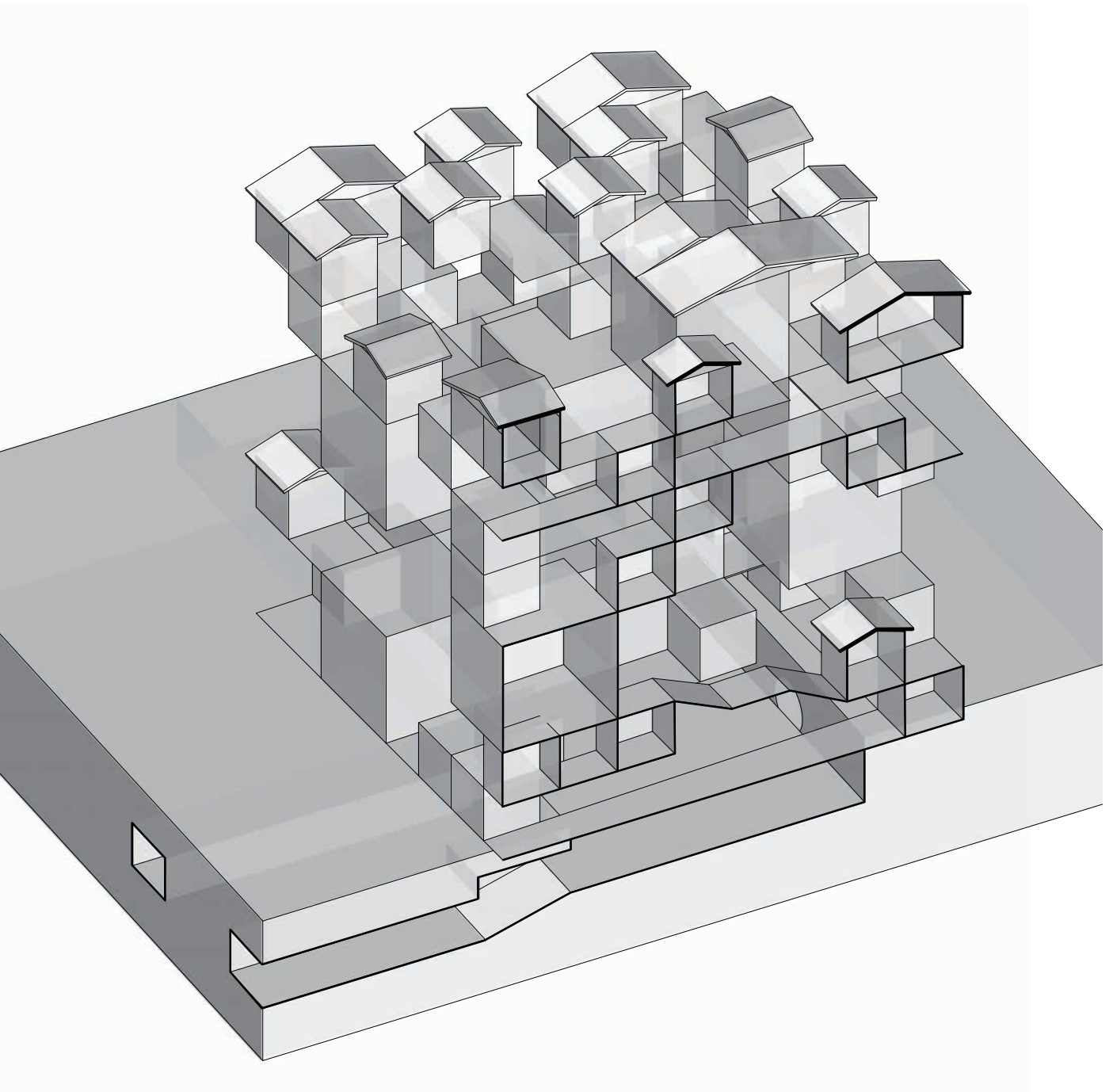


Fig.6.115 Perspective Section of Polysurface Model

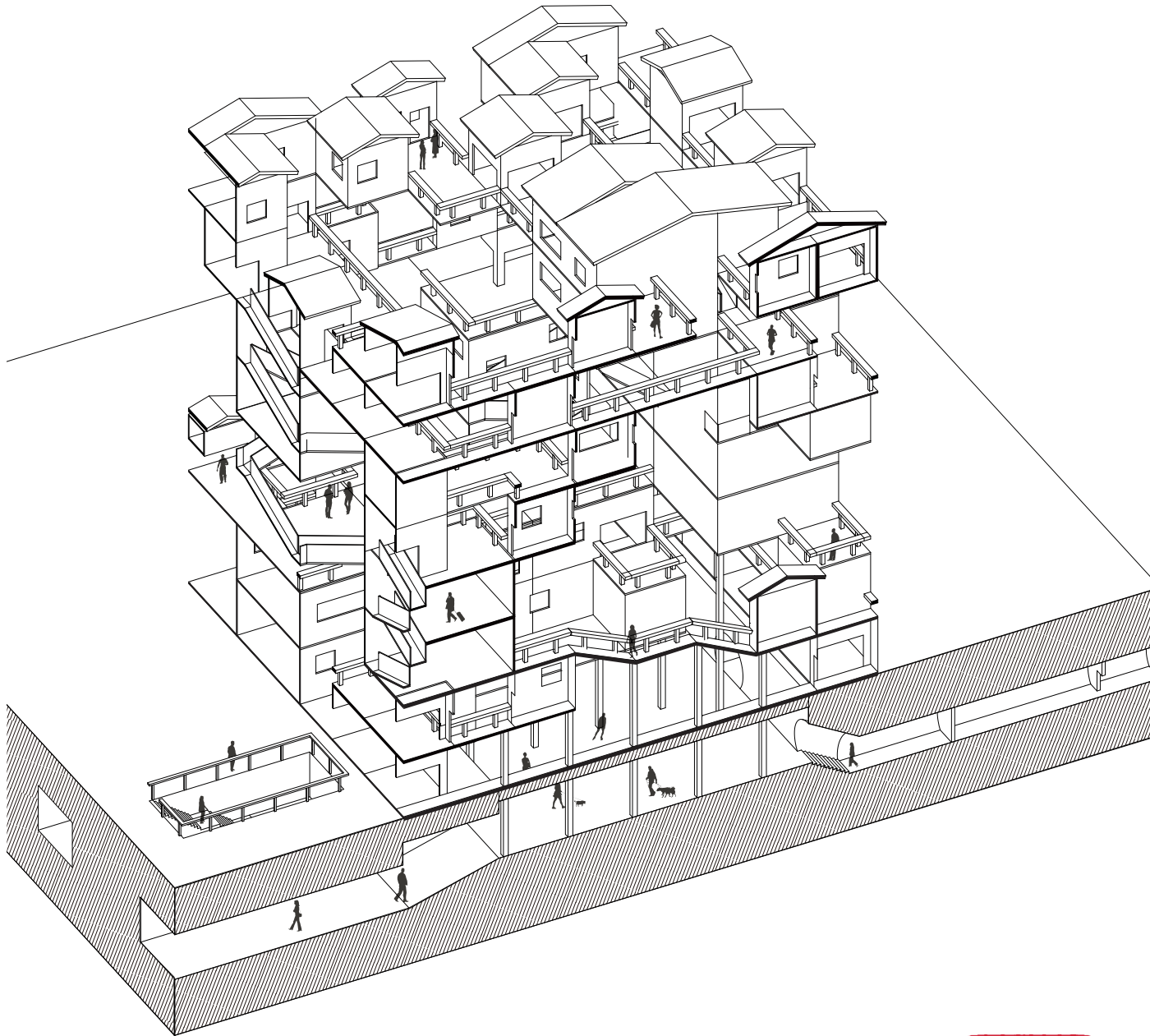


Fig.6.116  
Perspective Section of the Propose  
of Sunken Courtyard





# 7 Conclusion



This academic work of thesis dedicates our concept of Chinese modern city and architecture built environment accompany with the practical development plans that can be achieved in this environment. The lack of Chinese characteristic architecture in modern Chinese cities promote us to have the idea that re-establishing the identity of these buildings with a local identity. Let us rediscover the cognition of our own Chinese culture in architectural aspect. Rebuilding the Chinese vernacular style of our modern city in contemporary. Using our own architectural language to liberate bland cities from the rapid urbanization. We introduce and interpret this bold idea through computerize modelling and architectural drawings that simulate real buildings and urban scenes.

In our thesis work, there two cores are always running through our research process. The origin of inspiration for this topic is back to the rumination of critical regionalism architecture. Under the influence of systematic Western architectural thoughts, we begin to study and analysis in this academic program. This first core is vernacular manifestation, we start from the study of Chinese ideology. By comparing Chinese ideology with western ideology to trace the different root causes of East and West buildings,

as well as understand the formation process of our own traditional culture. We believe that only by fundamentally and hierarchically understanding Chinese traditional architecture then we can progress the way of vernacular manifestation in a correct direction. From understanding the way our ancestors think about architecture and the factors of the natural environment, to the architectural techniques mastered by the ancestors when they built the building, we summarized the origins of our Chinese architecture.

During the research phase, we have compiled the resources we collected into three parts, which are urban scale materials, street scale materials and architectural scale materials. Depending on the intersecting from these three different scales of resources we can understand the historic Chinese architecture's venation in a scientific way. The learning from Chinese cities let us know the reason why the urban planning principle for Beijing fabric is along the central axis. By comparing the cartographies about four target cities in chronologically, more and more city memories are fading from the rapid urban modernization. We can say without exaggeration that this is another New

York City land located in China if we keep these vanish of Chinese representative architectures. Certainly, we also found the traditional vernacular urban textures in some towns and second and third tier city. Different from the modernization of the metropolis, it is full of streets and buildings that carry memories. They are organizing an interesting vernacular manifestation in front of us.

Subsequently, we received inspiration from Peter Eisenman, he presented his method for analysing on architectural space. Using universal geometric analysis techniques of the world to interpret us many interesting architectural spaces. Then we used this method that we learnt from Peter Eisenman, simplified complicated Chinese traditional architectures and abstracting to simple geometrical models. We decide to dedicate a common architectural language to introduce our Chinese vernacular architectures for people who are not quite familiar with Chinese history and cultural background, the abstracted models are both in big scale and small scale. Such as imperial palace, Chinese garden, pagodas and dwellings.

Final important stage of our thesis is demonstrating our propose about the

vernacular manifestation could realized by parametric language. The impact of digital technologies is perceptible on architectural field apparently. The parametric modelling is a tool helping us to realize our hypothesis in simulation. According to several parametric experimental models, we confirm there are possibilities to achieve our bold conception. As Luis Mumford said there is no conflict between advanced technologies and vernacular architectures. In addition, we have demonstrated that idea for this relationship. Parametric design is a product of modern society, but it's a tool for architects to design a propriate project, and the results shows the perfect application for vernacular architectural elements when they are running under the parametric machine. The resultant theoretical city and under ground system as well as experimental parametric models have deduced our attitude of this topic. As an architect, we have to take responsibility to improve our urban environment. In order to retrieve our clan consciousness and perception of affiliation, we confirm that these parametric models we generated from our experimentations are playing the magnificent role inspiring people to design our won Chinese modern architectures and metropolis.



Besides that, we have to emphasize a perspective that we are just we just showed some of the possibilities we generated from our parametric language to the public, and the received results are not completely correct. But we are aiming to introduce and spread the new mentality to think about the architectural design in this new era. And parametric tool is just a tool to explore a potentially unlimited number of design solutions conveniently for architects. We must always grasp the subjective initiative as an architect during the design phases. Undoubtedly, a good propose or project is always due to perfect understanding of space and the good controlling of tools from architects. And this is an immutable truth in our epistemology.

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Fig.6.26 City is partitioning by Voronoi Tessellation. Because of the topography, red line presents the major urban drainage run off, and on the route of run off, there are four important city nodes.

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Fig.6.29 Urban Section

Fig.6.30 Axonometric view of urban generation and underground system. Different sizes of courtyards are according to the attracting degree from four urban nodes.

Fig.6.31 City is partitioning by Voronoi Tessellation. Because of the attraction from red line and four important city nodes, the sizes of Sunken Courtyards are different.

Fig.6.32 Then we offset the red line to a principle region of urban run off, the hatched area is permeating to courtyards nearby.

Fig.6.33 Finally, We take away extra solid volume from permeated area and design them as an urban public space and serve for people.

Fig.6.34 The permeating from offsetted region to Sunken Courtyards nearby generates four new underground open space, which could be used as underground urban park. Different scale of sunken space provide various functions for the city in order to face the social needs of people in a modern city.

Fig.6.35 Urban Section

Fig.6.36 Axonometric view of urban generation and underground system. The massive excavations will generate as underground urban park.

Fig.6.37 Axonometric view of urban generation landscape and underground system propose C.

Fig.6.38 Typology A Urban Amphitheater

Fig.6.39 Typology B Urban Coutyard with Dwelling

Fig.6.40 Typology C Urban Growing Square

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Fig.6.106 Perspective Section of Polysurface Model

Fig.6.107 Perspective Section of the Integrated  
Parametric Model

Fig.6.108 Architectural Typology A

Fig.6.109 Architectural Typology B

Fig.6.110 Architectural Typology C

Fig.6.111 Architectural Typology D

Fig.6.112 Masterplan

Fig.6.113 There are rich overhead layers

Fig.6.114 Rich overhead layers, good ventilation and  
natural light. It is our preference to make Typology C  
integrated with Sunken Courtyard.

Fig.6.115 Perspective Section of Polysurface Model

Fig.6.116 Perspective Section of the Propose of  
Sunken Courtyard

