Doctoral Dissertation

Study on Spatial Characteristics and Visitor Stay Behavior of Chinese Garden: A Case Study of the Ningbo Tianyige Museum Gardens

中国庭園における空間特性と訪問者の滞留行動に関する研究:
寧波の天一閣博物院の庭園を対象として

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ABSTRACT

Chinese gardens play an important role in Chinese landscape architecture both in ancient and modern times. Chinese gardens, together with urban parks, green spaces and forest parks, has formed the landscape system in urban green open space, integrated into people's daily life, and become an indispensable public and leisure place. The overall aim of this study is to explore the contemporary value of tourism and utilization of Chinese gardens, and to inherit and innovate the Chinese gardens in order to play a leading role of traditional culture and undertake more public and social functions in the future. This study focused on the following three research questions: What are the spatial changes and characteristics of Chinese gardens in history? What are the characteristics of the space composition and tourism of contemporary gardens? What is the relationship between the visitor behavior and garden space in contemporary gardens? Among the above three questions, the first question regarded the traditional Chinese garden as a whole object, and the latter two questions took the Tianyige Museum gardens as the specific research objects.

To answer the above three research questions, this study consisted of seven chapters, and were divided into four parts: Chapter 1 as the introduction, Chapter 2 as the overview of the history and spatial changes of the traditional Chinese gardens, Chapter 3-6 as the studies on the spatial characteristics and visitor stay behavior of the Tianyige Museum gardens, Chapter 7 as the conclusions. The scope of the study covered the ancient and modern times, as well as the garden space and visitor behavior. The contents of each chapter is shows below.

Chapter 1 introduced the past and prospect of Chinese landscape architecture as the research background, the objectives and significance of the study, the literature review, the structure and methodology of the dissertation, and the definition of terms. The research methods were literature survey and historical research.

Chapter 2 studied the definition and classification, history and spatial changes, functions and utilization of traditional Chinese gardens. This chapter functioned as an overview of Chinese garden history and the historical studies for the contemporary Chinese garden research. The research methods were literature survey and field survey.

Chapter 3 introduced the history and current situation of the research object of Chapter 4-6: Tianyige Museum gardens, as well as the investigation schedule and

results. Tianyige Museum gardens consist of the ancient Tianyige Library group and two contemporary gardens. The research methods were literature survey and field survey.

Chapter 4 is the research on the spatial composition and characteristics of the ancient Tianyige Library group and other seven libraries. This chapter analyzed the basic situation, construction ideas, architectures and gardens of Tianyige Library group, articulated the imitation of the seven libraries from the perspective of architectures and gardens, and finally conducted the restoration research of three destroyed libraries. The research methods were literature survey, historical research, field survey and mapping, and comparative research.

Chapter 5 & 6 took two contemporary gardens (East Garden and South Garden) of Tianyige Museum as the research objects, and revealed the openness of the garden space and its attractiveness to visitors. Chapter 5 focused on the visitor short-stay behavior, and Chapter 6 focused on the visitor long-stay behavior. The two chapters quantitatively analyzed the spatial composition of the garden space, the distribution characteristics of visitor stay behavior, and the correlations between spatial attributes and visitor stay distribution and duration. The research methods were literature survey, field survey, observation methods, statistical methods, quantitative analysis and comparative analysis.

Chapter 7 summarized the conclusions of this study, put forward the strategies and suggestions for contemporary garden planning and design, local improvement and management, and looked forward to the role of garden as an important green open space category in the city.

The significance of this study is the combination of the traditional and contemporary Chinese gardens. It not only traced the development and changes of traditional gardens, but also explored the openness value of contemporary gardens as sightseeing spots and green open space, and understood the preference of visitors and users for garden space. It is of great significance to explore the Chinese gardens as an important public green open space category.

Based on the findings, suggestions can be provided for the planning, management and local improvement of Chinese gardens corresponding with users' needs to make gardens more valuable urban green open space. This study is of great value to the mission of constructing of people-oriented urban green space and high-quality human settlements. The results of this study also contribute to the utilization and development of gardens in East Asia.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

There are six sections in Chapter 1. In order to explain the origination of the study and provide an overview of this dissertation, this chapter firstly introduces the research background: the past and prospect of Chinese landscape architecture, and emphasizes the importance of Chinese garden research to Chinese landscape architecture. Then it introduces the objectives and significance of the study, literature review, structure and methodology of the dissertation, and definition of terms.

1.2 Background:Past and Prospect of Chinese Landscape Architecture

1.2.1 Definition and history of world landscape architecture

The term landscape architecture was invented by Gilbert Laing Meason (1769–1832) in his book *On the Landscape Architecture of the Great Painters of Italy* in England, 1828. The United States founded the landscape architecture profession and discipline with the formation of the American Society of Landscape Architects (ASLA) in 1899. In 1900, the major of landscape architecture was founded at Harvard University to train professionals in this field, now known as landscape architects, marking the beginning of landscape architecture education. The International Federation of Landscape Architects (IFLA) was founded at Cambridge, England, in 1948, and it is an organization which represents the landscape architectural profession globally.

According to the two organizations of IFLA and ASLA, the definition of the term or the profession “Landscape Architecture” can be clarified.

> Landscape Architects plan, design and manage natural and built environments, applying aesthetic and scientific principles to address ecological sustainability, quality and health of landscapes, collective memory, heritage and culture, and territorial justice. By leading and coordinating other disciplines, landscape architects deal with the interactions between natural and cultural ecosystems, such as adaptation and mitigation related to climate

> change and the stability of ecosystems, socio-economic improvements, and community health and welfare to create places that anticipate social and economic well-being [1].
>
> —International Federation of Landscape Architects (IFLA)

> Landscape architecture involves the planning, design, management, and nurturing of the built and natural environments. With their unique skill set, landscape architects work to improve human and environmental health in all communities. They plan and design parks, campuses, streetscapes, trails, plazas, residences, and other projects that strengthen communities [2].
>
> —American Society of Landscape Architects (ASLA)

It is quite complex to discuss the landscape architecture history in that the term "landscape architecture" have come into being for just two hundreds of years, and the history of landscape architecture before 1800 was usually considered the history of landscape gardening, mainly that of garden design for imperial and royal families, government and ordinary people.

From the three remarkable landscape architecture histories published in the 1970s by Norman Thomas Newton, George B. Tobey, Geoffrey and Susan Jellicoe, the definition of landscape architecture can be concluded as "design on the land" and "shaping the environment", which focuses on the planning and construction of outdoor areas [3].

1.2.2 Concepts and thoughts of Chinese landscape architecture

The translated name of "Landscape Architecture" in Japan is "造園/造園学 (gardening)", and it is used in the name of the Japanese Institute of Landscape Architecture (日本造園学会) established in 1925, and the Japanese Society of Landscape Architects (JSLA) (日本造園家協会/日本造園修景協会) established in 1976. In China, the translated name of "Landscape Architecture" is "風景園林/風景園林学", which was adopted in the name of Chinese Society of Landscape Architecture (CHSLA) (中国風景園林学会) established in 1989, and has been commonly adopted since the mid-1980s when China's landscape architecture discipline was brought into line with international standards. As for the Chinese translated name, the former term "風景 (landscape)" represents both the meaning of "land/vernacular (風土)" and the "scape/scenery (景観)", and the latter term "園林" sticks with the conventional term with the meaning of Chinese Garden (中国庭園). The Chinese translation of "Landscape Architecture" not only keeps in line with the international discipline, but also retains the Chinese characteristics,

maximizing the coverage of the various aspects of the discipline, and facilitating the understanding of the discipline by the general public of China [4].

Like other countries around the world, landscape architecture has existed in China for thousands of years from the practical level. As a discipline, however, its history is much shorter - the earliest modern landscape architecture discipline in the world has only a history of nearly 120 years, and it has only a history of 70 years in China.

The first real discipline of Landscape Architecture in China was founded jointly by Tsinghua University and the former Beijing Agricultural University in 1951 under the name of "造園 (gardening)". From the mid-1980s, the landscape architecture discipline in China entered a period of vigorous development and began to integrate with the world in an all-round way. In 1984, Mr. Qian Xuesen proposed that the Chinese "garden" is a synthesis of these three aspects: Landscape, Gardening, and Horticulture, and it is also an artistic product that has been sublated to reach a higher level. In 1989, the Chinese Society of Landscape Architecture (CHSLA) (中国風景園林学会) was officially established. In 2011, the landscape architecture discipline was promoted to be one of the 110 national first-class disciplines in China, marking a brand new stage in the development of landscape architecture in China [5–6].

Since 2016, the Chinese Society of Landscape Architecture (CHSLA) has begun to compile *A Disciplinary History of Chinese Landscape Architecture*. In this book, the development of Chinese landscape architecture is divided into five periods: the tradition of knowledge and practice of Chinese landscape architecture (before 1912), gestation and germination (1912-1949), establishment and tortuous development (1949-1978), vigorous development (1978-2011), and comprehensive and standardized development (after 2011). A brief history of the development of Chinese landscape architecture is emphatically constructed finally.

This book is characterized by three aspects: 1) A broad perspective. It includes national lands, famous mountains and scenic areas, cities and towns, countryside, water conservancy, transportation and military projects, and even mausoleums and cemeteries, etc. 2) A long span. The study covers a span of thousands of years with three stages: agricultural civilization, industrial civilization and ecological civilization. 3) Highlight of the Chinese subjectivity. The Chinese landscape architecture discipline is not a simple introduction or copy of the discipline of Western landscape architecture, but a relatively independent discipline with its own development soil, logic and characteristics [7].

Chinese people's view of landscape has a long history and is quite unique. During the agricultural civilization period, the Chinese people's cognition of landscape architecture was based on their unique views of nature, humanities and

practice. Compared with Western traditions, the Chinese traditional view of nature is characterized by “integrity” and “collectivization”. Based on the cognitive views, the practice view of traditional Chinese landscape architecture is “the harmony of human with nature”, that is, standing on the position of “middle way” between “human” and “nature” with mutual adjustment in order to achieve the goal of “the best practice” [7].

At present, along with the trumpet of territorial spatial planning and the park city construction, the curtain of building a new era of human living environment and ecological civilization is being drawn. As a national first-class discipline of China, landscape architecture undertakes the major task of “balancing the relationship between human and nature, making the national land green and clear, and building a beautiful China”. The guiding ideology of landscape architecture in contemporary China needs to uphold the modern view of human settlement as a trinity of landscape, city and architecture, establish the leading role and status of modern landscape architecture in the construction of human settlement, and explore the future development direction of China in the new era with the Chinese view of human settlement and ecological wisdom [8–9].

1.2.3 Past of Chinese landscape architecture: Agricultural civilization period

A complete history of Chinese landscape architecture is the main source of the most fundamental theoretical basis and planning and design ideas of Chinese landscape architecture discipline. It is undeniable that a major context in the history of Chinese landscape architecture comes from the history of ancient gardening. However, since modern landscape architecture is the art and science of land analysis, planning, design, management, protection and restoration, the history of landscape architecture should not be limited to the history of gardening.

The broad sense of landscape architecture has already existed in history; most of the work covered by modern Chinese landscape architecture disciplines has already been engaged in history by many people. The history of Chinese landscape architecture is the history of Chinese people’s influence and transformation on land for production and living needs. This sorting, transformation and management of land has constructed the humanistic natural ecological system of China's territorial land. The formation, development and evolution of this system and the ideas behind it are the main contents of the history of Chinese landscape architecture. This historical research should include both the history of gardens and the history of the humanistic natural ecosystem development of villages, cities and towns, regions, and the entire territorial land. This is a history of Chinese people adapting to nature, transforming nature, leaving ideas on culture and leaving a mark on the earth, reflecting the long-term dependence of Chinese

people on nature [10].

For thousands of years, the Chinese have been developing agriculture to survive. To meet the developmental needs of agriculture, human settlement and transportation, they have built various water conservancies according to specific geographical environment and natural character of different regions, and formed a nationwide-covering water network by combining natural water system with artificial water system. Cities were built in proper site within the regional natural landscape and the artificial system of farmland and water conservancy. The land texture inside and outside the city were gradually transformed and embellished, and the landscape environment turned into scenic areas. This unique way of land arrangement and utilization has led to the traditional landscape of China including both artificial and natural elements, and formed the landscape system integrating mountain, water, field and city [11].

The ancients always regarded the natural and artificial landscape environment as the basis for urban construction, and cities formed their own unique landscape patterns and urban individualities in the process of adapting to and transforming nature. Shan-shui (山水) city is an urban structure rooted in China's land, and the way of life and value of the Chinese people, and it is the cultural result of the combination of farming civilization and camping practice produced by adapting to China's unique geographical environment and climatic conditions [12]. Shan-shui thought is the cultural core of the Chinese city planning and landscape architecture practice. It is of vital importance in the 21st century to design human settlements with adapting to local conditions and conserve the natural environments in research and practice of landscape architecture [13].

1.2.4 Present of Chinese landscape architecture: Industrial civilization period

After the agricultural civilization period, the second stage of human impact on land was the period of industrialization and urbanization. Contemporary landscape architecture has become a systematic profession and included in university curriculum as a discipline, which is inseparable from the practical demand for the more than 200 years' social and economic development. Ever since the First Industrial Revolution in the mid-18th century, western countries have spent more than a century to comprehensively reform the production technology, economic structure and social system. As a great number of people pouring into cities, the huge demand for residence, work, commuting and transportation has promoted the rapid development of modern cities. Later, urban parks were regarded as a "medicine" to remedy environmental pollution and deterioration of the living environment. Landscape construction was gradually getting rid of the limitation of serving only a few rich people; and designers started to attach

importance to public garden design and comprehensive urban renovation.

After the World War II, many socio-economic changes have raised the requirements for reformation regarding practices of the landscape architecture industry, such as the construction trend of new towns brought about by the economic recovery and prosperity, the increasing destruction to the ecological environment in the industrial cities in the 1960s, and the reform of European and American economic structure in the 1970s which released a large number of post industrial sites that need to be reused. These changes further influenced the form and connotation of landscape architecture education in the United States and Europe [14].

China's industrialization began in the second half of the 19th century, but its development has been slow for a long time. The landscape as a whole still retained the appearance of an agricultural society. It was until the middle of the 20th century that China began a large-scale industrialization process, and by the end of the 20th century, a rapid urbanization process began. With the development of industrialization, the rapid advancement of urbanization, the increasing complexity of society and the rapid increase of population, the relatively stable landscape structure of the agricultural era accumulated over thousands of years was also rapidly changing. The natural and semi-natural areas were drastically reduced, while the areas of high-intensity manual intervention and control was increasing. Under the huge adsorption and influence of cities, rural land, labor, and talents are constantly losing, agriculture is declining, the layout, style, materials and construction methods of rural buildings are increasingly becoming urban, and the rural landscape has undergone great changes. Changes in agriculture, rural areas and urban landscapes have caused fundamental changes in the territorial landscape of the country [15].

Started from the absorption and reference of Western landscape architecture and the architecture discipline, the education of modern landscape architecture in China integrated the traditional characteristics of construction. There are three main driving forces in the process of gestation, establishment and development of Chinese landscape architecture discipline, namely, the knowledge and practice tradition of Chinese native landscape architecture, the discipline of landscape architecture in the West (especially the United States), and the related education and practice of landscape architecture in the former Soviet Union and Eastern Europe.

On the whole, these three forces have promoted the discipline of Chinese landscape architecture in an uneven manner. The knowledge and practice tradition of Chinese native landscape architecture is supposed to be the root and foundation of Chinese landscape architecture and the endogenous driving force for the

development of Chinese landscape architecture. However, due to various historical reasons, the promotion and influence of the knowledge and practice tradition of Chinese native landscape architecture on Chinese landscape architecture is insufficient and incomplete, and its influence is also more implicit than explicit in most periods. In summary, the resilience and vitality of this force is the strongest, and its potential and space for future development is also the greatest. The promotion and influence of the Western landscape architecture discipline, represented by the United States, on Chinese landscape architecture has been extensive, deep and comprehensive, and can even be described as excessive or pervasive during certain periods. The promotion of landscape architecture education and practice in the Soviet Union and Eastern Europe to the discipline of landscape architecture in China only occurred during the tortuous development of the discipline of landscape architecture in China in the 1950s [7].

From the founding of the first real discipline of Landscape Architecture in China in 1951 to the present day, the generations of educators and practitioners have been nurturing the landscape architecture discipline with great difficulties and times of ups and downs. With the rapid development of China's economy as well as the social changes after the reform and opening up, the education, research and practice of landscape architecture in China have made continuous progress and eventually achieved the inclusive and open situation today. Since the reform and opening up, four characteristics of landscape architecture development in this period are summarized: 1) the landscape architecture industry system was gradually standardized; 2) the landscape architecture construction project transformed from tradition to modernity; 3) the landscape architecture design unit transformed from single to the diversity; and 4) the cultivation of landscape architecture talents flourished [16].

Looking back on the 70 years since the founding of the country, the contemporary practice of landscape architecture in China has made achievements, albeit with twists and turns. In 1956, in the tide of "learning from the Soviet Union", the "gardening" major in the university was renamed "urban and residential greening", forming an atmosphere of "restraining the garden and promoting the green". In August 1958, Chairman Mao Zedong proposed "to make all the mountains and rivers of our motherland green and achieve gardening, to change the natural appearance and be beautiful everywhere". "Learning from the Soviet Union in an all-round way" was a major historical event in the history of Chinese landscape architecture. Its progressive significance lies in the revolutionary expansion of Chinese landscape architecture from "gardening" to "landscape planning". The negative impact is that the discipline of Chinese landscape architecture lost the nourishment of the knowledge and practice

tradition of Chinese native landscape architecture at the early stage of its development.

In the 30 years since the reform and opening up, China's landscape architecture planning and design has made great progress and entered the fastest and best development period in history. Around the 1980s, the development of China's landscape architecture entered the recovery period, which has become an important turning period of China's new landscape architecture design. During this period, the design team continued to grow, and the major urban landscape design institutes became an important force in domestic landscape design, producing a number of excellent landscape design works, such as the restoration and reconstruction of Chinese classical gardens and scenic spots, the construction and reconstruction of urban parks, hotel garden projects, residential areas and urban road greening design. The reform and opening up has made Chinese garden to go abroad and go to the world. The Ming Hall, also known as the Astor Court located in the the Metropolitan Museum of Art in New York City, is a re-creation of a Ming dynasty-style, Chinese-garden courtyard based on Suzhou gardens, which is the first exported garden in China. The export of Chinese gardens became a hot topic at that time.

In the early 1990s, China's economy entered a period of rapid development. With the reform and opening up, the opening of the country, the return of overseas students, and the continuous deepening of international exchanges and the advent of the information age, the national landscape design thought presents a resurgence, and the landscape design market is unprecedentedly prosperous. During this period, traditional cultural gardens radiated new vitality, and modern design techniques, advanced technology, building materials and modern engineering skills were widely used to create new garden landscapes.

Since 2000, western landscape design concepts have entered China, and there has been a trend of integration, inclusiveness and diversified development between China and foreign countries, which has greatly promoted the development of China's landscape architecture planning and design. At the same time, it is inevitable that some local design ignored regional characteristics. With the advancement of the concept of national ecological civilization construction, urban green space system planning, urban ecology and landscape restoration began to develop in an all-round way. China Garden Expositions are also held in various places, which has led to a feast of design innovation. The conservation planning of natural and cultural resources has made great progress, and the planning and protection systems of scenic spots and national parks have been gradually established. Landscape architecture is becoming an important carrier of ecological civilization and human settlements in the future, and the cause of

landscape architecture will enter a new normal of accelerated development [17].

1.2.5 Prospect of Chinese landscape architecture: Ecological civilization period

At the beginning of the 21st century, China's environmental, social, economic and cultural situation is facing the following challenges: the environmental pressure is becoming more and more severe, or has reached the edge of crisis; The lack of regional cultural vitality and cultural convergence are becoming more and more obvious; The urbanization level continues to develop rapidly, which has exceeded the level of 50%; The sense of insecurity of all social groups has increased rapidly, and the awareness of public participation has been strengthened; The follow-up effects such as employment pressure caused by economic slowdown need to be further observed; "Spiritual desertification" is worrying. All this means a lot to the development of landscape architecture.

In the 21st century, the Chinese landscape architecture discipline calls for both characteristics of modernity spirit and Chinese culture vitality. The relationship between the past, present and future of Chinese landscape architecture is incorporated into the "modernity" category; the relationship between the oriental, Chinese and Western landscape architectures is incorporated into the "Chinese characteristic" category. The fundamental significance of the study of "modernity" is the transformation from traditional Chinese gardening to modern landscape architecture. The fundamental significance of the study of "Chinese Characteristic" is to maintain the foundation of Chinese culture in the modern transformation period of landscape architecture [18].

In the 21st century, the Chinese landscape architecture discipline should make comprehensive contributions to environment, culture, city, society, economy and spirit. Such landscape architecture has the following characteristics: focusing on conservation priority, cultural identity, urbanism and urban issues, integrating green industries, and public participation and public environmental education, the mission of the discipline is to protect, steward, and create a landscape system to fulfill the various purposes of conservation, living quality improvement, spiritual habits and even production fields [19].

Landscape architecture is a human activity. Its basic tasks include three categories: protecting the state and cycle process of the beautiful nature, improving the living environment disturbed or destroyed by human beings, and creating a beautiful urban and rural area where man and nature live in harmony. The essence of natural ecosystem is the biochemical cycle carried out in the earth's life circle maintained by the life activities of organisms. This cycle needs a certain environment, maintains the environment at the same time, and creates a more conducive environment for life in the long run. This cycle has a certain degree of

redundancy, which can allow human civilization to change this cycle more or less. Controlling this redundancy is the scientific basis of the discipline of landscape architecture. The most taboo of this discipline is the excessive intervention and self righteousness of human beings in the process of participating in the natural cycle [20].

Landscape architecture, with the priority of protection, can make great contributions to China's human settlements and natural environment. As one of the three leading disciplines of human settlements discipline group (architecture, urban planning, landscape architecture), landscape architecture plays a very important role. As the fundamental mission of landscape architecture, coordinating the relationship between man and nature determines its nature and task different from the disciplines of architecture and urban and rural planning. In terms of protection intensity, landscape architecture practice can be divided into two levels: protection and management of natural and cultural heritage sites and landscape planning and design under the premise of ecological and cultural protection. It can be said that all practices of landscape architecture are protective practices to some extent [19].

In addition to ecological protection and environmental restoration, landscape architecture also shoulders the construction and integration of natural and artificial environment. To find a more effective way to re-establish balance between the artificial and nature in the city, one of the most direct ways is to turn the gray infrastructure into green and build green infrastructure. It is imperative for China to turn the cities with engineering facility system into cities with ecological system by the means of green infrastructure, which will make the previous city with more complete and natural ecological function. Landscape architecture is also capable to combine the natural systems and artificial systems together, integrate all kinds of individual structures and infrastructures, improve landscape system and establish vibrant urban space. In a larger scale, integration means reconnecting fragmentized landscape caused by human activities with biotopes and habitats by landscape architecture approach and establishing an integrated and continuous system [21].

Landscape is not only the product of natural process, but also the product of human activities. They are the results of people's intervention and transformation in order to meet some needs. The landscape surrounds us and interacts with us day and night through material or spiritual ways. The landscape constitutes the grand background of the whole human historical process. Therefore, landscape is not only an ornamental object, but also a readable text. Landscape records the impact of human beings on land, reflects the relationship between people and land and people's production and lifestyle, and has the attribute of culture.

Due to different natural environments and cultural differences, each landscape unit is unique and unique all over the world. If the space-time continuity of the landscape unit is broken, it often means the disappearance of the landscape characteristics, which will lead to the homogenization of the landscape, the weakening of diversity and the lack of regional cultural carrier, followed by the crisis of local cultural identity. China's territorial landscape consists of countless landscape units, which are the records of China's long history and the carrier of broad culture. However, in the process of China's rapid industrialization and urbanization, the characteristics of many such landscape units have become blurred. Understanding, maintaining, adapting and continuing the structure and characteristics of each landscape unit is of great significance to maintaining China's local cultural identity [22].

The culture connotation and theme quintessence of Chinese landscape architecture is shan-shui culture. It is an artistic piece that takes natural landscape and vernacular features as the main aesthetic and expression subject and integrates material and spiritual cultures in one. Shan-shui aesthetics is the spiritual and cultural needs formed in the complex communication between man and nature. It is a high-level spiritual and cultural life when human society develops to a certain stage. The excellent landscape environment is the most ideal place for humans to obtain wealth from nature and rely on for survival and development.

Mr. Qian Xuesen said: "The idea of a shan-shui city is an organic combination of Chinese and foreign cultures, an organic combination of urban gardens and urban culture. A shan-shui city should be a model for the construction of Chinese cities in the 21st century." The creation of shan-shui city can integrate science and art, retain the characteristics of Oriental culture, inherit China's traditional culture, and develop the content of modern science and technology [23].

To sum up, China's landscape architecture has the following goals in the 21st century. Landscape architecture has the potential to become one of the leading disciplines of ecological generation and Anthropocene; Chinese landscape architecture has the opportunity and potential to become one of the leading disciplines in the construction of ecological civilization, and make important contributions to landscape architecture worldwide in practice, theory and education [24].

1.3 Objectives and Significance of the Study

Chinese gardens play an important role in Chinese landscape architecture both in ancient and modern times. A major context in the history of Chinese landscape architecture comes from the history of ancient gardening. Garden is also the

epitome of Chinese traditional art as an entity, embodying the shan-shui thought as the cultural core of the Chinese landscape architecture, reflecting the Chinese people's unique view on nature, humanities and practice. Ancient Chinese cities and Chinese gardens have very similar structures, so ancient Chinese cities can be described as enlarged Chinese gardens, combining the farming civilization and camping practice and adapting to China's unique geographical environment and climatic conditions.

In 2018, China proposed to build a high-quality "Park City" with urban public green space as the main system. As a unique type of landscape in China, Chinese gardens, together with urban parks, green spaces and forest parks, form the landscape system in urban green open space, integrate into people's daily life, and become an indispensable public space and leisure place.

The overall aim of this study is to explore the contemporary value of tourism and utilization of Chinese gardens, and to inherit and innovate the Chinese gardens in order to play a leading role of traditional culture and undertake more public and social functions in the future. This study focuses on the following three research questions:

1. What are the spatial changes and characteristics of Chinese gardens in history?
2. What are the characteristics of the space composition and tourism of contemporary gardens?
3. What is the relationship between the visitor behavior and garden space in contemporary gardens?

Therefore, the three main objectives of this study are to: 1) Analyze the history and spatial characteristics of traditional Chinese gardens (Chapter 2), and take the imitation of Tianyige library group by seven libraries of *Siku quanshu* as a study case (Chapter 4); 2) Take Tianyige garden (East Garden and South Garden) as the research object, and quantitatively analyze the spatial composition of garden space and the distribution characteristics of visitor stay (Chapters 5 and 6); 3) Take Tianyige Garden (East Garden and South Garden) as the research object, and quantitatively analyze the correlations between spatial attributes and visitor stay distribution (Chapters 5 and 6).

The significance of this study is the combination of the traditional and contemporary Chinese gardens. It not only traces the development and changes of traditional gardens, but also explores the openness value of contemporary gardens as sightseeing spots and green open space, and understands the needs of visitors and users for garden space. It is of great significance to explore the Chinese gardens as an important public green open space category.

The originality of this study is twofold. Firstly, the study systematically compared the architecture and garden of the Tianyige library and seven libraries of *Siku quanshu*, and conducted the restoration research of three destroyed libraries. Secondly, the study fills the gap of a special field on the visitor stay behavior and influencing factors research in the small scale of Chinese garden space, which plays a key role in the utilization of Chinese gardens as urban green open space.

Based on the findings, suggestions can been provided for the planning, management and local improvement of Chinese gardens corresponding with users' needs. The study can be applied to the design and local transformation of gardens, so as to increase the openness and use frequency of garden places, and make gardens more valuable urban green open space. This study is also of great value to the mission of constructing of people-oriented urban green space and high-quality human settlements. The results of this study also contribute to the utilization and development of gardens in East Asia.

1.4 Literature Review

From the perspective of research problems and objectives, the existing studies can be categorized into the following four aspects. The first is the research on the history and spatial changes of traditional Chinese gardens, the second is the research on the architecture and garden of Tianyige library and the seven libraries of *Siku quanshu*, the third is the research on the spatial composition and characteristics of Chinese gardens, and the fourth is the research on the visitor behaviors and influencing factors in green open space (mainly in gardens and parks).

1.4.1 Research on the history of traditional Chinese gardens

Since the 20th century, the first batch of modern Chinese architecture scholars such as Tong Jun and Liu Dunzhen began to pay attention to the Chinese gardens. At that time, the research objects were mainly the Jiangnan gardens, especially in Suzhou. *Records of Jiangnan Gardens* by Tong Jun [25] became the first result of that time, followed by Liu Dunzhen's *Suzhou Classical Gardens* [26] and Chen Congzhou's *Suzhou Gardens* [27]. These studies are based on the field investigation and mapping of Jiangnan gardens, and elaborate some theories of Chinese gardens, creating a precedent for modern domestic garden research.

The systematic combing and research of Chinese scholars on the history of Chinese gardens began with *History of Chinese Landscape Architecture* by Zhang Jiaji [28], *History of Traditional Chinese Gardens* by Zhou Weiquan [29], and *History of*

Ancient Chinese Gardens by Wang Juyuan [30]. So far, there have been fruitful achievements on garden history research. At present, *History of Chinese Landscape Architecture* and *History of Chinese Landscape Architecture Discipline* are being compiled, which are broader studies on the history of Chinese landscape architecture covering the history of ancient gardening.

The research results of aesthetics and theory of Chinese gardens have been extremely rich since ancient times. The earliest monograph on garden theory in China is *Yuan Ye* [31], which was written in the 17th century by Ji Cheng. It reflects the achievements of ancient Chinese gardens and summarizes the gardening experience. Modern research on garden theory also rose with the development of garden research, such as the summary of garden theory by Tong Jun, Liu Dunzhen and Chen Congzhou, as well as Chen Zhi's *Conspectus of Landscape Making* [32], Yang Hongxun's *A Treatise on the Garden of Jiangnan* [33], Peng Yigang's *Analysis of Traditional Chinese Garden* [34], pan Guxi's *Jiangnan Landscape Coordinating Art* [35], Meng Zhaozhen's *Yuan Yan* [36] and so on.

1.4.2 Research on the spatial characteristics of Chinese gardens

The research on the spatial composition and characteristics of Chinese gardens can be divided into garden space research, garden elements research, garden aesthetics and artistic conception research.

The contemporary study of Chinese gardens began with the study of garden space and artistic conception. With the return of the first batch of overseas scholars in the field of architecture, such as Tong Jun, Liang Sicheng and Liu Dunzhen, western scientific research methods began to be applied to the field of Chinese classical garden research. In the initial stage of this research, the research content focuses on the architectural form beauty such as garden layout and garden art, and the discussions were gradually enriched after the founding of the people's Republic of China. For example, many studies on the architectural analysis on Chinese gardens were published in 1963 by Peng Yigang [40], Guo Daiheng and Zhang Jinqiu [41], Pan Guxi [42–43], and Wang Juyuan [44] and so on. In the mid-1980s, Peng Yigang published *Analysis of Traditional Chinese Garden* [34], analyzing the Chinese classical gardens with a series of architectural analysis methods which can be applied to modern architectural practice. Since 2000, the quantitative researches on garden space by using information technology and analysis methods have gradually increased, such as the research on garden space by spatial syntax theory.

In addition to the analysis of spatial characteristics of Chinese gardens, with the deepening of garden research and on the basis of a large number of garden plan mappings, the analysis of garden elements has also become one of the major

research fields. Garden elements include architecture, water, rockery, flowers and trees, as well as plaques, landscape titles, flower windows, paving, and so on, among which the research on rockery is the most abundant. The garden elements research focus on the analysis such as aesthetic analysis and structural techniques, and pay attention to the role of garden elements in design in order to guide the future architectural and garden design practice. In recent years, more and more quantitative analysis have been applied in the garden elements research.

The research contents of garden aesthetics and artistic conception include the analysis of garden aesthetics, the study of ancient gardening ideas, the study of ancient garden aesthetic methods, the comparative study between garden aesthetics and other aesthetics such as painting and music. Many studies were published in the 1980s, such as *The Explanation of Yuan Ye* by Chen Zhi [45], *Overview of Chinese Garden Art* by Zong Baihua et al. [46], *On Chinese Gardens* by Chen Congzhou [47], *Garden Beauty and Garden Art* by Yu Shuxun [48], and *Chinese Park Thesis* by Jin Xuezhi [49]. After 2000, the technical methods and data analysis such as view and isovist analysis, auditory analysis, color analysis, physiological and psychological reflection analysis have also been applied to the quantitative analysis of garden aesthetics and experience.

1.4.3 Research on the Tianyige library and the seven libraries

The research on the architecture and garden of Tianyige library and the seven libraries of *Siku quanshu* can be divided into the research on the ancient Chinese library and the research on the imperial gardens in Qing Dynasty.

The upsurge of contemporary researches on ancient Chinese library history started in the early 1980s. *History of Ancient China Library Course* by Lai Xinxia [37] was published in 1990. Lai made a comprehensive investigation on ancient China library course by combining the history of Chinese text, bibliography and library together for the first time. In 2001, two great works on ancient Chinese library history were published almost at the same time. *Chinese Book Storage Buildings* by Ren Jiyu [38] is a panoramic display of China's book collection history for thousands of years, as well as the history of ancient Chinese libraries and book collectors. *General History of Chinese Book Collection* by Fu Xuancong and Xie Zhuohua [39] comprehensively discussed the historical facts of ancient Chinese book collections on the basis of systematic demonstration.

Researches on imperial gardens in Qing Dynasty and measurements of historic buildings were carried out earlier by Tianjin University, which has collected a number of useful measurement drawings and research achievements. In the late 1980s, Wang Qiheng, professor of Tianjin University pushed forward the research of imperial gardens in Qing Dynasty and the Yangshi Lei Family, and

at the same time Guo Daiheng, professor of Tsinghua University started the research on the digital reconstruction of the Yuanmingyuan (Old Summer Palace). In 2008, the The Institute of Qing History of Renmin University of China cooperated with the Yuanmingyuan Management Office to jointly establish the Center for Imperial Gardens in Qing Dynasty, which explains and reflects the multicultural function of the Imperial Gardens in Qing Dynasty from many fields such as political history, economic history, social history, cultural history, historical geography, historical philology of Qing Dynasty and so on.

1.4.4 Research on the visitor behavior in green open space

The research on the visitor behavior and influencing factors in green open space mainly focuses on urban parks, gardens, green spaces and forest parks, and studies the recreation and utilization of visitors and users, involving many interdisciplinary fields such as tourism, recreation, environmental psychology and environmental behavior, landscape architecture planning and design, sociology and so on. Journals in related fields include *Landscape and Urban Planning* and *Urban Forestry & Urban Greening* in the field of landscape architecture, *Environment and Behavior* and *Journal of Environmental Psychology* in the field of environmental behavior, *Visitor Studies* and *Tourist Studies* in the field of tourism, and so on.

The research on visitor behavior in Chinese gardens and parks can be divided into the following aspects. The first aspect is the research on the recreational experience of visitors in classical gardens, such as Zhang's study on the visitor behavior in Lion Grove Garden [50] and Ding's study on the stationary points in Liu Garden [51]. The second aspect is the research on the behavior of users and specific groups in the garden, such as Wang's study on the tourists distribution and behavior in Hangzhou West Lake Scenic Area [52] and Chen's study on the recreational behavior of the elderly in Kunming Cuihu Park [53]. The third aspect is the post occupancy evaluation (POE) research on users' satisfaction, such as Yao's study on POE of Hangzhou West Lake Scenic Area [54] and Zhai's study on the influencing factors on urban park overall satisfaction [55]. The fourth aspect is the analysis of user behavior in specific garden areas and elements, such as Senda and Ren's study on the users' stay and behavior in the veranda space of Chinese gardens [56–57].

1.5 Structure and Methodology of the Dissertation

This dissertation consists of seven chapters, and it can be roughly divided into four parts: Chapter 1 as the introduction, Chapter 2 as the overview of Chinese

traditional gardens, Chapter 3-6 as the studies on the research object Tianyige Museum, Chapter 7 as the conclusions. The flow chart is shown in Figure 1-5-1. The scope of the study covers ancient and modern times, as well as the garden space and visitor behavior. The scope of each chapter are shown in Figure 1-5-2. The following is the contents and research methods of each chapter.

Chapter 1 introduces the research background: the past and prospect of Chinese landscape architecture, and emphasizes the importance of Chinese garden research to Chinese landscape architecture. Then it introduces the objectives and significance of the study, literature review, structure and methodology of the dissertation, and definition of terms. The research methods of Section 1.1 mainly consist of literature survey and historical studies.

Chapter 2 introduces the definition and classification of Chinese gardens, the stages and classification of garden development, the spatial characteristics of main garden categories, and the functions and utilization of traditional Chinese gardens. Finally, it summarizes two mainstreams and various styles in the historical process of traditional Chinese garden development and illustrates some existing gardens. The research methods of this chapter consist of literature survey and field survey.

Chapter 3 introduces the history and current situation of the research object: Tianyige Museum, as well as the schedule and results of field investigation. The research methods of this chapter consist of literature survey and field survey (questionnaire, mapping and interview).

Chapter 4 analyzes the basic situation, construction ideas, architectures and gardens of Tianyige library group, articulates the imitation of the seven libraries from the perspective of architectures and gardens, and finally conducts the restoration research of three destroyed libraries in architectures and gardens. The research methods of this chapter consist of literature survey, historical research, field survey and mapping, and comparative research.

Chapter 5 & Chapter 6 study the visitor stay distribution and spatial influencing factors in Tianyige garden. Chapter 5 is the study on visitor short-stay behavior, and Chapter 6 is the study on visitor long-stay behavior.

Chapter 5 analyzes the spatial attributes of the Tianyige garden, the short-stay characteristics of visitors and its relationship with relevant spatial attributes, in order to analyze the openness of the garden space and its attraction to visitors. The research methods of this chapter consist of literature survey, field survey, observation methods, statistical methods, quantitative and comparative analysis.

Chapter 6 analyzes the spatial attributes of the Tianyige garden, the long-stay characteristics of visitors and its relationship with relevant spatial attributes, and compares the long-stay characteristics of visitors in different garden spaces, so as to analyze the different needs of visitors and the openness of garden space. The

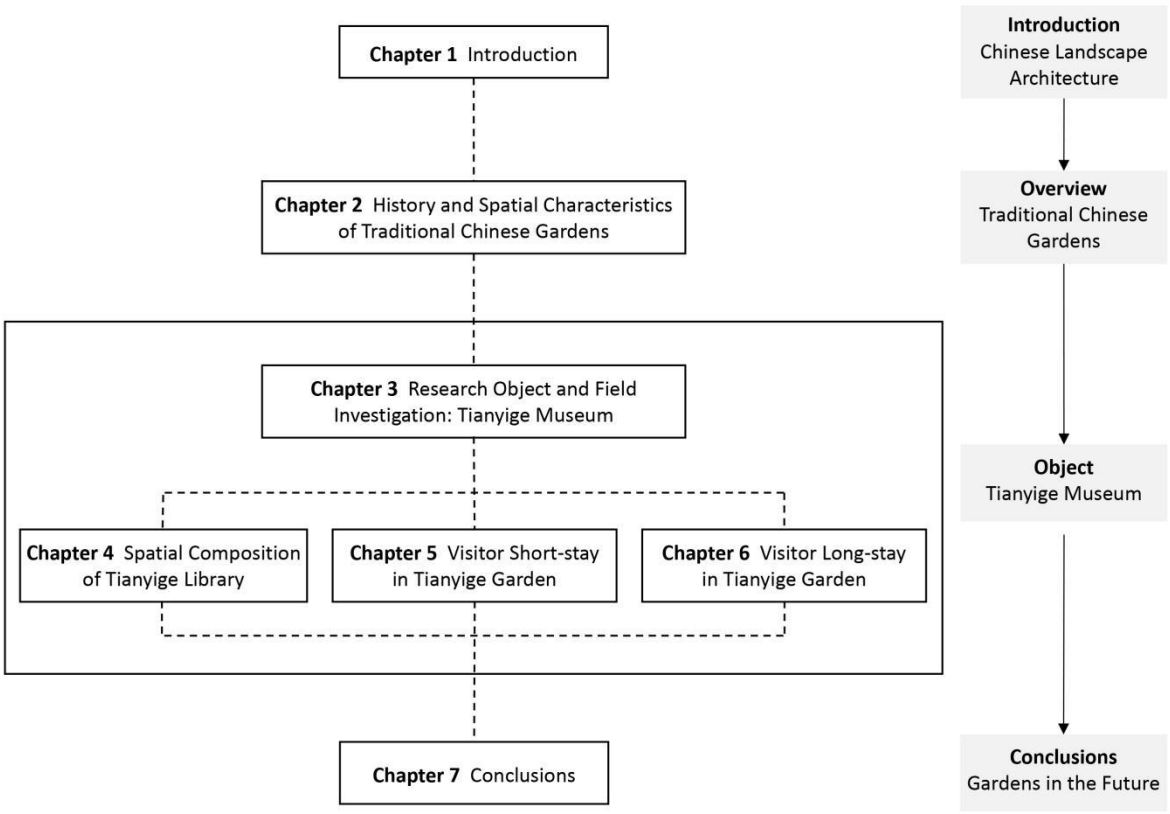

Figure 1-5-1. The flow chart of the dissertation.

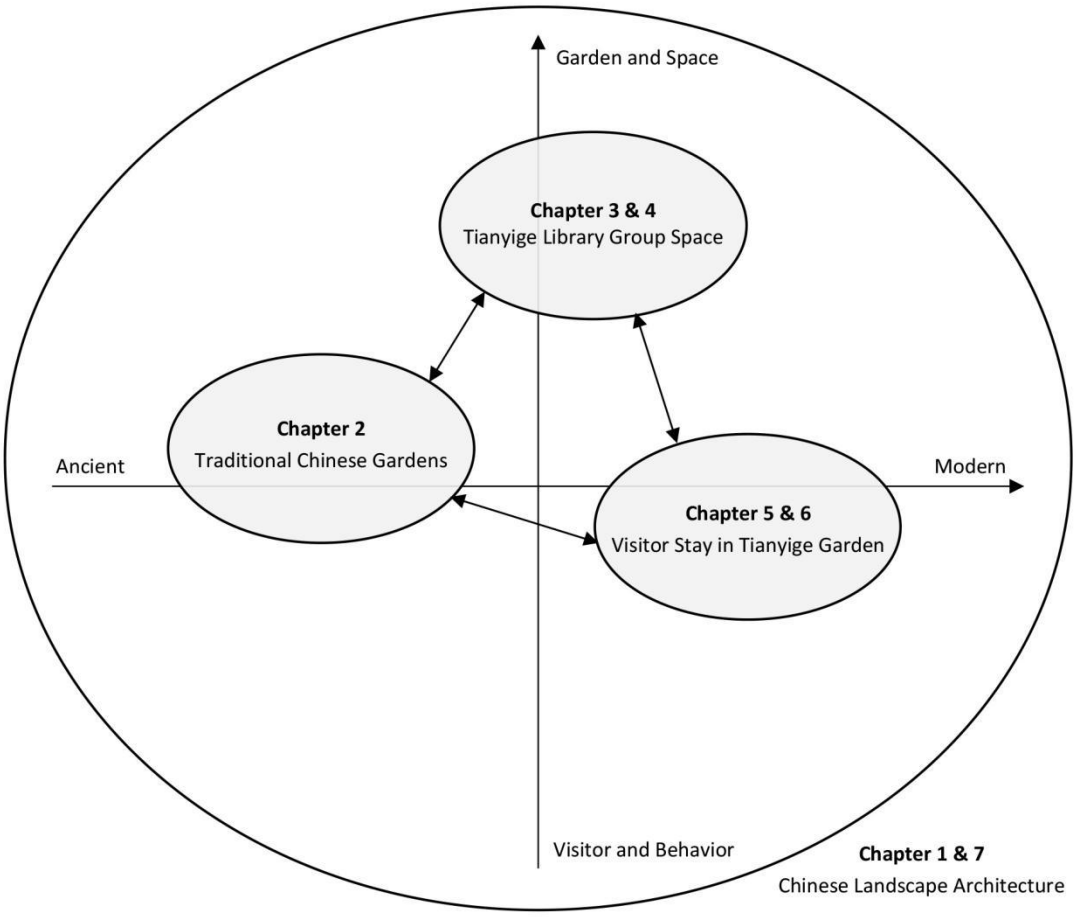

Figure 1-5-2. The scope and their relationships of each chapter.

research methods of this chapter consist of literature survey, field survey, observation methods, statistical methods, quantitative and comparative analysis.

Chapter 7 summarizes the conclusions of this study, puts forward the strategies and suggestions for contemporary garden planning and design, local improvement and management, and looks forward to the role of garden as an important green open space category in the city.

1.6 Definition of Terms

The terms used in this dissertation are defined in two main categories: terms on Chinese gardens, and terms on the research object Tianyige Museum gardens.

1.6.1 Terms on Chinese gardens

Chinese Landscape Architecture (中国風景園林学)

A discipline that aims to safeguard the landscape and nature, regional culture and public welfare, and comprehensively applies scientific, engineering and artistic means to create a healthy, pleasant, applicable and sustainable landscape environment through conservation, planning, design, construction and management [24].

Chinese Garden (中国園林/中国庭園)

A beautiful nature and a living realm of beauty formed by the creation of a certain plot of land with scientific and artistic principles. This kind of creation is formed either by slightly polishing, embellishing and building the original landscape - the earth and its scenery, or by reorganizing various themes constituting the garden [30].

A typical Chinese garden is enclosed by walls and includes one or more ponds, rockeries, trees and flowers, and an assortment of halls and pavilions within the garden, connected by winding paths and zig-zag verandas. By moving from structure to structure, visitors can view a series of carefully composed scenes, unrolling like a scroll of landscape paintings [58].

Imperial Garden (皇家園林)

A type of Chinese garden that are usually constructed and owned by the emperor and imperial families.

Private Garden (私有園林)

A type of Chinese garden that are usually constructed or bought, and owned

by an individual person and its family.

Northern Garden (北方園林)

A type of Chinese garden located north of the Qinling – Huaihe Line in China.

Jiangnan Garden (江南園林)

A type of Chinese garden located south of the Yangtze River in China. The Jiangnan region contains the city of Shanghai and part of Jiangsu, Anhui, Jiangxi and Zhejiang Province.

Lingnan Garden (嶺南園林)

A type of Chinese garden located south of the Nanling Mountains in China.

Shan-shui (山水)

1) Mountain and water, usually refers to the the form of nature and nature itself.

2) Short for Shan-shui Painting (山水画) or Chinese Landscape Painting, a style of traditional Chinese painting that involves or depicts scenery or natural landscapes, using a brush and ink rather than more conventional paints.

Mountains, rivers and often waterfalls are prominent in this art form. Although there are also works for the purpose of reproducing the real scenery, there are many "created scenery" according to the matching scenery of mountains, trees, rocks and rivers, trying to present the thought about nature. It is fundamentally different from the landscape painting in Western Europe, reflecting the Chinese view of nature that mountains are regarded as the existence of spiritual soul [59].

3) A cultural concept that reflects the unique view of nature and aesthetics of Chinese people. It is the spiritual and cultural needs formed in the complex communication between man and nature, with their desire to love and advocate the mountains and rivers, admire the universe, purify their hearts, understand the righteousness of heaven and earth, stimulate their ideals of life and pursue a better life. It pursues the harmonious realm between man and nature and the inner comfortable realm corresponding to the nature [23].

1.6.2 Terms on the Tianyige Museum Gardens

Tianyige (天一閣)

A private book storage building (or library) located in Ningbo, Zhejiang Province, China. It was founded in 1561 by Fan Qin during the Ming dynasty, and is the oldest existing library in China. Also translated as **Tianyi Pavilion**.

Tianyige Museum (天一閣博物院)

A museum featuring the renowned Tianyige and dedicated to the art of book collecting, located in Ningbo, Zhejiang Province, China with an area of 34,000 m^2. It is currently a Key Cultural Relics Protection Unit, Key Protection Unit of Ancient Books, and 5A-Class Scenic Area in China.

East Garden (東園)

Short for East Garden of Tianyige Museum. A classical style Chinese garden in the central part of Tianyige Museum. It was designed by Chen Congzhou and built from 1983-1986, with an area of 4,000 m^2.

South Garden (南園)

Short for South Garden of Tianyige Museum. A classical style Chinese garden west of East Garden in the central part of Tianyige Museum. It was built in 1996, with an area of 2,000 m^2.

Siku quanshu (四庫全書)

The largest collection of books in Chinese history, compiled by nearly 360 scholars from 1773-1792 under the order of Emperor Qianlong in Qing Dynasty. It contains 3,462 books with 79,338 chapters, which has more than 800 million Chinese characters. It was divided into four sections (四庫) in reference to the imperial library divisions, that is, Jing (經 "Classics"), Shi (史 "Histories"), Zi (子 "Masters" which means philosophy), and Ji (集 "Literature Collections"). Also translated as the *Complete Library in Four Sections*, *Complete Library in Four Branches*, or *Complete Library of the Four Treasuries* [60].

Seven Libraries of *Siku quanshu* (四庫全書藏書閣)

Northern four libraries (Wenyuange, Wenyuarnge, Wenjinge, Wensuge) and southern three libraries (Wenzongge, Wenhuige, Wenlarnge) built by Emperor Qianlong dedicated to the storage of *Siku quanshu*.

Wenyuange (文淵閣) is in the Forbidden City in Beijing. Wenyuarnge (文源閣) is in the Old Summer Palace in Beijing. Wenjinge (文津閣) is in the Mountain Resort in Chengde, Hebei Province. Wensuge (文溯閣) is in the Shenyang Imperial Palace in Shenyang, Liaoning Province. Wenzongge (文宗閣) is in Zhenjiang, Jiangsu Province. Wenhuige (文滙閣) is in Yangzhou, Jiangsu Province. Wenlarnge (文瀾閣) is in Hangzhou, Zhejiang Province. All the seven libraries were built following the architectural form and overall layout of the famous private library Tianyige (天一閣).

Chinese Garden Elements

Hill and rockery, pond, tree, house, pavilion, veranda and other elements that constitute a typical Chinese garden. In this study, the four garden elements (water, architecture, veranda and rockery) were chosen to classify the Tianyige garden space into four main spatial types.

Space Syntax

A set of techniques for analyzing spatial layouts and human activity patterns in buildings and urban areas. It is also a set of theories linking space and society. It addresses where people are, how they move, how they adapt, how they develop and how they talk about it. It was conceived by Bill Hillier, Julienne Hanson, and colleagues at The Bartlett, University College London in the late 1970s to early 1980s to develop insights into the mutually constructive relation between society and space [61].

Space syntax is founded on two fundamental propositions: 1) Space is not a background to human activity, but is intrinsic to it; 2) Space is first and foremost configurational. In other words, what happens in any individual space - a room, corridor, street or public space - is fundamentally influenced by the relationships between that space and the network of spaces to which it is connected.

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CHAPTER 2
HISTORY AND SPATIAL CHARACTERISTICS OF TRADITIONAL CHINESE GARDENS

2.1 Introduction

In order to better study the spatial characteristics and visitor activities in Chinese gardens, this chapter briefly examines the history, spatial characteristics, and functions and utilization of traditional Chinese gardens as background research. In this chapter, we can deepen the understanding of the definition and classification, as well as the spatial characteristics of traditional Chinese gardens in different historical periods, which are essential for the contemporary research on Chinese gardens.

There are six sections in this chapter. The first section explains the research purpose and main contents of this chapter. The second section explains the definition and classification of traditional Chinese gardens. The third section describes the history of traditional Chinese gardens in four main stages. The fourth section describes the spatial characteristics of main garden categories. The fifth section briefly introduces the functions and utilization of traditional Chinese gardens. The sixth section summarizes the two mainstreams and various styles in the historical process of traditional Chinese garden development and illustrates some existing gardens (Figure 2-1-1).

2.2 Definition and Classification of Traditional Chinese Gardens

2.2.1 Definition of traditional Chinese gardens

Chinese garden usually refers to the form of Chinese landscape garden cultivated by China's agricultural economy, centralized politics and feudal culture for thousands of years. Compared with other garden systems at the same stage, it has the longest history and the widest distribution. It is quite unique and has great achievements in Chinese traditional constructions. It is deeply immersed in the connotation of Chinese culture, with the ultimate goal of pursuing the spiritual realm of nature.

The definition of traditional Chinese gardens can be better clarified by comparing with the following words “garden”, “park”, and “landscape”. First of

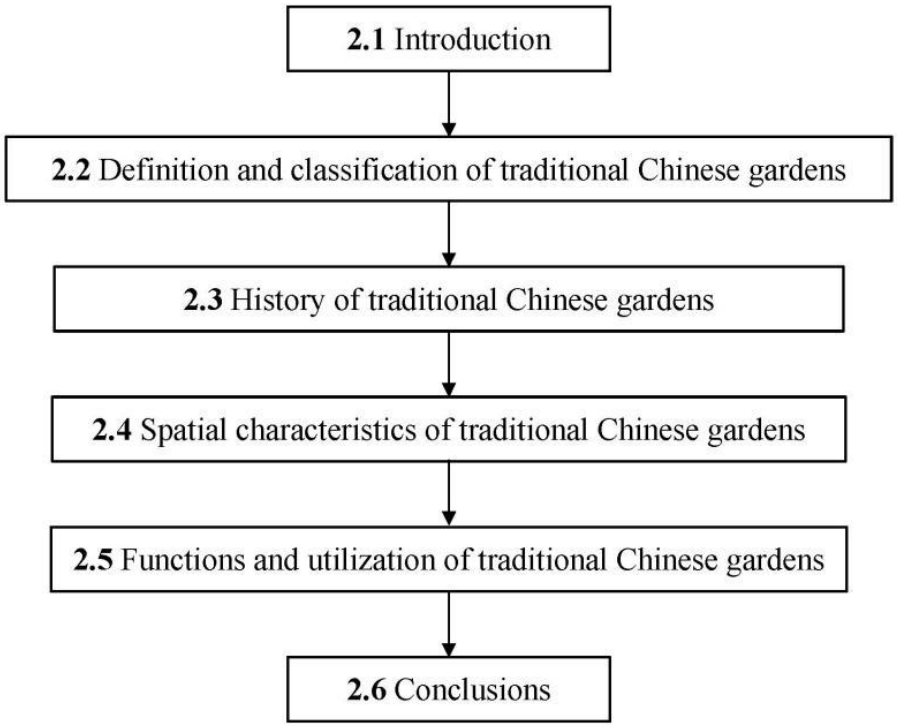


Figure 2-1-1. Contents of Chapter 2, containing six sections.

all, the word "garden" in English often reminds people of flower garden, vegetable garden or botanical garden nowadays. It usually refers to a piece of land next to a house, with flowers, vegetables, other plants, and often grass. At some other circumstances, the word "garden" in English can also refer to places like a park that have areas of plants, trees, and grass, and that people can visit and walk around. Regarding the two meanings of the word "garden" in English, the meaning of traditional Chinese gardens are more close to the latter, that is, traditional Chinese gardens include both the meanings of flower or botanical gardens and parks.

Different from gardens and parks, Chinese gardens are not only entertainment places but also places with residential functions. In terms of residential functions, traditional Chinese gardens are essentially closer to manors or estates, which usually refers to large areas of land in the country which is owned by a person, family, or organization. So on the other hand, the meaning of traditional Chinese gardens are close to the phrase "Garden of Eden", which refers to a paradise including flora and fauna, landscapes, rivers, and people living here.

The word "landscape" means everything you can see when you look across an area of land, including hills, rivers, buildings, trees, and plants. However, unlike natural landscapes on large tracts of land, traditional Chinese gardens are more abundant with artificial elements. Specifically, traditional Chinese gardens are the concentration and refining of natural landscapes, presenting an intertwined and rich scenery per unit area. Therefore, it can be concluded that traditional Chinese gardens are concentrated natural landscapes.

2.2.2 Classification of traditional Chinese gardens

Traditional Chinese garden can be divided into several types according to their ownership, and the main types include imperial garden, private garden, temple garden, scenic area, etc. Imperial gardens contain royal gardens located in the imperial city, imperial palaces for short-term stays close to the imperial city, and remote imperial palaces for long-term residence far from the capital. Private gardens can be divided into residential gardens in the city and villa gardens in the mountains and forests. Temple gardens generally refer to the attached gardens of Buddhist temples and Taoist temples. Scenic areas are public landscape gardens and tourist attractions located in suburban areas. Besides, there are also some other types of garden such as library garden, ancestral temple garden, local government garden, etc. In terms of regional division, traditional Chinese gardens can be divided as Northern (北方) Gardens, Jiangnan (江南, South of the Yangtze River) Gardens and Lingnan (嶺南, South of the Five Ridges) Gardens. From the perspective of site location, traditional Chinese gardens can be separated into artificial gardens and natural gardens according to the surrounding natural landscape conditions.

Although traditional Chinese gardens can be divided into multiple categories, traditional Chinese gardens are still one unity in its style and core, with different categories and styles influencing and integrating with each other.

2.3 History of Traditional Chinese Gardens

Chinese garden is a long-standing landscape garden system. The development of Chinese garden is a process of self-improvement and gradual progress, with little influence from outside garden culture. In general, the development of traditional Chinese gardens experienced four stages: generation stage, transformation stage, bloom stage and mature stage.

2.3.1 Generation period (pre-Qin Period to Qin and Han Dynasties)

The earliest recorded Chinese gardens emerged during the Shang Dynasty (商, 1600–1046 BC). These gardens were large enclosed parks where the kings and nobles hunted game, or where fruits and vegetables were grown. They can be seen as the prototype of the imperial gardens.

In Qin Dynasty (秦, 221–206 BC), the emperor was quite interested in building large-scale imperial palaces as well as imperial gardens and villas. In one of his palace near the capital Xianyang (咸陽), he created a hill of Mount Penglai (蓬莱) and a giant stone whale following the legend of immortals and symbolized his

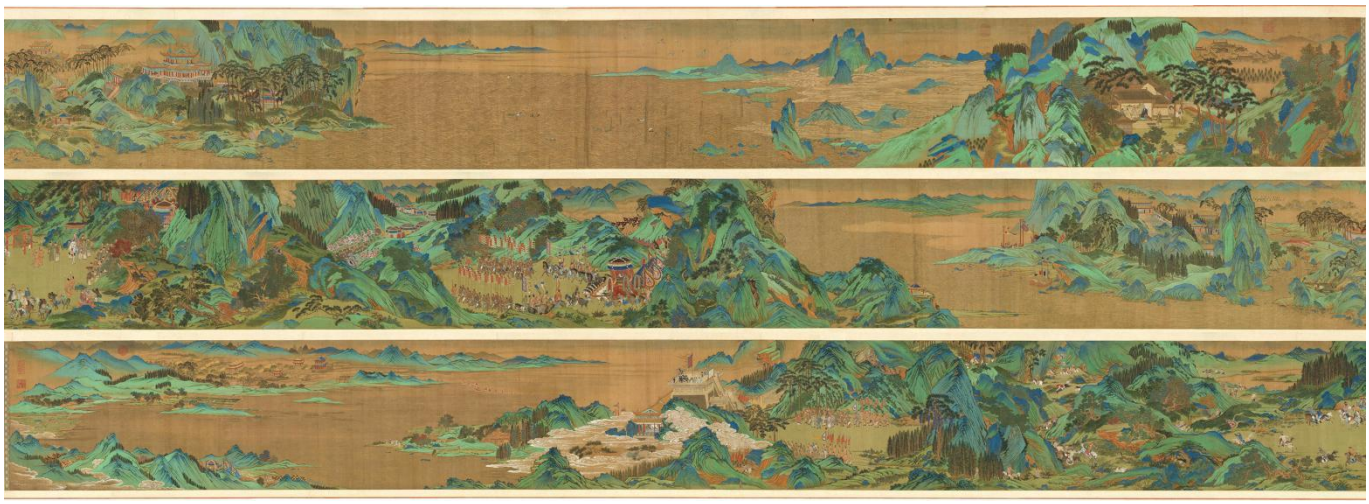


Figure 2-3-1. Anonymous, *Imperial Hunting with Retinue in Shanglin* (上林羽獵図), Ming Dynasty.
Courtesy of the National Palace Museum, Taipei.

desire for paradise. The theme of three immortal islands had a huge impact on later Chinese gardens.

In Han Dynasty (漢, 206BC–220AD), the capital was settled in Chang'an (長安), and the emperor constructed a vast imperial garden on the basis of Shanglin garden of the former Qin Dynasty, including numerous landscape categories and functions such as rivers and wetland, cultivation and wildlife parks, as well as hunting grounds (Figure 2-3-1), combining the residence and amusement function together. Since then, almost each dynasty after Han all had its own imperial gardens, quite large in scale and cost. In Han Dynasty, imperial garden could be divided into palace garden (宮殿苑囿) and natural landscape garden (林泉苑囿), and private garden originally emerged as large country estates (私有荘園).

2.3.2 Transformation period (Wei, Jin, the Southern and Northern Dynasties)

The transformation stage of traditional Chinese gardens was in Wei, Jin and the Southern and Northern dynasties (魏晉南北朝, 220–589). In Jin Dynasty (晉, 265–420), a new seclusion culture (隠逸) was born by combining the Confucianism, Taoism and Metaphysics (玄学), and the scholar gardens (文人園) became the conveyor of the seclusion culture (Figure 2-3-2). The imperial gardens during this period established a realism (写実主義) taste, and the private gardens were built as a refuge for the owners to escape from the outside world. The private gardens at this time could be divided into rural country estates (田園主義の荘園) and city villas (都市の邸宅庭園). The rise of the scholar gardens pushed forward the booming of the private gardens, and the latter one reached its peak in the Ming and Qing dynasties and became the model of the imperial gardens.

Since the Buddhism (仏教) was spread to China, it gradually accomplished the integration with the traditional religions such as Confucianism and Taoism in China, and had a great impact on traditional Chinese gardens, creating a brand new type of garden known as temple garden. In the Northern and Southern dynasties (南北朝, 420–589), Buddhism had spread quite widely among the nobles

Figure 2-3-2. Sun Wei (孫位), *Picture of Learned Men* (高逸図), Tang Dynasty.
Courtesy of the Shanghai Museum, Shanghai.

and the common people. By 495, the city of Luoyang (洛陽), capital of the Northern Wei Dynasty (北魏, 386–534), had over 1,300 temple gardens. At that time, the emperors had many connections with the Buddhism, so the Buddhist architectures and gardens could also be seen in imperial gardens.

2.3.3 Bloom period (Tang and Song Dynasties)

The Tang and Song dynasties (唐宋時代, 618–1279) is the bloom stage of traditional Chinese gardens. In Tang Dynasty (唐, 618–907), the imperial gardens were deeply influenced by landscape (山水) thought and a great many imperial villas (離宮) emerged. The city villas at this time flourished in the capital and around the country. The mountain villas (山居別荘) also became quite popular with the influence of landscape painting (山水画) and scenic poem (山水詩). A magnificent imperial garden called the Huaqing Palace (華清宮) was built near Chang'an (長安) by Emperor Xuanzong (玄宗). It carried forward the tradition of previous imperial gardens of combining the residence and entertainment functions together, and strengthened the function of entertainment substantially. Meanwhile, painting and poetry reached a level never seen before, and the capital city, Chang'an were full of private gardens. Even ordinary residences had tiny gardens in their courtyards with small ponds and hills. Wang Wei (王維) in the Tang Dynasty advocated the ideal habitat concept of living in the countryside with picturesque landscape (Figure 2-3-3), and Bai Juyi (白居易) pushed forward the concepts of seclusion in mountain and being a recluse as an idle official.

The Song Dynasty (宋, 960–1279) had one of the most prosperous and advanced economies in the medieval world. Both the Northern and Southern Song dynasties were well known for the construction of famous gardens. The gentries and scholars engaged in the various arts including painting, poetry, and calligraphy. These all gave rise to the booming of the private gardens in Song Dynasty, and it began to influence the imperial gardens and temple gardens. The private gardens of the Song Dynasty can be divided into the famous gardens of the Central Plains (中原) mainly in the western capital Luoyang (洛陽) (Figure 2-3-4) and the east capital Kaifeng (開封), and the famous gardens in the Jiangnan (江南) areas mainly in Hangzhou (杭州), Suzhou (蘇州) and Huzhou (湖州).

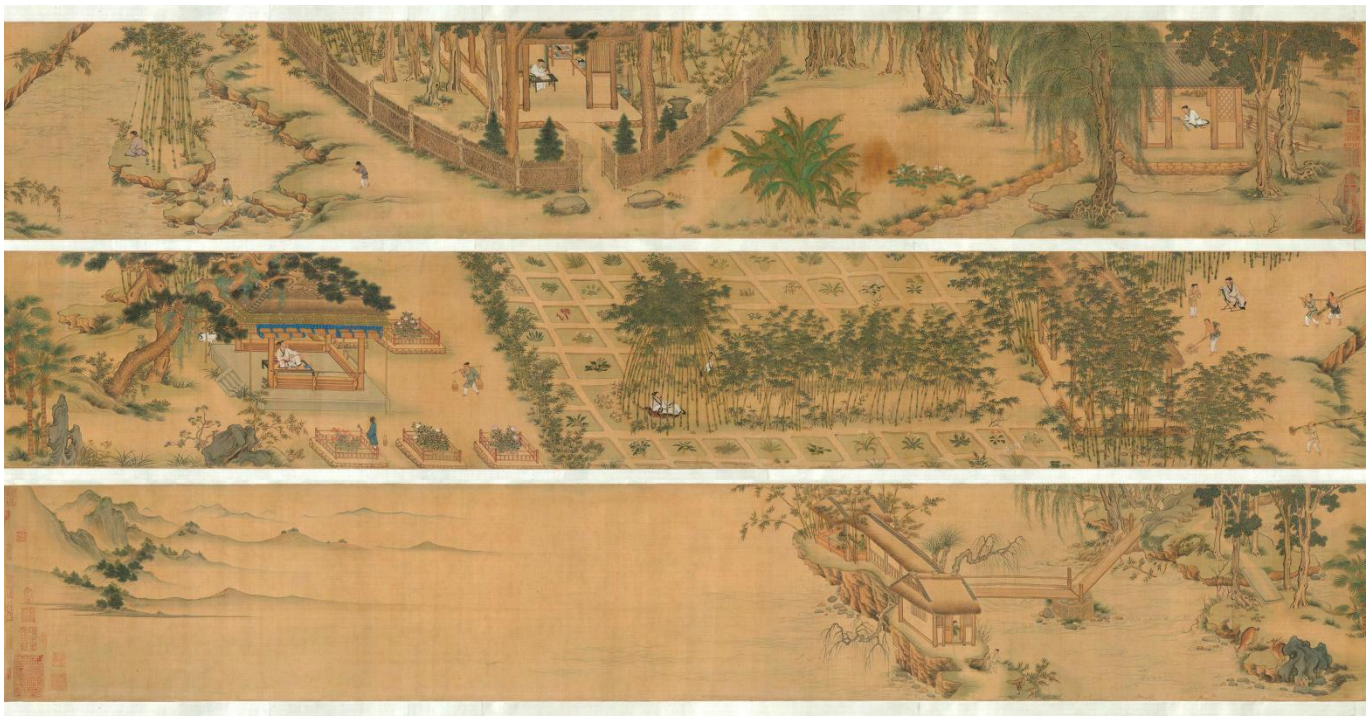


Figure 2-3-3 (Top). Guo Zhongshu (郭忠恕), The *Wangchuan Villa after Wang Wei* (臨王維輞川図), Song Dynasty.
Courtesy of the National Palace Museum, Taipei.

Figure 2-3-4 (Bottom). Qiu Ying (仇英), *The Garden for Solitary Enjoyment* (獨樂園図), 1515-52.
Courtesy of the Cleveland Museum of Art, Cleveland.

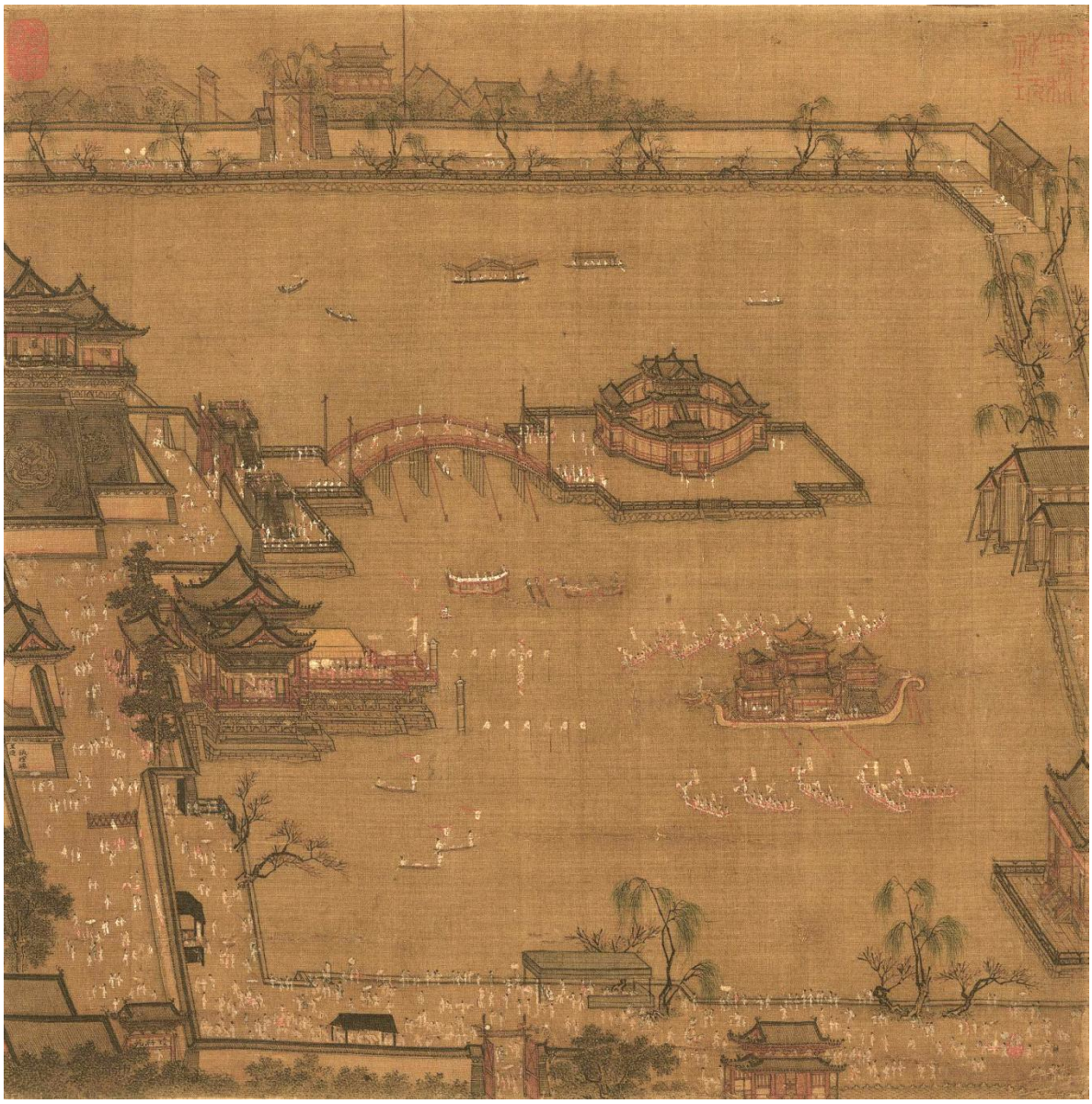


Figure 2-3-5. Zhang Zeduan (張択端), *Competition on the Jinming Pool* (金明池爭標図), Song Dynasty.
Courtesy of the Tianjin Museum, Tianjin.

Emperor Huizong (徽宗, 1082–1135) was an accomplished scholar of traditional Chinese painting and calligraphy. One of his famous garden was the Jinming Pool (金明池), located outside of the city and had a regular opening to the public (Figure 2-3-5). From 1117 to 1122, he built the garden of Genyue (艮岳) characterized by lofty mountains and rockeries. Countless marvellous stones and plants all around the country were transported by water on the Grand Canal (京杭大運河) for the garden construction. Since then, the construction of rockery has become popular in traditional Chinese gardens, moving natural mountains into gardens, and at the same time liberating gardens' dependence on landscape site selection, which has played a particularly important role in the concept of "Urban Forests" in Chinese gardens.

Figure 2-3-6 & 2-3-7. Zhang Hong (張宏), *Album of the Zhi Garden* (止園図册), Ming Dynasty. *Courtesy of the Museum für Asiatische Kunst, Berlin (Left), and the Los Angeles County Museum of Art, Los Angeles (Right).*

2.3.4 Mature period (Ming and Qing Dynasties)

The Ming and Qing dynasties (明清時代, 1368–1912) is the mature stage of traditional Chinese gardens. The gardens in Yuan, Ming, and early Qing Dynasties are in the same line as that in the Song Dynasty. Most of them could only be found in the literature, yet some gardens or historical relics lasted until now. Among them, the Jiangnan area, with the most developed economy and culture at that time, had the most prosperous gardening activities with prominent local style. Since Beijing was established as the capital during the reign of Yongle (永楽, 1403–1424), it has become the political and cultural center of the country. The northern gardens gradually formed a distinctive style based on the introduction of Jiangnan gardening skills, which were adopted by the imperial gardens. The gardening techniques of the imperial and private gardens all reached their peaks in the Qing Dynasty.

In Ming Dynasty (明, 1368–1644), the imperial gardens were mainly concentrated in the capital Beijing, near or in the Forbidden City (紫禁城), and the vast scale of imperial gardens revealed a typical imperial spirit. Meanwhile, the private gardens became more sophisticated, especially in the Jiangnan (江南) gardens built by the scholars, which were unrivaled in both variety and quality (Figure 2-3-6,2-3-7). Yangzhou and Suzhou were well-known for large amounts of private gardens and earned the reputation of "Garden City". Along with the prosperity of gardening activities and skills, large numbers of gardeners and craftsmen emerged, and many thesis on gardening theory were published.

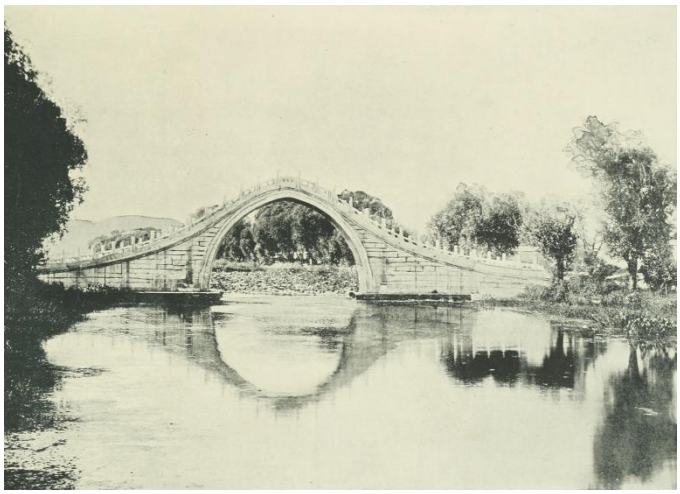
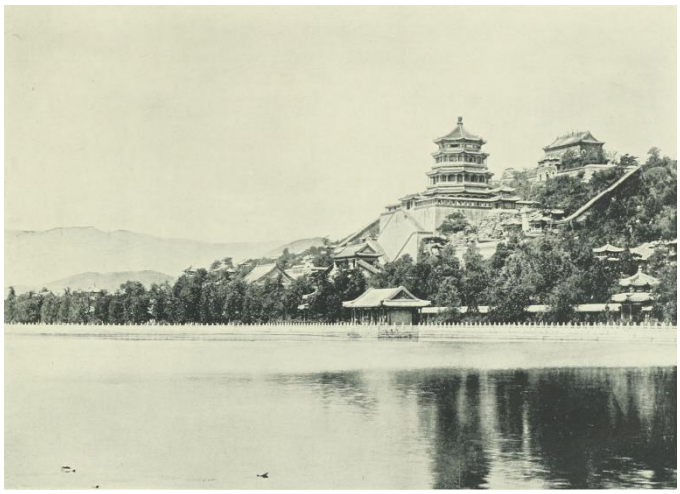



Figure 2-3-8 & 2-3-9. The Summer Palace (頤和園), Beijing, 1906.
All photos by Yamamoto Sanshichiro (山本讃七郎), included in Peking, 1909.

The Qing Dynasty (清, 1644–1912) was the last feudal dynasty of China. The early Qing Dynasty adopted all the old palaces and gardens of the Ming Dynasty, so there were not many imperial constructions. Since the middle period of the reign of Kangxi (康熙, 1662–1722), the construction of imperial gardens developed rapidly. Till the reign of Qianlong (乾隆, 1736–1795) and Jiaqing (嘉慶, 1796–1820), the construction campaign finally reached its heyday. During this period, the skilled gardening techniques were combined with the grand scale of the imperial gardens. The most famous gardens of this period were the Summer Palace (頤和園) (Figure 2-3-8,2-3-9) and the Old Summer Palace (圓明園) in Beijing. In addition, during three reigns from 1703 to 1792, the Qing emperors successively constructed a new magnificent palace in the mountains 200 kilometers northeast of Beijing as a summer resort. The palace was designated as the Chengde Mountain Resort (承德の避暑山莊), and it occupied 560 hectares with 72 separate views, transplanting and recreating miniature landscapes from many scenic spots of China.

During the Qing Dynasty, three major garden styles: North, Jiangnan, and Lingnan, were in a strong state owing to the development of private gardens. In Jiangnan area, as the mainstream of gardening activities, private gardens were still concentrated in Yangzhou and Suzhou as in the Ming Dynasty. Two trends were seen during this period. The first trend was that gardening skills overwhelmed the gardening ideology. Another trend was the outstanding development of house gardens in the city. Most famous gardens in various places belonged to the house gardens. The exquisite gardening skills and rich techniques of the house garden reached the highest level since the Song and Ming dynasties. However, country villas and mountain villages became less prosperous than in ancient times. This is due to the secularization of the society that scholars at that time were more keen to enjoy the city life rather than pursuing the reclusive life in the mountains. Many delicate private gardens of this period can still been seen nowadays, with more artificial features than earlier gardens.

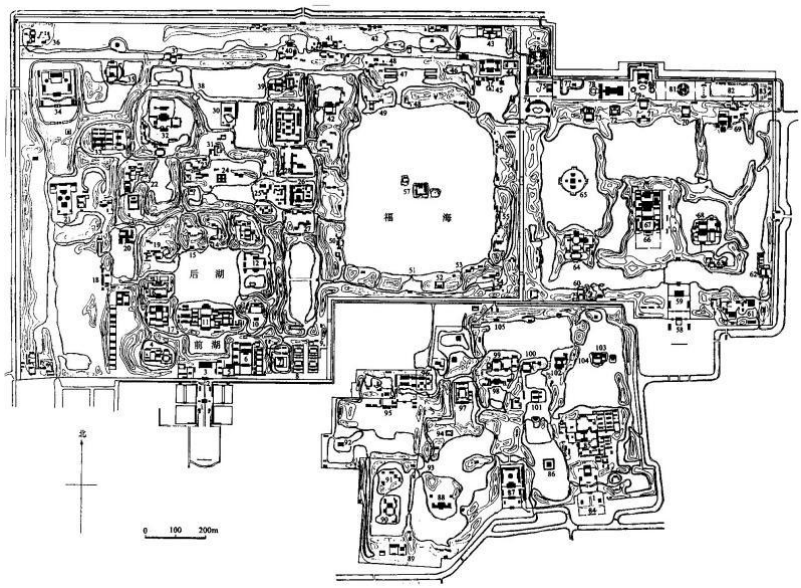


Figure 2-4-1. Site plan of the Old Summer Palace (円明園), Beijing.
Data source: Zhou Weiquan, History of traditional Chinese gardens, 1990.

Figure 2-4-2. Site plan of the Mountain Resort (避暑山荘), Chengde.
Data source: Zhou Weiquan, History of traditional Chinese gardens, 1990.

2.4 Spatial Characteristics of Traditional Chinese Gardens

This section introduces the spatial characteristics of traditional Chinese gardens of different types. Even the same type of gardens have different spatial characteristics in different periods of history. Therefore, the overview of the spatial characteristics is based on existing examples, mainly focusing on gardens of Ming and Qing dynasties, which cannot represent the garden characteristics of different historical periods.

2.4.1 Spatial characteristics of imperial gardens

Based on the resources and hard work throughout the whole country, the imperial gardens were far more splendid and magnificent than the private gardens and temple gardens in China. The scale of existing huge imperial gardens of Qing Dynasty such as the Summer Palace (頤和園), the Old Summer Palace (円明園) and the Chengde Mountain Resort (承徳の避暑山荘) all reach hundreds of hectares. Located in the central plains and the north areas, the imperial gardens were built for the most powerful emperor at that time, which embodied the characteristics of solemn, elegance and grandeur. It usually included a grand mountain, a huge lake, a central axis, symmetrical buildings with a decorative imperial style. The existing imperial gardens are mainly located in Beijing and its surrounding areas, which are the Three Mountains and Five Gardens (香山＆静宜園, 玉泉山＆静明園, 万寿山＆頤和園, 円明園, 暢春園) in Beijing, the Chengde Mountain Resort.

The imperial gardens of the Qing Dynasty had the four main features. The first is the unique and spectacular overall planning. Different planning ideologies were adopted in the artificial landscape gardens built entirely on the flat ground and the natural landscape gardens that were partially transformed from natural

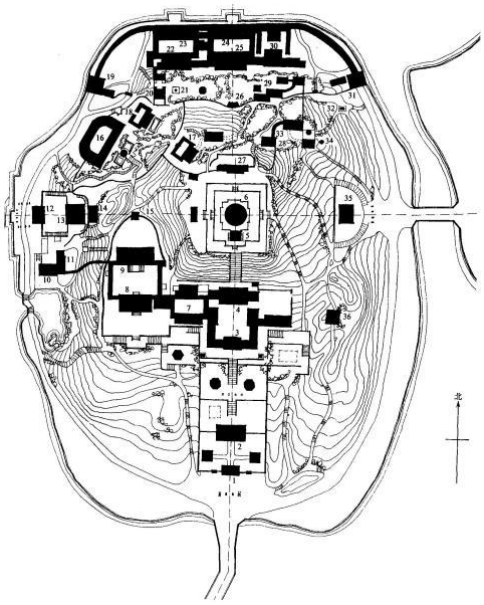


Figure 2-4-3. Plan of the Qiognhua Island of Xi Yuan (西苑の瓊華島), Beijing.
Data source: Zhou Weiquan, History of traditional Chinese gardens, 1990.

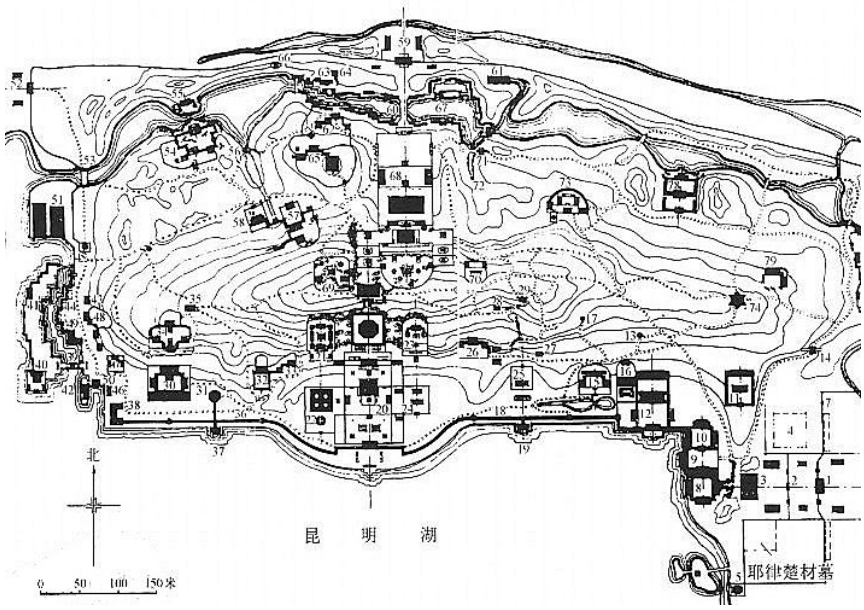


Figure 2-4-4. Plan of the Longevity Hill of the Summer Palace (頤和園の万寿山), Beijing.
Data source: Wang Juyuan, History of Ancient Chinese Gardens, 2006.

landscapes. The typical example of the former one is the Old Summer Palace (円明園) (Figure 2-4-1). The palace was a collection of many small garden units with different themes, creating an unprecedented planning methods of imperial gardens. The latter one is the planning method for most imperial gardens, similar to the planning of scenic areas. Many imperial gardens and palaces were created with different characteristics adapting to local conditions, showing its innovative ideas and superb constructing level. One of the outstanding example is the Chengde Mountain Resort (承徳の避暑山荘) (Figure 2-4-2).

Secondly, the imperial gardens of the Qing Dynasty highlighted the dominant positions of building groups in the overall garden and its functions as garden landscape. From the reign of Kangxi to Qianlong, the emperor spent more and more time living in the imperial gardens, and the diverse activities in the imperial gardens grew rapidly. Accordingly, the number and type of building groups in the gardens increased substantially. Therefore, the building groups in the imperial gardens gradually became the center of the garden composition and aesthetic appreciation, forming the unique imperial gardening style (Figure 2-4-3,2-4-4). The imperial gardens of the Qing Dynasty included almost all types of ancient buildings, and also innovated many brand new building forms.

The third feature is the introduction of Jiangnan gardens. Imperial gardens began to introduce the Jiangnan gardening skills in the early Qing Dynasty. A comprehensive absorption of art and technology of Jiangnan gardens emerged during the Qianlong period. During this period, the integration of gardening art of the north and the south, the imperial and the private reached an unprecedented breadth and depth, which greatly enriched the contents and improved the skills of northern gardens, and promoted the imperial gardens to the highest peak.

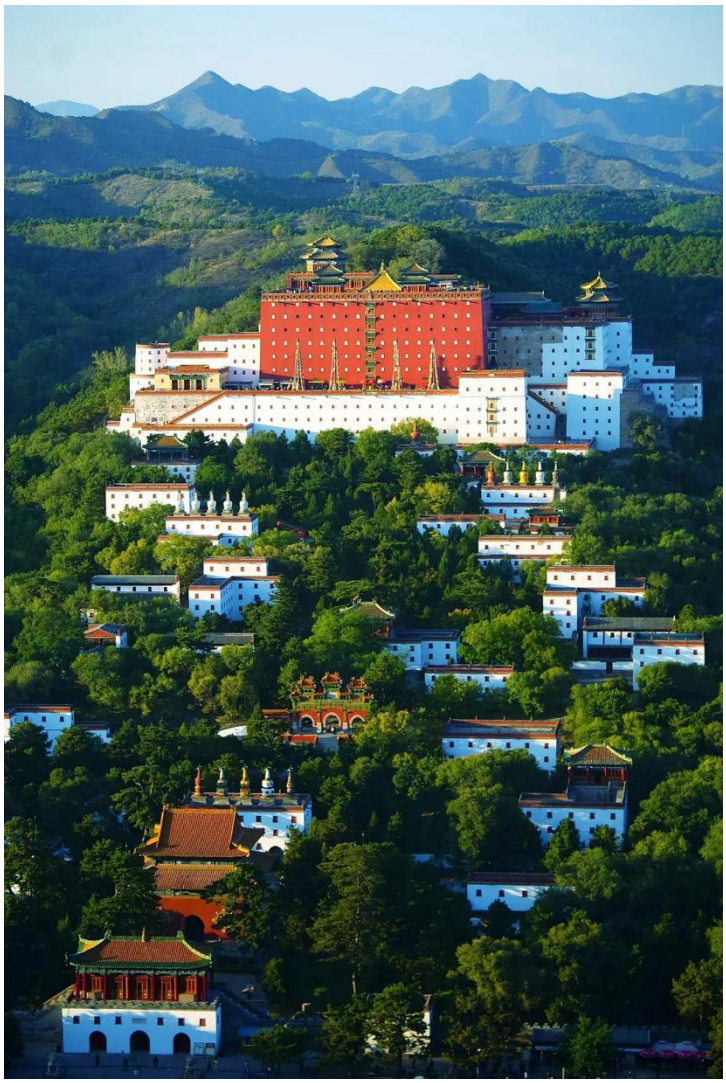


Figure 2-4-5. The Putuo Zongcheng Temple (普陀宗乘之廟), one of the Outer Eight Temples of the Mountain Resort (避暑山莊の外八廟), Chengde, 2019.
Data source: https://www.douban.com/photos/photo/2549923586/.

Fourthly, the connection between the imperial gardens and the Buddhism including the Tibetan Buddhism and the Chinese Buddhism had reached an unprecedented new level. In order to maintain the ruling order, many Buddhism temple gardens were built in or beside the imperial gardens, which had formed a new religion aesthetics in the imperial gardens of Qing Dynasty. Typical examples include the Longevity Hill in the Summer Palace (頤和園の万寿山) and the Outer Eight Temples of the Mountain Resort (避暑山莊の外八廟) (Figure 2-4-5).

2.4.2 Spatial characteristics of private gardens

Since the private gardens initially appeared in Han Dynasty, it was developed in Wei and Jin dynasties and widely popularized in Tang and Song dynasties. Landscape painting originated in the Wei and Jin dynasties and reached its peak in the Song Dynasty, which profoundly influenced the gardening ideas and overall style of private gardens. Many early gardens had disappeared in the history, and most existing gardens were built in the Ming and Qing dynasties and distributed in Suzhou, Yangzhou and other Jiangnan areas. They are mainly in the form of house gardens, reflecting the trend of secularization and refinement in Jiangnan gardens.

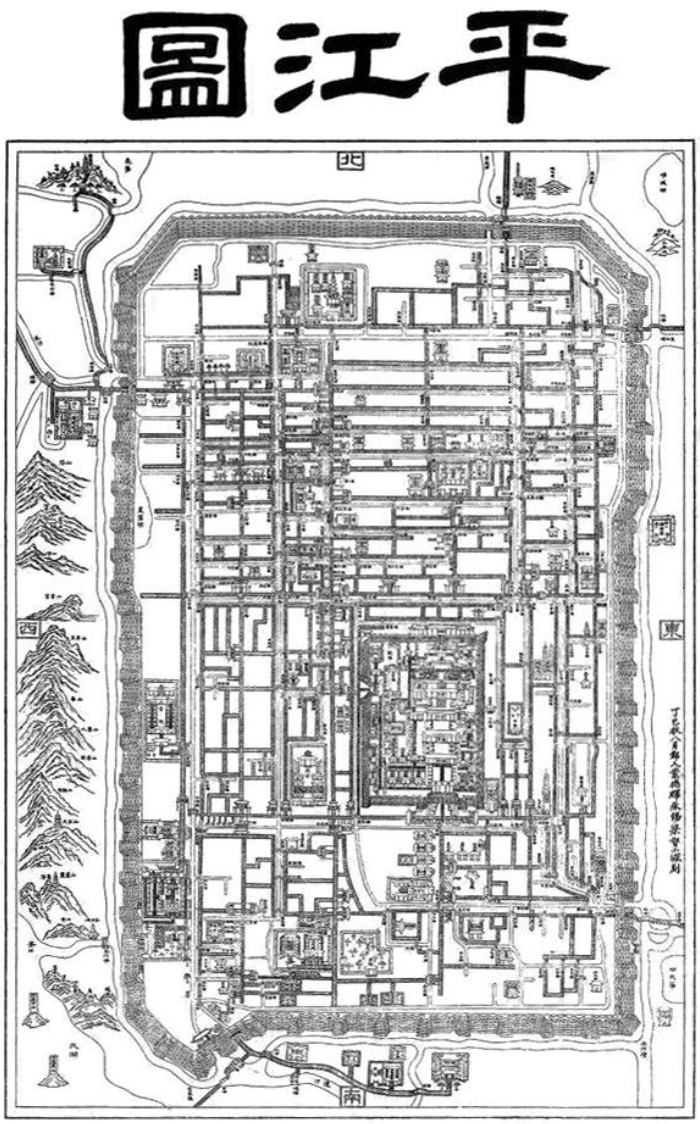


Figure 2-4-6. The ancient city plan of Suzhou (平江図), 1229.
Data source: Wang Juyuan, History of Ancient Chinese Gardens, 2006.

Most of the existing gardens in Suzhou (蘇州) are house gardens built on the flat ground in the city. This is due to the geographical conditions of Suzhou and the changes of gardening ideas since the Song Dynasty (Figure 2-4-6). Suzhou is located in the Taihu (太湖) Plain, and ancient Suzhou city had formed a complete river network with the canal, which is very suitable for the construction of Chinese gardens. Since the Song Dynasty, the gardening ideas transformed from the living in the mountain to the city, so the house gardens in the city gradually became the mainstream in Jiangnan areas. Due to its prosperous economy and culture during the Ming and Qing dynasties, Suzhou attracted the most famous scholars and skilled craftsmen from all over the country, producing various advanced paradigms in building and garden style. In other words, the Chinese garden is the best production with the wisdom of scholars and craftsman.

Suzhou gardens are typical miniature landscape gardens of scholars in Ming and Qing dynasties. The garden style can be divided into two types: before and after the mid-Qianlong period. Before the middle of the Qing Dynasty, Suzhou gardens generally followed the garden style of the Ming Dynasty: natural and

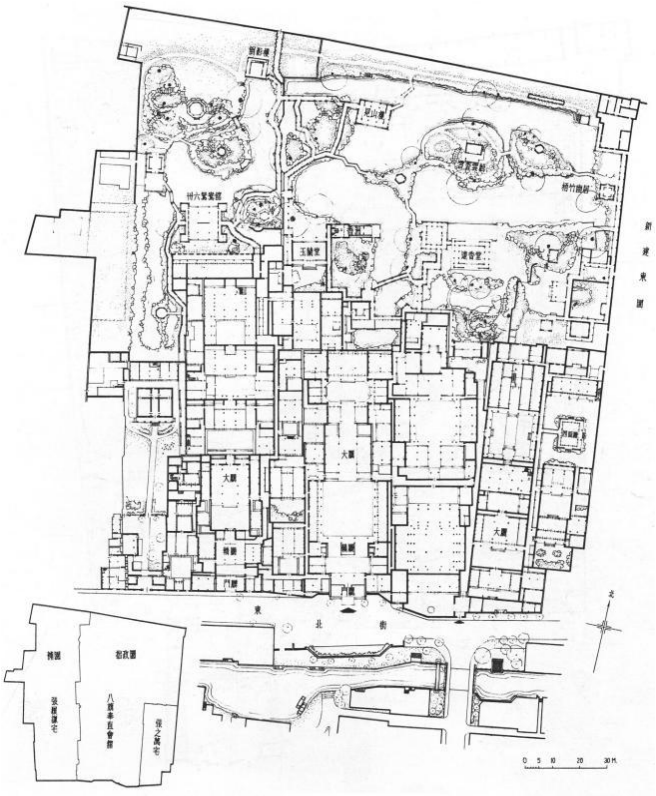


Figure 2-4-7. Plan of the Humble Administrator's Garden (拙政園), Suzhou.
Data source: Liu Dunzhen, Suzhou Classical Gardens, 1979.

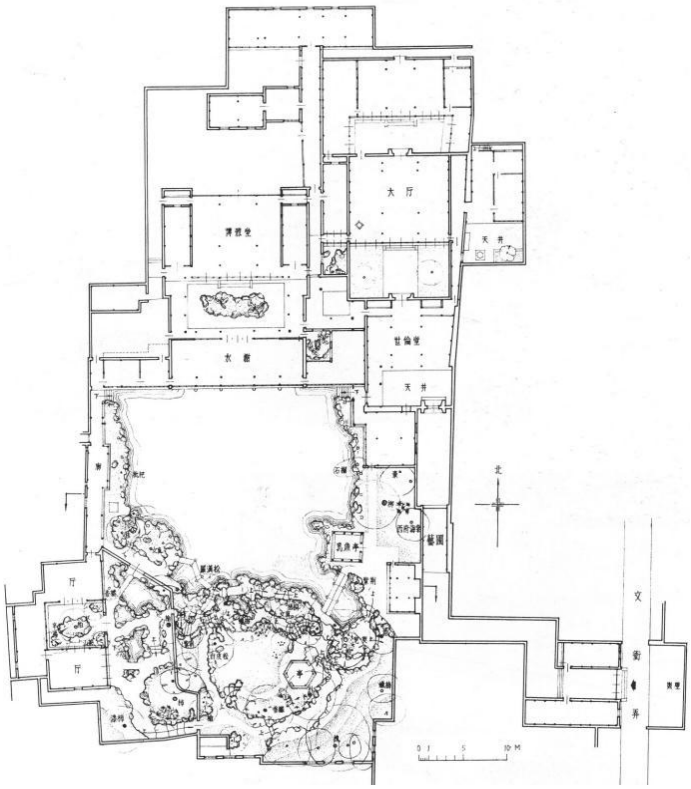


Figure 2-4-8. Plan of the Yipu Garden (芸圃), Suzhou.
Data source: Liu Dunzhen, Suzhou Classical Gardens, 1979.

quaint artistic conception, sparse layout, and the harmony of overall atmosphere. After the mid-Qing Dynasty, Suzhou gardens became more and more smaller and exquisite. The garden space was gradually narrow and congested, with compiled buildings and rockeries, and complicated gardening techniques. Among the existing examples of Suzhou gardens, styles of multiple periods overlapped in most gardens. The Humble Administrator's Garden (拙政園) (Figure 2-4-7) and the Yipu Garden (芸圃) (Figure 2-4-8) are primarily the garden style of Ming Dynasty, with sparse layouts and centered on a pond of water. The Lion Grove Garden (獅子林) was changed and transformed several times and finally appeared a style of late-Qing Dynasty, with a compact layout of garden and buildings, and the skillful arrangement of verandas (Figure 2-4-9,2-4-10). More garden examples such as the Lingering Garden (留園), Master of the Nets Garden (網師園), and Canglang Pavilion (滄浪亭) all possessed the original layout of Ming style and the local reconstructions in the Qing Dynasty. The Yi Garden (怡園), built in late-Qing Dynasty, is characterized by widely imitating and absorbing other exquisite gardens, but not as good as previous gardens in the artistic standards.

In addition to the house gardens in the city, natural landscape gardens in the suburban areas and mountains also existed near Suzhou. Among them, Yongcui Mountain Villa in Tiger Hill (虎丘の擁翠山荘) (Figure 2-4-11) and Gaoyi Garden in Mount Tianping (天平山の高義園) (Figure 2-4-12) are private mountain villas, and Lingyan Temple (霊巌寺) and Hanshan Temple (寒山寺) are temple gardens.

Figure 2-4-9 (Top). The veranda of the Humble Administrator's Garden (拙政園), Suzhou, 2020.

Figure 2-4-10 (Top). The veranda of the Lion Grove Garden (獅子林), Suzhou, 2020.

Figure 2-4-11 (Bottom). The Yongcui Mountain Villa in Tiger Hill (虎丘の擁翠山荘), Suzhou, 2020.

Figure 2-4-12 (Bottom). The Gaoyi Garden in Mount Tianping (天平山の高義園), Suzhou, 2020.

The number of existing gardens in Yangzhou (揚州) is less than in Suzhou. Yangzhou gardens can be roughly divided into two types: house gardens in the city and waterscape gardens on the Slender West Lake (Figure 2-4-13). The prosperity of Yangzhou gardens predated Suzhou gardens in the history. Yangzhou began to flourish with the opening of the Grand Canal (大運河) in the Sui Dynasty (隋, 581–619). During the Tang and Song dynasties, Yangzhou reached an economic booming, with a thriving construction of private gardens. In the Ming and Qing dynasties, Yangzhou became a distribution center for salt in the Lianghuai area, which brought Yangzhou an advanced commerce and economy. In the reign of Kangxi and Qianlong, waterscape gardens of Yangzhou reached its heyday with the emperor's southern tours. Yangzhou gardens began to went downhill in the late Qing Dynasty with the decline of Yangzhou's economy.

Compared with the delicate and soft style of Suzhou gardens, the building and garden style of Yangzhou is more elegant and vigorous. For house gardens in Yangzhou, the styles can also be divided into the Ming style and Qing style. The Ming style was typical landscape garden of scholars, while the gardens after the

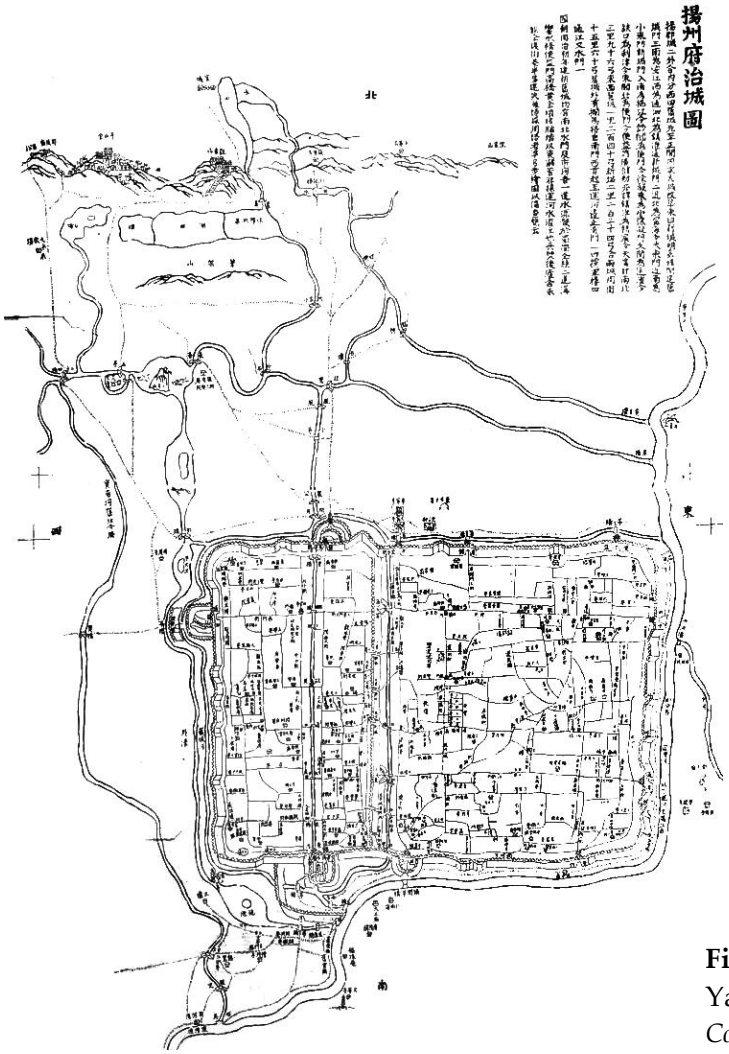


Figure 2-4-13. The ancient city plan of Yangzhou (揚州府治城図), 1862-75. *Courtesy of the Yangzhou Archives.*

early-Qing Dynasty were in a luxurious style with the salt merchants as garden owners, such as He Garden and Ge Garden. Owing to the preference and pursuit of local officials, merchants and scholars, the building and rockery techniques were both prominent and unrivalled in Yangzhou, with a unique style of combining the northern and southern features together. There are many magnificent existing examples of rockeries in Yangzhou, such as the rockeries in the Pieces of Rock Hill Housing (片石山房) (Figure 2-4-14), Ge Garden (个園) (Figure 2-4-15), and Little Pangu Garden (小盤谷).

The waterscape gardens in Yangzhou also have a unique style. The Slender West Lake (瘦西湖) area was full of private villas and gardens, and it also functioned as a famous suburban scenic spot in Yangzhou. During the Qianlong period, several south tours of the emperor led to the heyday of Slender West Lake. Numerous private villas, temple gardens, commercial facilities, tea houses, poetry clubs played an important role in decorating the scenic area, pleasing the emperor and serving the public at that time. The famous records *Yangzhou Huafang Lu* (1764–1795) by Li Dou in the Qing Dynasty gave a detailed description on the grand scene of the waterscape gardens on the Slender West Lake. In the late Qing Dynasty, the waterscape gardens gradually declined with the termination of the south tour.

Figure 2-4-14. The Pieces of Rock Hill Housing (片石山房), Yangzhou, 2020.

Figure 2-4-15. The rockery of the Ge Garden (个園), Yangzhou, 2020.

Besides Suzhou and Yangzhou, Hangzhou have also had many private gardens in history, but there are few existing examples. Other cities in Jiangnan area all have some existing gardens or historical garden sites, such as the five major gardens in Shanghai (上海五大園林), the Zhan Garden (瞻園) in Nanjing, the Jichang Garden (寄暢園) in Wuxi, the Yan Garden (燕園) and Xukuo Garden or Zeng Garden (虛霩園) in Changshu, and the Qi Garden (綺園) in Haining. However, most gardens of the past have disappeared in history.

2.4.3 Spatial characteristics of temple gardens and scenic areas

Unlike imperial gardens and private gardens, there is no definite style and feature for temple gardens and scenic areas. Compared with temples gardens which have clear garden walls, the scenic areas have more uncertainly in the boundaries. Since there is a mutual influence and symbiotic relationship between temple gardens and scenic areas, the two were discussed together. The biggest difference between imperial gardens, private gardens, temple gardens and scenic areas is that the former two have the most important function of residence, while the latter two are mainly built for worship or sightseeing. Although the living function have changed, the temple gardens and scenic areas are still built with the style of traditional Chinese gardens. It is worth noting that although the scenic areas have undergone a great deal of artificial transformations and local constructions in past dynasties, natural landscapes are still in the central stage in most of the scenic areas. Therefore, they are not equivalent to traditional Chinese gardens, but incorporate many gardening features.

Buddhism was introduced into China during the Northern and Southern dynasties, and a new type of temple garden began to flourish. Temple gardens were usually located in mountains on the suburban areas of the city, which is not only quiet and secluded for monks, but also convenient for the worship of pilgrims. The temple gardens inspired the artificial transformation of the surrounding environment, and some suburban areas with good views gradually became scenic spots for pilgrims and tourists, bringing alive the scenic areas in the suburbs.

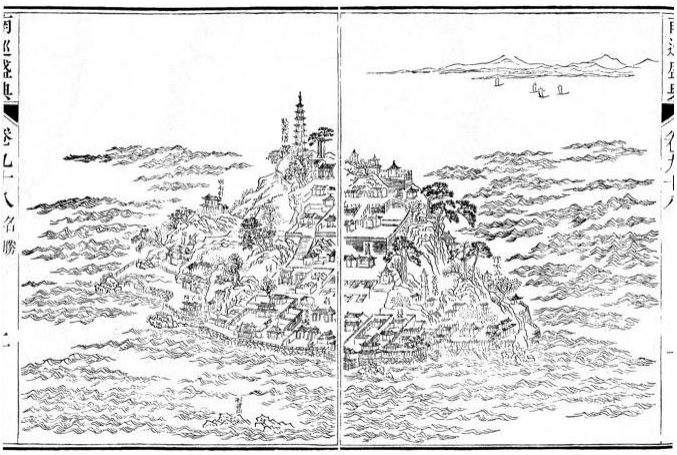
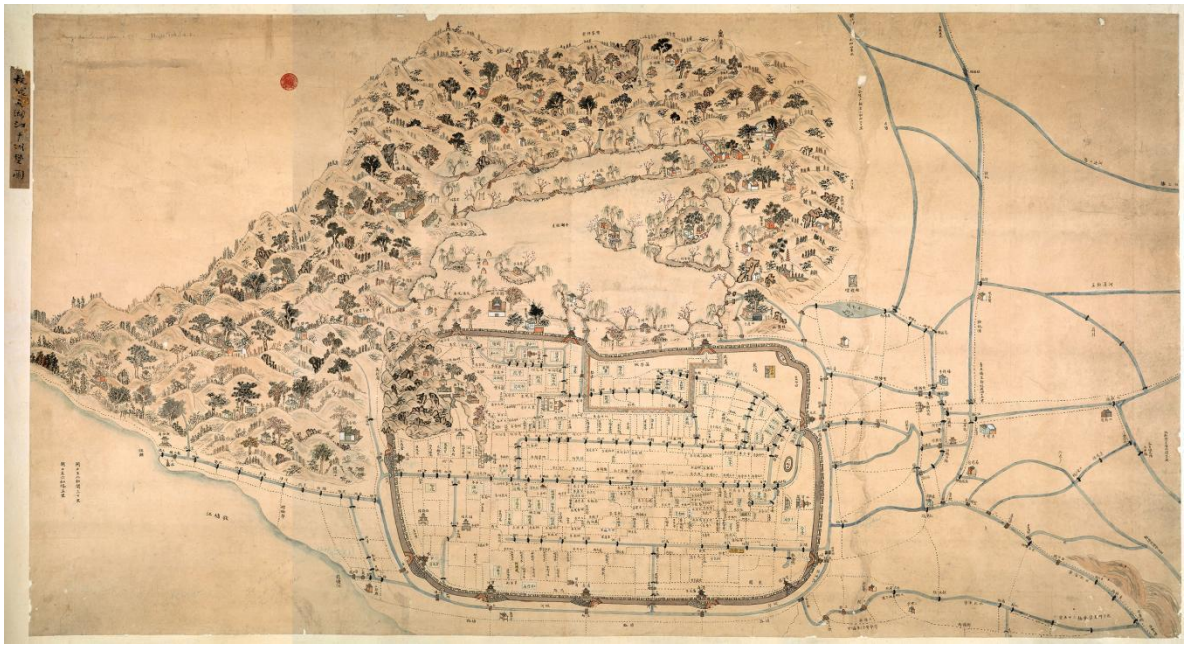


Figure 2-4-16. *The Picture of Jinshan Hill* (金山), Zhenjiang.
Data source: Gao Jin, Nanxun Shengdian (南巡盛典), 1771.

Figure 2-4-17. The Jinshan Hill (金山), Zhenjiang, 2013.
Data source: https://www.huitu.com/photo/show/20130307/152320699163.html.

Many scenic areas thrived on famous Buddhist temples, such as Tiger Hill (虎丘) of Suzhou, Lingyan Mountain (靈巖寺) of Suzhou, Jinshan Hill (金山) of Zhenjiang. The Tiger Hill and Lingyan Mountain can be traced back to the Spring and Autumn Period (春秋時代, 770–476 BC) before the establishment of Buddhist temples. The Tiger Hill was rumoured as the burial vault of He Lu (闔閭) the king of the State of Wu, while Lingyan Mountain was the original site of the Guanwa Palace (館娃宮) of Fu Chai (夫差) the king of the State of Wu. The Jinshan Hill was originally an island standing in the middle of the Yangtze River. Along with the construction of Jinshan Temple (323–325), the Jinshan Hill was gradually buried in more and more temple buildings, forming a spectacular sight with the fusion of the mountain and the temple (Figure 2-4-16,2-4-17). The unique pattern of Jinshan Hill was imitated by numerous later gardens such as the Longevity Hill of the Summer Palace, the Jinshan Hill in the Mountain Resort, the Little Jinshan Hill in the Slender West Lake. In addition, the scenic areas thrived on Taoist temples include the Mount Qingcheng (青城山) in Sichuan Province and the Mount Wudang (武当山) in Hubei Province. Mount Song (嵩山) in Henan Province is famous for both Taoism and Buddhist temples.

Some scenic areas grew with the temple gardens as well as the continuing constructions and maintenance of the local infrastructures, especially the irrigation works of the city, such as West Lake (西湖) in Hangzhou (Figure 2-4-18,2-4-19). During the Qian' Kingdom of Wuyue (吳越, 907–978) in the Five Dynasties (五代十国時代, 907–960), Qian Liu (錢鏐) and his successors built more than 150 temples and dozens of towers in Hangzhou. Most of the temples, towers, and stone carvings in West Lake nowadays were originally built at that time (Figure 2-4-20,2-4-21). Meanwhile, as the important water conservancy facility of Hangzhou city, the West Lake was formally dredged up to 20 or 30 times in history from the Tang Dynasty to the Qing Dynasty. Among them, Bai Juyi (白居易) in the Tang Dynasty and Su Shi (蘇軾) in the Song Dynasty are both well-known as the leader of the dredging works. As one of the most prominent scenic areas in China, the West



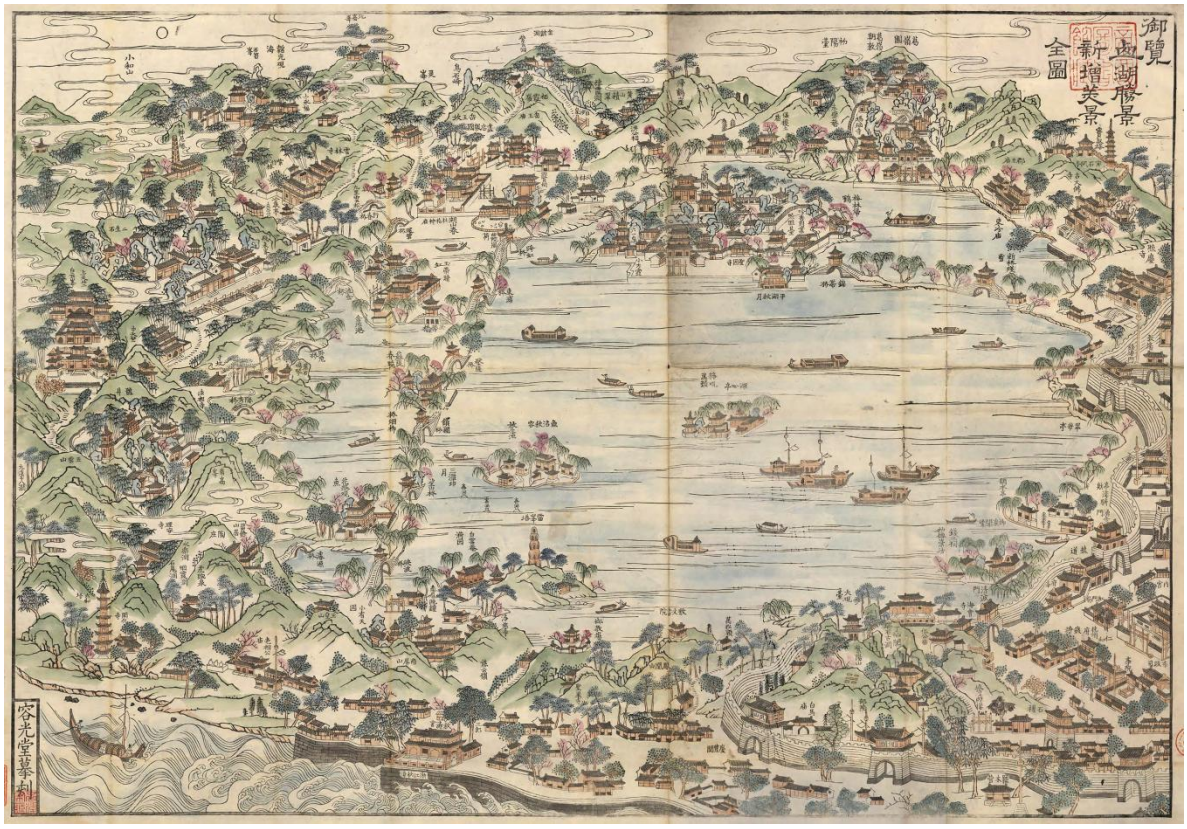


Figure 2-4-18 (Top). Anonymous, *Plan of the City and Environs of Hangzhou, showing the Chief Buildings* (杭城西湖江干湖墅図), 1716-27.
Courtesy of the British Library, London.

Figure 2-4-19 (Bottom). Anonymous, *Overall Grand View of the New Scenery of the West Lake* (御覽西湖勝景新增美景全図), Qing Dynasty.
Courtesy of the National Diet Library, Tokyo.

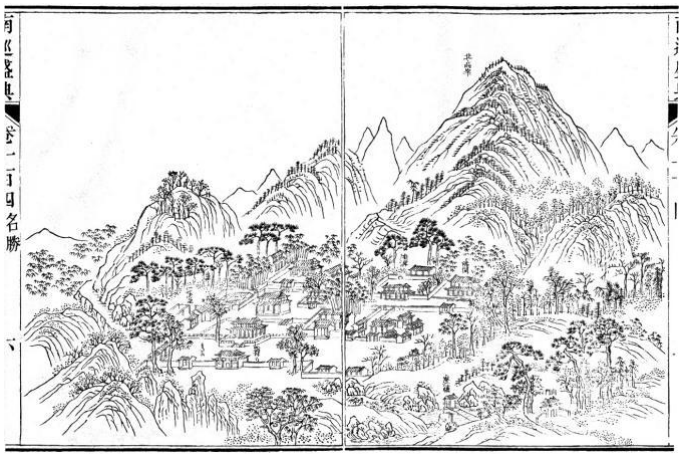


Figure 2-4-20. *The Picture of LingYin Temple* (靈隱寺), Hangzhou.
Data source: Gao Jin, Nanxun Shengdian (南巡盛典), 1771.

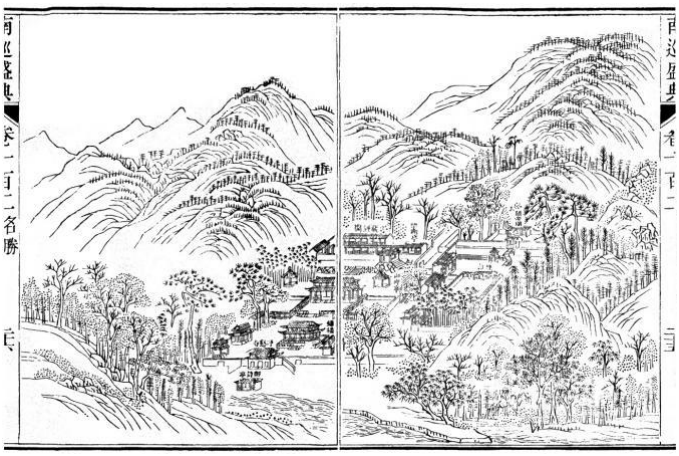


Figure 2-4-21. *The Picture of Jingci Temple* (淨慈寺), Hangzhou.
Data source: Gao Jin, Nanxun Shengdian (南巡盛典), 1771.

Lake has influenced poets and painters throughout Chinese history for its natural beauty and historic relics, and was made a UNESCO World Heritage Site in 2011, described as reflecting "an idealized fusion between humans and nature". Similar to the West Lake, the Slender West Lake in Yangzhou was transformed from the city moat, and finally became a famous scenic area in the Qing Dynasty, which is now part of the UNESCO World Heritage Site the Grand Canal (大運河), the longest canal or artificial river in the world.

2.5 Functions and Utilization of Traditional Chinese Gardens

Gardens were determined by economic, political, and cultural factors in each dynasty, and it reflected the functional requirements of people at that time. Therefore, the functions and utilization of traditional Chinese gardens varied in different times. The functions and utilization of traditional Chinese gardens can be roughly divided into the following three aspects: production and ecology functions, recreational functions and aesthetic and spiritual pursuit, and social activities and public places.

2.5.1 Production and ecology functions

Traditional Chinese gardens had a close relationship with the production and economy of farming and animal husbandry from the beginning, and this relationship ran through the entire generation period. In the pre-Qin period, gardens were created to satisfy the needs of hunting animals and planting crops. The character "囿" refers to a place where animals are kept, and the characters "園" and "圃" refer to a place where vegetables and fruit trees are planted. In Wei-Jin Period, the developed manor economy gave birth to a large number of manors and villas. Manors often included the functions of residence, agriculture, and sideline productions, and were usually carefully planned with garden features and

Figure 2-5-1 (Top). *Simple Life in Quietude* (澹泊寧靜), in *Forty Scenes of the Old Summer Palace* (円明園四十景図咏), 1744.
Courtesy of the National Library of France, Paris.

Figure 2-5-2 (Top). *Sounds of Trees and Water* (水木明瑟), in *Forty Scenes of the Old Summer Palace* (円明園四十景図咏), 1744.
Courtesy of the National Library of France, Paris.

Figure 2-5-3 (Bottom). *Crops as Beautiful as the Clouds* (多稼如雲), in *Forty Scenes of the Old Summer Palace* (円明園四十景図咏), 1744.
Courtesy of the National Library of France, Paris.

Figure 2-5-4 (Bottom). *Village of Distant North Mountains* (北遠山村), in *Forty Scenes of the Old Summer Palace* (円明園四十景図咏), 1744.
Courtesy of the National Library of France, Paris.

picturesque landscape. However, the agricultural production and economics were still in the main position in most manors.

In the later stages of the garden history, the recreational functions became the major position in the garden, but the production functions still existed with symbolic significance. For example, the Plowing and Weaving Picture (耕織図) Scenic Area of the Summer Palace in Beijing consists of agricultural landscapes such as rivers and lakes, farming lands, silkworm and textile scenery, quite similar to the Jiangnan villages. Among the Forty Scenes of the Old Summer Palace (円明園四十景図咏), four scenes are in the theme of farming and weaving (Figure 2-5-1,2-5-2,2-5-3,2-5-4). These reflected the idea of encouraging agriculture and production by the Qing emperors. The theme of farming can be also found in Japanese gardens. For example, in the Shugakuin Imperial Villa (修学院離宮) in Kyoto, the Lower Garden (下御茶屋), Middle Garden (中御茶屋) and Upper Garden (上御茶屋) are linked by two straight avenues, with surrounding rice plantations and excellent views of the nearby hills, representing the idea of pastoral life and natural landscape.

In addition to production and economy functions, traditional Chinese gardens could also serve as an ecological infrastructure to the city, contributing to the urban and regional ecological network and making the city with strong ecological resilience. Since the Han Dynasty, most of the imperial gardens were built combining with water conservancy in the capital. This was also the case in the northwestern suburbs of Beijing in the Qing Dynasty, with a close relationship between imperial palaces and water conservancy system. While building the Qingyi Garden (清漪園, the former Summer Palace) and the Jingming Garden (静明園), Emperor Qianlong of the Qing Dynasty thoroughly renovated the water system in the northwestern suburbs of Beijing, which was the largest renovation project of the water system since the Yuan and Ming dynasties. The completion of the Qingyi Garden signified the final success of the water system renovation project. The water conservancy system combining the imperial gardens achieved great economic, environmental and social benefits, and it was undoubtedly an outstanding combination of art and engineering.

2.5.2 Recreational functions and aesthetic and spiritual pursuit

Traditional Chinese gardens are most well-known for its recreational functions as well as the aesthetic and spiritual pursuit. Apart from planting crops, the gardens in the pre-Qin period were primarily used as hunting and playing grounds for the emperors and nobles. During the Qin and Han dynasties, imperial palaces occupied the largest area in history with dozens of multiple functions together, and the landscape in the garden also embodied the emperor's pursuit of

immortal mountains and islands for longevity.

During the Wei-Jin Period, the manors and villas satisfied the production needs as well as the residential functions and daily amusement requirements. For example, the Jingu Garden (金谷園) in the Western Jin Dynasty (西晉, 265–316) integrated the cultural cultivation and aesthetic taste of the garden owner into the residential and production planning of the manor, showing the pursuit of a high-quality human settlement environment. For the recluse scholars of the Wei-Jin Period, mountain villages and studios offered them to live a secluded life. The seclusion amidst mountains developed their appreciation of natural landscape, which became a main content of their spiritual life and inspired the landscape art of painting and poem.

Since the Tang and Song dynasties, the spiritual pursuit in scholar gardens rose to a higher stage, and scholar gardens gradually became mainstream and affected the imperial gardens such as the Genyue (艮岳) in the Song Dynasty. The Lushan Thatched Cottage (廬山草堂) by Bai Juyi (白居易/白樂天) and the Wangchuan Villa (輞川別業/輞川莊) by Wang Wei (王維) were all famous scholar gardens in Tang Dynasty. Bai Juyi had a great affection for gardens, which could be found in many of his articles and poems (Figure 2-5-5). He was in charge of the constructions of four private gardens of his own, and he also had deep knowledge in gardening theory. Bai regarded garden as the materialization of his seclusion idea, and made the garden an integral part of his daily life. His garden thought was in line with the low-key, near vernacular style of his articles and poems, and profoundly affected the garden style and idea of Song Dynasty.

In the Northern Song Dynasty, Guo Xi (郭熙) put forward the four standards of landscape experience on the basis of the landscape painting theory: walk (行), gaze (望), wander (游), dwell (居), with the latter two on the first priority (Figure 2-5-6). This greatly expanded the scope of traditional Chinese gardens and integrated the gardens into daily life, which had made a big step forward in the garden history. Guo also proposed the methods of collecting and refining the natural landscape on the landscape painting and gardening.

During the Ming and Qing dynasties, gardens became more and more small and delicate, and had a closer relationship with city life than ever. More scholars devoted themselves to the construction of gardens, some of whom even became professional garden designers. The poetic and romantic feature was given to the garden by the the taste of the scholars and its association with the literary realm. At this time, Jiangnan gardens have formed their own distinct spiritual pursuit and aesthetic consciousness, marking the arrival of the mature stage of traditional Chinese gardens.

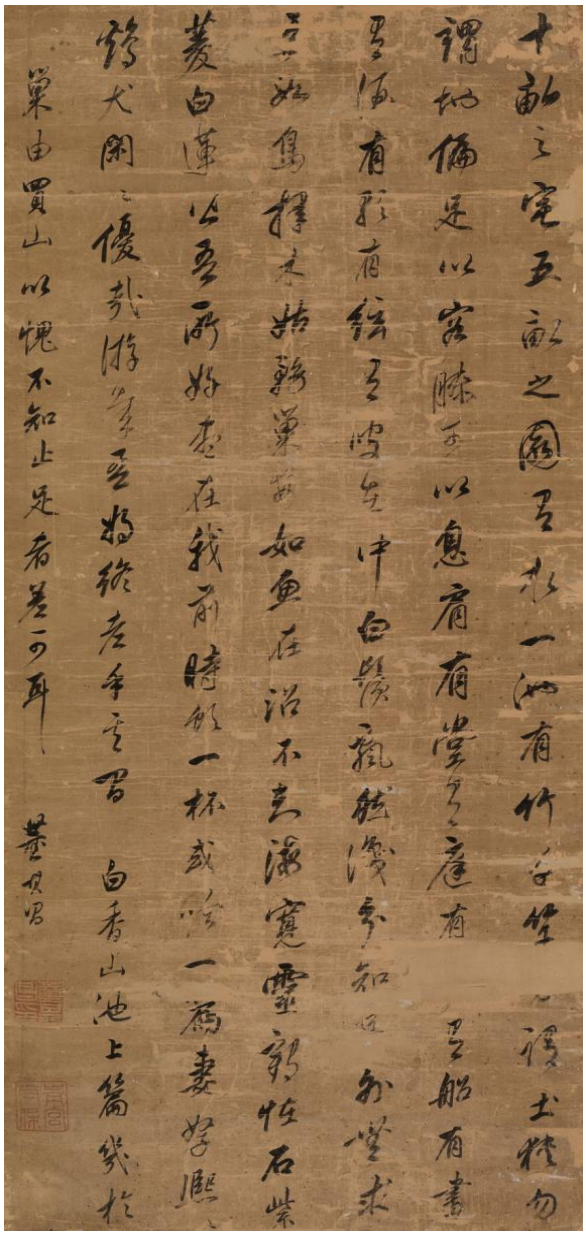


Figure 2-5-5 (Left). Dong Qichang (董其昌), *Calligraphy in Running Script, On the Pond* (池上篇) *by Bai Juyi* (白居易/白楽天) , Ming Dynasty.
Data source: https://auction.artron.net/paimai-art5139500931/.

Figure 2-5-6 (Right). Guo Xi (郭熙), *Snowscape* (畫雪景), Song Dynasty.
Courtesy of the National Palace Museum, Taipei.

Social activities and public places

Besides the functions of personal entertainment and spiritual pursuits, the social and public attributes of gardens played an important role and were often overlooked. Although most gardens were privately owned, there were many social activities and elegant gatherings in the garden.

In the pre-Qin period, imperial hunting with retinue in the garden was not only recreational activity but also military training and ceremony. During the Qin and Han dynasties, most of the imperial gardens were quite large in scale and multifunctional. For example, Shanglin Garden (上林苑) in the Han Dynasty accommodated all the imperial family and attendants, and was equipped with almost all the imperial functions such as strolling, residence, morning assembly, entertainment, hunting, seeking immortality, military training, and production.

During the Wei, Jin, Southern and Northern dynasties, many scholar groups were admired by the society. They often went sightseeing in groups and led the trend of appreciating the natural landscape (Figure 2-5-7). The rise of temple gardens and scenic areas during this period promoted the sightseeing activities to the whole society.

Public gardens for civic activities appeared in the Tang Dynasty. With the massive construction of the capital Chang'an (長安), Qujiang Park (曲江) became the largest public garden in the capital, where the imperial family, monks, and common people gathered and travelled. In addition, the two capitals in Tang Dynasty devoted much attention to the urban greening, with countless small gardens, street greening, temple gardens and so on, showing the advanced city planning and prosperous society at that time.

During the Tang and Song Dynasties, private gardens became a gathering place for the garden owner and famous scholars. Many popular poetry, painting and calligraphy works came from these gatherings, and the celebrity anecdotes were widely spread in the later generations (Figure 2-5-8). In the Ming and Qing dynasties, the recreational and social functions of gardens increased. As far as most scholars of that time were concerned, the idea of "gathering and entertaining in the garden" had replaced the traditional idea of "seclude in the garden". The transformation of ideas directly led to the change of the garden functions and style. The simple and natural characteristics of gardens had gradually disappeared, and gardens were more and more focused on the skills and techniques and weakened their depth on gardening thoughts.

During the Ming and Qing dynasties, public activities and visiting scenic spots became popular in some developed areas. Correspondingly, public gardens and scenic areas were widely built in the city, suburbs and country. The Shichahai (什刹海) became the largest public garden in the inner city of capital Beijing, and the

Figure 2-5-7 (Left). Tang Yin (唐寅), *Gathering at the Orchid Pavilion* (蘭亭修禊図), Ming Dynasty.
Data source: http://www.360doc.com/content/20/1104/09/28833735_944017348.shtml.

Figure 2-5-8 (Right). Zhao Mengfu (趙孟頫), *Elegant Gathering in the Western Garden* (西園雅集図), Yuan Dynasty.
Courtesy of the National Palace Museum, Taipei.

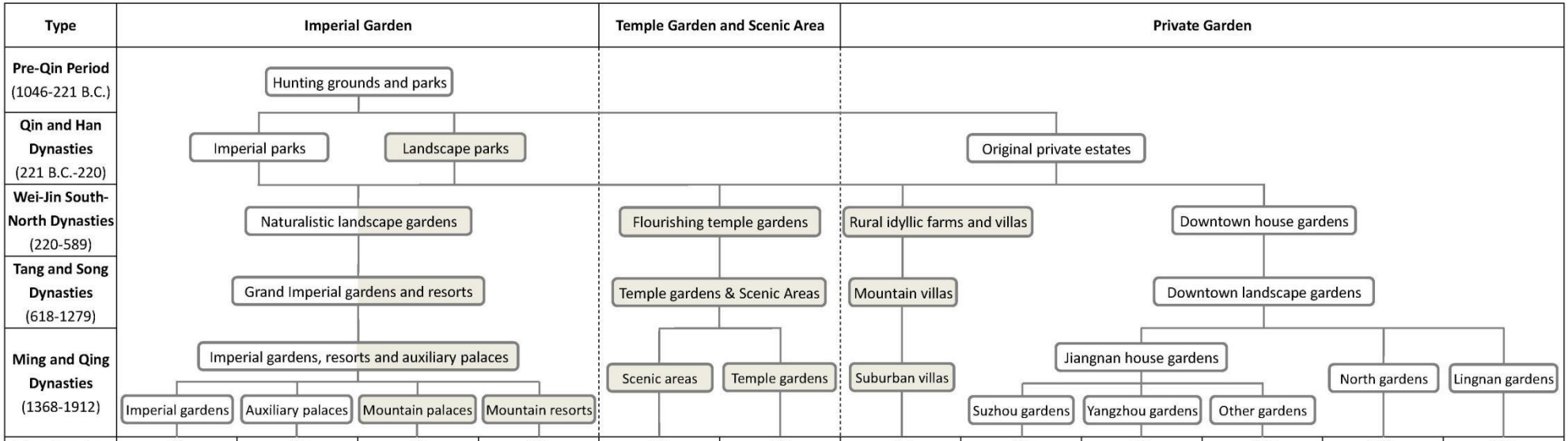
Slender West Lake (瘦西湖) in Yangzhou was also a popular area for citizens with the nature of scenic areas. The West Lake (西湖) in Hangzhou was a famous scenic area since the Tang and Song dynasties, which played an important role in the entertainment and recreation of the citizens throughout history.

2.6 Conclusions

The style and spatial characteristics of traditional Chinese gardens had been changing throughout history, but the central theme was carried forward and remained unchanged, which can be summarized as the Shan-shui (山水, "landscape") thought, namely living in the environment with mountains and forests. This central theme was formed in Wei-Jin Period and became the fundamental pursuit in later generations, and the imperial gardens, private gardens, temple gardens and scenic areas can all be integrated with this theme as "Chinese Landscape Gardens (中国山水園)".

Throughout garden history, imperial and private garden shared a parallel growth and mutual influence, and jointly influenced the temple gardens and scenic areas. The mutual influence of imperial and private gardens went through two stages, originally top-down (from imperial gardens to private gardens) and later bottom-up (from private gardens to imperial gardens). Furthermore, the imperial and private gardens shared slightly different themes, pursuits and tastes and were relatively complemented, strengthening the central core and spiritual pursuit of traditional Chinese gardens. They also gave rise to a wide range of traditional Chinese garden types, extending the breadth and depth of Chinese gardens.

Figure 2-6-1 shows the evolution diagram of traditional Chinese gardens with three main garden types, twelve subtypes, and their features and existing cases. Table 2-6-1 shows the brief introduction of the existing garden cases appeared in Figure 2-6-1. Table 2-6-2 shows the investigation schedule on the spatial characteristics and visitor behavior of traditional Chinese gardens during this study. The investigation mainly consisted of photographic record and observation study on garden space and visitor behavior.



Type	Imperial Garden				Temple Garden and Scenic Area		Private Garden					
Pre-Qin Period (1046-221 B.C.)												
Qin and Han Dynasties (221 B.C.-220)												
Wei-Jin South-North Dynasties (220-589)												
Tang and Song Dynasties (618-1279)												
Ming and Qing Dynasties (1368-1912)												
Type Number	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
Subtype	**Imperial gardens**	**Auxiliary palaces**	**Mountain palaces**	**Mountain resorts**	**Scenic areas**	**Temple gardens**	**Suburban villas**	**Suzhou gardens**	**Yangzhou gardens**	**Other gardens**	**North gardens**	**Lingnan gardens**
Features	Beijing Large scale Plain garden	Nationwide Medium scale Lodging	Nationwide Medium scale Mountain garden	Beijing & Hebei Large scale Mountain garden	Nationwide Large scale Sightseeing	Nationwide Medium scale Mountain garden	Nationwide Mid-small scale Countryside	Suzhou Mid-small scale House garden	Yangzhou Mid-small scale Lake garden	Jiangnan areas Mid-small scale Scholar garden	Beijing Mid-small scale Aristocratic garden	Lingnan Mid-small scale Court garden
Cases	Old Summer Palace Changchun Palace Xi Yuan Jingshan Park Imperial Garden in Forbidden City	Jiangning Prefecture Auxiliary Palace Tianning Temple Auxiliary Palace Suzhou Prefecture Auxiliary Palace Dule Temple Auxiliary Palace	Jinshan Auxiliary Palace Tiger Hill Auxiliary Palace Lingyan Mountain Auxiliary Palace West Lake Auxiliary Palace	Summer Palace Jingyi Palace Jingming Palace Chengde Mountain Resort Jingji Mountain Resort	Tiger Hill Mount Lingyan Jinshsan Hill Mount Song Mount Qingcheng Mount Wudang West Lake Slender West Lake	Lingyan Temple Lingyan Temple Hanshan Temple Jinshsan Temple Zhongyue Temple Fawang Temple Shaolin Temple Chang Gu Temple Zixiao Palace LingYin Temple Leifeng Pagoda Outer Eight Temples	Lingering Garden Yongcui Mountain Villa Gaoyi Garden Jichang Garden Guo Zhuang Xiling Seal Art Society	Humble Administrator's Garden Lion Grove Garden Canglang Pavilion Master-of-Nets Garden Yi Garden Ou Garden Yipu Garden The Mountain Villa Canli Garden	He Garden Ge Garden Little Pangu Garden Pieces of Rock Hill Housing Xu Garden Fu Villa Pingshan Hall Di Garden Wang's Residence	Tuisi Garden Yan Garden Xukuo Garden Shuihui Garden Zhan Garden Yu Garden Guyi Garden Yanyu Building Qi Garden	Garden of Prince Kung's Mansion Garden of Prince Chun's Mansion Garden of Wenyu's Mansion	Qinghui Garden Liang Garden Ke Garden Yu Yin Shan Fang

Gardens in colored columns (N3-N7) are located in rural and suburban areas with mountains and forests. Other gardens are located in the urban areas.

Figure 2-6-1. Evolution diagram of traditional Chinese gardens.

Table 2-6-1. Brief introduction of the existing garden cases in Figure 2-6-1.

Garden Types	Garden Cases	Location	Year of Construction
Imperial Gardens	Summer Palace (頤和園)	Beijing	1750
	Old Summer Palace (円明園)	Beijing	1707
	Changchun Palace (暢春園)	Beijing	1684
	Jingyi Palace (静宜園)	Beijing	1745
	Jingming Palace (静明園)	Beijing	1692
	Xi Yuan or the Three Seas (西苑三海)	Beijing	1179 (originated)
	Jingshan Park (景山)	Beijing	1179 (originated)
	Imperial Garden in Forbidden City (紫禁城御花園)	Beijing	1420 (originated)
	Jingji Mountain Resort (静寄山莊)	Tianjin	1744
	Chengde Mountain Resort (承德避暑山莊)	Chengde, Hebei	1703
	Dule Temple Auxiliary Palace (獨楽寺行宮)	Tianjin	1753
	Jiangning Prefecture Auxiliary Palace (江寧府行宮)	Nanjing, Jiangsu	1751
	Tianning Temple Auxiliary Palace (天寧寺行宮)	Yangzhou, Jiangsu	1772
	Jinshan Auxiliary Palace (金山行宮)	Zhenjiang, Jiangsu	1779
	Suzhou Prefecture Auxiliary Palace (蘇州府行宮)	Suzhou, Jiangsu	1750
	Tiger Hill Auxiliary Palace (虎丘行宮)	Suzhou, Jiangsu	1706
	Lingyan Mountain Auxiliary Palace (霊巌山行宮)	Suzhou, Jiangsu	1689
	West Lake Auxiliary Palace (西湖行宮)	Hangzhou, Zhejiang	1705
Private Gardens	Garden of Prince Kung's Mansion (恭王府粋錦園)	Beijing	1776
	Garden of Prince Chun's Mansion (醇親王府花園)	Beijing	About 1635
	Garden of Wenyu's Mansion (文煜宅可園)	Beijing	About 1864
	Humble Administrator's Garden (拙政園)	Suzhou, Jiangsu	1506
	Liuyuan or Lingering Garden (留園)	Suzhou, Jiangsu	1593
	Lion Grove Garden (獅子林)	Suzhou, Jiangsu	1342
	Canglang Pavilion or Surging Waves Pavilion (滄浪亭)	Suzhou, Jiangsu	1044
	Master-of-Nets Garden (網師園)	Suzhou, Jiangsu	1174
	Yi Garden (怡園)	Suzhou, Jiangsu	1874
	Ou Garden or Garden of Couple's Retreat (耦園)	Suzhou, Jiangsu	1875
	Yipu Garden or Garden of Cultivation (芸圃)	Suzhou, Jiangsu	1541
	The Mountain Villa (環秀山莊)	Suzhou, Jiangsu	1736
	Yongcui Mountain Villa (擁翠山莊)	Suzhou, Jiangsu	1884
	Gaoyi Garden (高義園)	Suzhou, Jiangsu	826 (originated)
	Canli Garden (残粒園)	Suzhou, Jiangsu	Late Qing Dynasty
	He Garden (何園)	Yangzhou, Jiangsu	1862
	Ge Garden (个園)	Yangzhou, Jiangsu	1818
	Xu Garden (徐園)	Yangzhou, Jiangsu	1866
	Fu Villa (鳧莊)	Yangzhou, Jiangsu	1921
	Pingshan Hall (平山堂)	Yangzhou, Jiangsu	1048
	Little Pangu Garden (小盤谷)	Yangzhou, Jiangsu	1904
	Pieces of Rock Hill Housing (片石山房)	Yangzhou, Jiangsu	Ming Dynasty
	Di Garden (棣園)	Yangzhou, Jiangsu	1844
	Wang's Residence (汪氏小苑)	Yangzhou, Jiangsu	Early Qing Dynasty
	Jichang Garden (寄暢園)	Wuxi, Jiangsu	1527
	Tuisi Garden (退思園)	Suzhou, Jiangsu	1885
	Yan Garden (燕園)	Changshu, Jiangsu	1780
	Xukuo Garden or Zeng Garden (虚霩園)	Changshu, Jiangsu	Late Qing Dynasty
	Shuihui Garden (水絵園)	Rugao, Jiangsu	Late Ming Dynasty
	Zhan Garden (瞻園)	Nanjing, Jiangsu	Early Ming Dynasty
	Yu Garden (豫園)	Shanghai	1559
	Guyi Garden (古猗園)	Shanghai	Late Ming Dynasty
	Guo Zhuang (郭庄)	Hangzhou, Zhejiang	1907
	Xiling Seal Art Society (西泠印社)	Hangzhou, Zhejiang	1904
	Yanyu Building (煙雨楼)	Jiaxing, Zhejiang	936 (originated)
	Qi Garden (綺園)	Jiaxing, Zhejiang	1871
	Qinghui Garden (清暉園)	Foshan, Guangdong	1621 (originated)
	Liang Garden (梁園)	Foshan, Guangdong	1796
	Ke Garden (可園)	Dongguan, Guangdong	1850
	Yu Yin Shan Fang (余蔭山房)	Guangzhou, Guangdong	1867

Temple Gardens	Yunyan Temple (雲巖寺)	Suzhou, Jiangsu	About 327
	Lingyan Temple (靈巖寺)	Suzhou, Jiangsu	About 494 B.C.
	Hanshan Temple (寒山寺)	Suzhou, Jiangsu	About 502
	Jinshsan Temple (金山寺)	Zhenjiang, Jiangsu	About 323
	Zhongyue Temple (中岳廟)	Dengfeng, Henan	221 B.C.(originated)
	Fawang Temple (法王寺)	Dengfeng, Henan	About 71
	Shaolin Temple (少林寺)	Dengfeng, Henan	495
	Chang Gu Temple (常道觀)	Chengdu, Sichuan	About 605
	Zixiao Palace (紫霄宮)	Danjiangkou, Hubei	1121
	LingYin Temple (靈隱寺)	Hangzhou, Zhejiang	326
	Leifeng Pagoda (雷峰塔)	Hangzhou, Zhejiang	977
	Outer Eight Temples (外八廟)	Chengde, Hebei	1713
Scenic Areas	Tiger Hill (虎丘)	Suzhou, Jiangsu	About 327
	Mount Lingyan (靈巖山)	Suzhou, Jiangsu	About 494 B.C.
	Jinshan Hill (金山)	Zhenjiang, Jiangsu	About 323
	Mount Song (嵩山)	Dengfeng, Henan	About 221 B.C.
	Mount Qingcheng (青城山)	Chengdu, Sichuan	About 143
	Mount Wudang (武当山)	Danjiangkou, Hubei	About 627
	West Lake (西湖)	Hangzhou, Zhejiang	About 907
	Slender West Lake (瘦西湖)	Yangzhou, Jiangsu	Early Qing Dynasty

Table 2-6-2. Investigation schedule of traditional Chinese gardens.

Date	Location	Destination
July 30, 2018	Shanghai (上海)	Yu Garden (豫園)
August 24, 2018	Wuxi (無錫)	Jichang Garden (寄暢園)
August 15, 2019	Suzhou (蘇州)	Canglang Pavilion (滄浪亭)
August 16, 2019	Wuxi (無錫)	Jichang Garden (寄暢園)
October 13, 2020	Nanjing (南京)	Yu Garden (愚園)
October 13, 2020	Nanjing (南京)	Zhan Garden (瞻園)
October 13, 2020	Nanjing (南京)	Mustard Seed Garden (芥子園)
October 14, 2020	Yangzhou (揚州)	He Garden (何園)
October 14, 2020	Yangzhou (揚州)	Little Pangu Garden (小盤谷)
October 14, 2020	Yangzhou (揚州)	Two-thirds of Moonlight Building (二分明月楼)
October 16, 2020	Yangzhou (揚州)	Ge Garden (个園)
October 17, 2020	Yangzhou (揚州)	Slender West Lake (瘦西湖)
October 18, 2020	Suzhou (蘇州)	The Mountain Villa (環秀山莊)
October 19, 2020	Suzhou (蘇州)	Yipu Garden (芸圃)
October 19, 2020	Suzhou (蘇州)	Yi Garden (怡園)
October 20, 2020	Suzhou (蘇州)	Ou Garden (耦園)
October 20, 2020	Suzhou (蘇州)	Humble Administrator's Garden (拙政園)
October 21, 2020	Suzhou (蘇州)	Master-of-Nets Garden (網師園)
October 21, 2020	Suzhou (蘇州)	Liuyuan or Lingering Garden (留園)
October 22, 2020	Suzhou (蘇州)	Lion Grove Garden (獅子林)
October 22, 2020	Suzhou (蘇州)	Canglang Pavilion (滄浪亭)
October 25, 2020	Suzhou (蘇州)	Tiger Hill (虎丘)
October 26, 2020	Suzhou (蘇州)	Gaoyi Garden (高義園)
October 27, 2020	Hangzhou (杭州)	Solitary Hill of West Lake (西湖孤山)
October 28, 2020	Hangzhou (杭州)	LingYin Temple (靈隱寺)
October 29, 2020	Shanghai (上海)	Fang Ta Park or Square Pagoda Garden (方塔園)
December 1, 2020	Shanghai (上海)	Qiuxia Garden (秋霞圃)
December 2, 2020	Shanghai (上海)	Yu Garden (豫園)

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CHAPTER 3
RESEARCH OBJECT AND FIELD INVESTIGATION: TIANYIGE MUSEUM GARDENS

3.1 Introduction

From Chapter 3-6, this dissertation focuses on the research objects: Tianyige Museum gardens, containing the Tianyige Group, East Garden and South Garden. Chapter 3 introduces the basic information of the research objects and investigation results. Chapter 4 focuses on the architectures and gardens of Tianyige Group. Chapter 5 and 6 study the visitor stay behavior in the East Garden and South Garden.

There are four sections in Chapter 3. This chapter firstly introduces the relationship between Chapter 3 and Chapter 4-6, and explains the reason of the research object as Tianyige Museum gardens. Then it introduces the history and current situation of the research object and the schedule and results of field investigation.

There are two reasons of choosing Tianyige Museum gardens as the research objects. Firstly, East Garden and South Garden were designed following the classical style of the Tianyige group in the Ming Dynasty, and the garden scale is similar to that of other Jiangnan gardens, but there are few studies on Tianyige garden. Secondly, Tianyige Museum garden are more open in terms of management, and the visitor flow is relatively moderate, which is in line with the garden capacity, and can provide reliable investigation data.

3.2 History and Current Situation of Tianyige Museum

Tianyige Museum is located in Zhejiang, Ningbo, China (Figure 3-2-1). Featuring the renowned Tianyige (天一閣, "Tianyi Pavilion"), Tianyige Museum is dedicated to the art of book collecting and occupies an area of 34,000 m^2. Today the Tianyige holds nearly 300,000 ancient books, of which 80,000 are rare volumes in prime condition. It is currently a Key Cultural Relics Protection Unit (全国重点文物保護単位), Key Protection Unit of Ancient Books (全国古典籍重点保護単位), and 5A-Class Scenic Area in China (国家5A等級観光地). Each year, hundreds of thousands of tourists from home and abroad visit the museum, drawn by its book

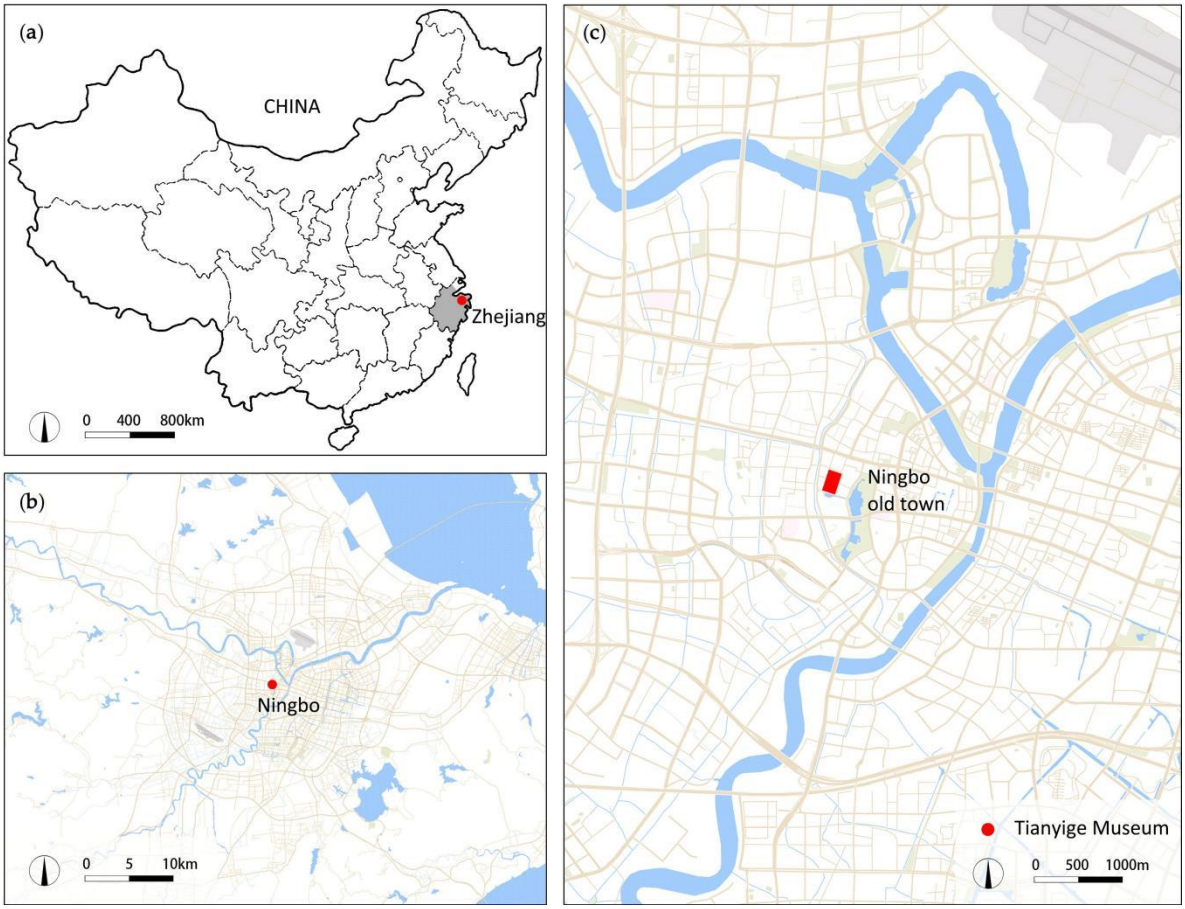
collecting traditions, long history and culture, ancient buildings and exquisite gardens.

Tianyige is now the oldest existing private library in China, and one of the three oldest existing private libraries in the world (Figure 3-2-2). Built between 1561 and 1566, the pavilion was build by Fan Qin (范欽, 1505–1585), who resigned from his post as a high-ranking military official of the Ming Dynasty, and returned to his hometown (Figure 3-2-3). It was next to the residence of Fan's family in the west of Moon Lake (月湖) in Ningbo, where private houses and gardens of scholars gathered together. It originally housed a book collection of approximately 70,000 volumes.

During the reign of Emperor Kangxi, Fan Guangwen, great-grandson of Fan Qin, decorated the Tianyige group in 1665 with a giant rockery with pavilions, bridges and trees on the Tianyi Pool facing the library and a flower bed with grass and tall bamboos on the back of the library, forming the current layout of Tianyige group. During the compilation of *Siku quanshu* from 1773 in Qing Dynasty, the Fan's family contributed 641 species of books to the court. The long history and rich collection of Tianyige impressed Emperor Qianlong, and it was finally designated as the prototype of the seven libraries of *Siku quanshu*, making the Tianyige quite famous at home and abroad.

In 1933, the east wall of Tianyige collapsed by the hit of typhoon, and a committee was formed by local people to raise funds for the renovation of Tianyige (Figure 3-2-4). In this renovation, the Zunjing Pavilion (尊経閣) and some ancient stone tablets were moved to the backyard of Tianyige group. In 1978, the Ningbo Tianyige Cultural Relic Conservation Office was established and Tianyige became an independent organization. In 1994, the Ningbo Museum was merged with Tianyige, and the new institution became the Ningbo Tianyige Museum (天一閣博物館). The East Garden and South Garden were built in 1986 and 1997, and some ancestral halls were incorporated into the Tianyige Museum, forming the current scale of Tianyige Museum. In 2018, the Tianyige Museum & Moon Lake Scenic Area (天一閣・月湖観光地) was approved as the 5A-Class Scenic Area in China (Figure 3-2-5). In 2020, the Ningbo Tianyige Museum and Ningbo Baoguo Temple (保国寺) were amalgamated into a new institution called Ningbo Tianyige Museum (天一閣博物院).

The visitor number to the Tianyige Museum has been increasing in recent years, reaching an annual attendance of nearly 739,000 in 2019 before the COVID-19 pandemic. The Tianyige Museum currently has a variety of functions, such as museum, cultural relics protection unit, documentation institute, and 5A-Class Scenic Area. The cultural exhibition area and garden recreation area are mainly open to visitors and serve as a museum and scenic area. It also houses numerous



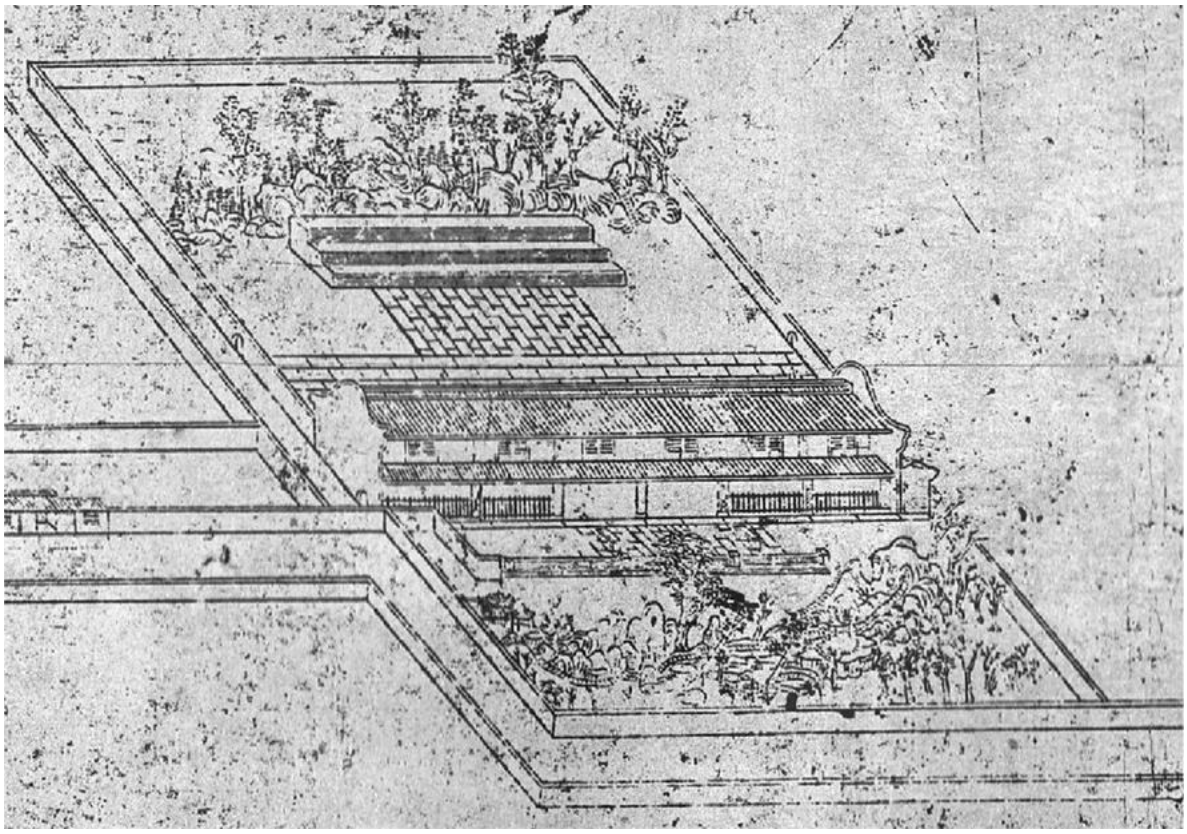


Figure 3-2-1 (Top). The location of the study area: (a) Zhejiang province in China; (b) Ningbo city in northeast Zhejiang province; (c) Tianyige Museum in Ningbo old town.

Figure 3-2-2 (Bottom). Anonymous, *Tianyige Picture* (天一閣図) by inscription, Ming Dynasty. *Courtesy of the Tianyige Museum, Ningbo.*

Figure 3-2-3 (Left). Anonymous, *Portrait of Fan Qin* (范欽の肖像), Ming Dynasty.
Courtesy of the Tianyige Museum, Ningbo.

Figure 3-2-4 (Bottom). Photos on the renovation of Tianyige, Ningbo, 1933.
Courtesy of the Tianyige Museum, Ningbo.

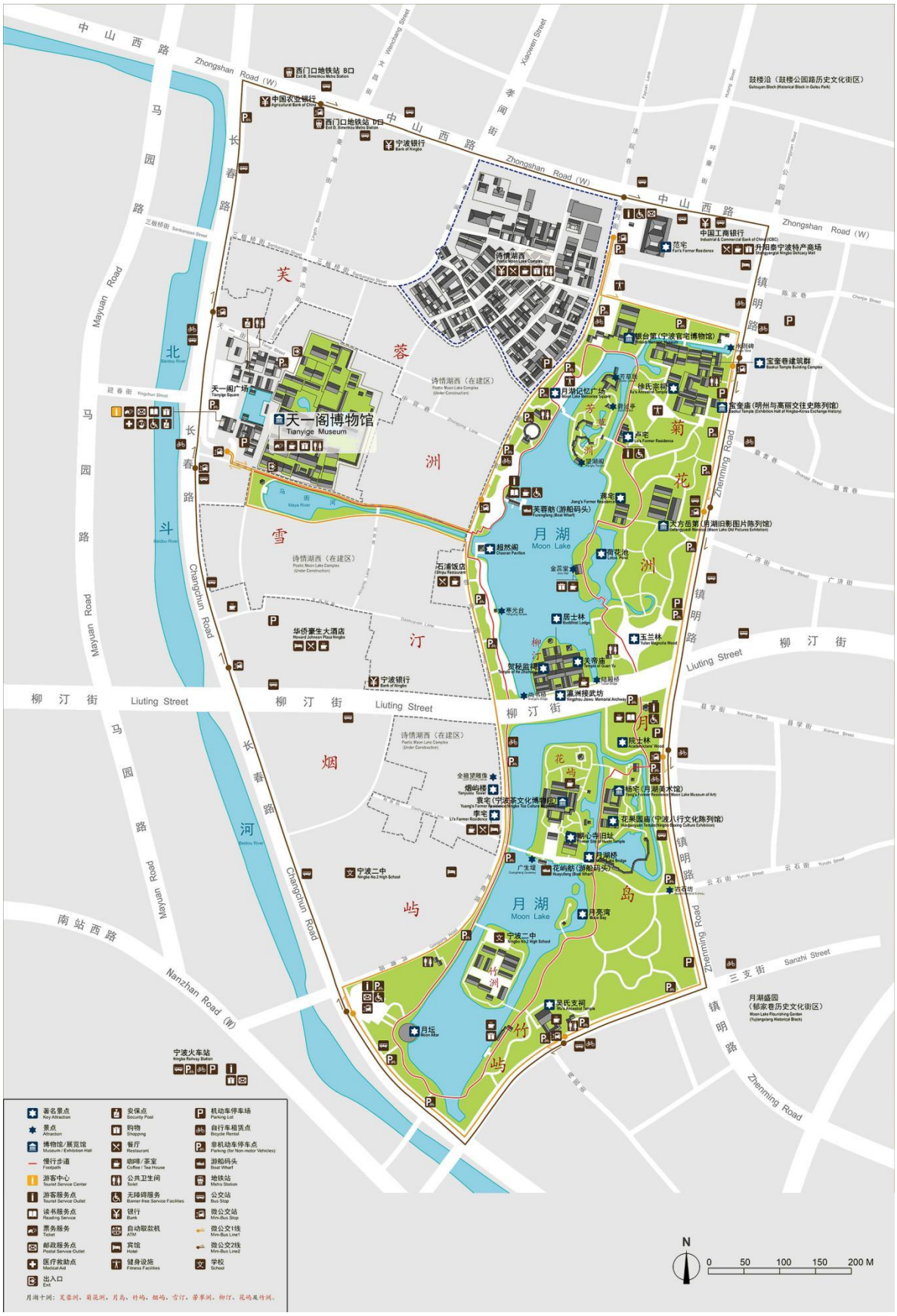


Figure 3-2-5. Site plan of 5A-Class Scenic Area: Tianyige Museum & Moon Lake Scenic Area (天一閣·月湖観光地). The left small green part is Tianyige Museum, and the right big green part is Moon Lake.

Data source: http://nbtygyh.haishu.gov.cn/panorama_tyg.html.

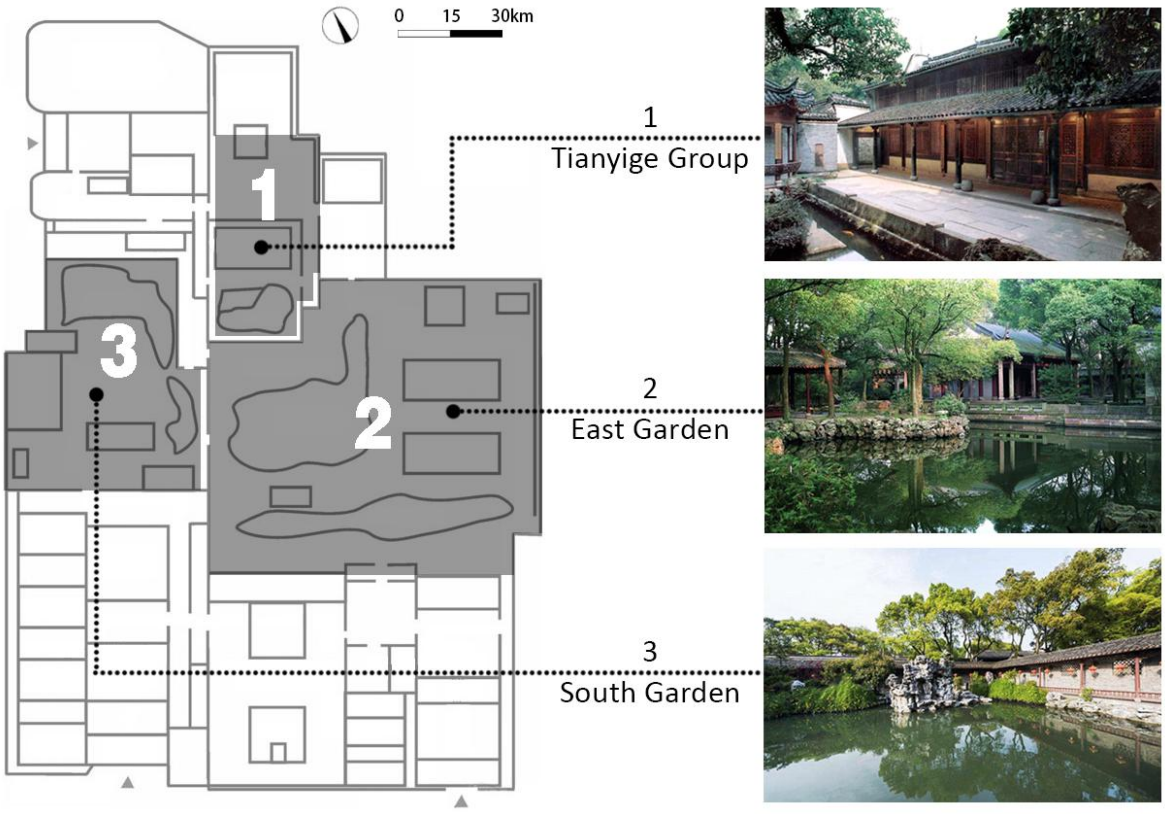


Figure 3-2-6. Plan of Ningbo Tianyige Museum containing three research objects: Tianyige group (1), East Garden (2), and South Garden (3).

collections, such as ancient books, paintings and calligraphy, inscriptions and artifacts. As a cultural research institution, it hosts many academic forums and conferences each year, and it also issues the *Tianyige Series* (天一閣文叢), an annual academic publication on the study of Chinese book collection culture and literature. As a cultural communication institution, it hosts the lecture series as well as handicraft art experience course on traditional Chinese culture to the public.

The research object of this study is the Tianyige group, East Garden and South Garden in the Ningbo Tianyige Museum (Figure 3-2-6). The main entrance of the museum is in the northwest. After entering through the northwest museum gate, visitors pass through the former residence of Fan's family and arrive the Tianyige group. Then the visitors will enter the East Garden via its north entrance. Following the completion of their tour of the East Garden, visitors usually leave the garden via its south entrance and enter the southern part of the museum. Later, the visitors return to the South Garden via its south entrance and leaved via its north entrance. Finally, the visitors end their tour through the main entrance of the museum.

Figure 3-2-7 shows the plan of the three research objects. In this paper, Chapter 4 studies the characteristics of buildings and garden of Tianyige group, and the imitation and Restoration of the Seven Libraries of *Siku quanshu*. Chapter 5 and 6 study the spatial characteristics and the visitor stay behavior of the East Garden and South Garden in Tianyige Museum.

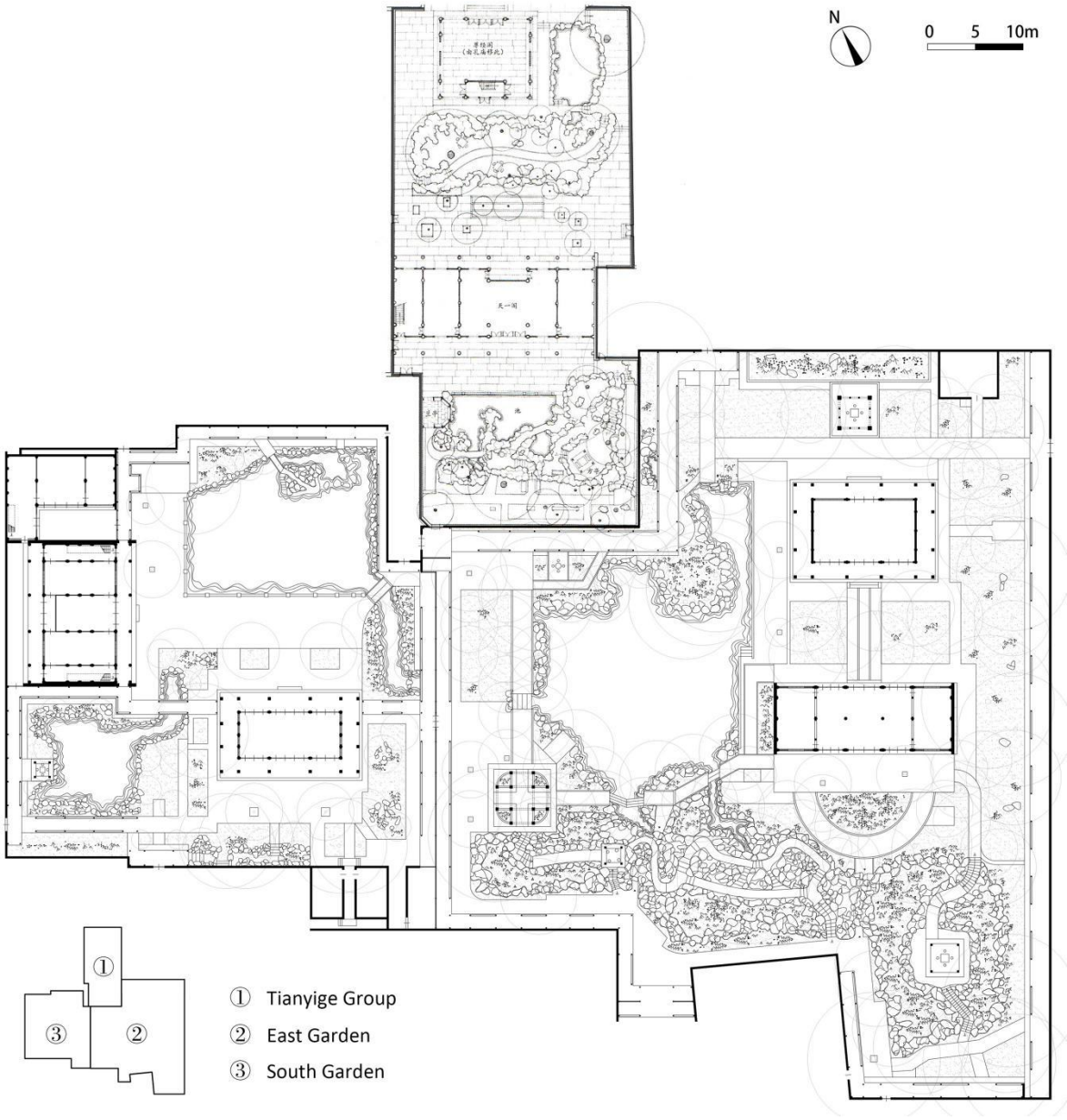


Figure 3-2-7. Plan of three research objects: Tianyige group (1), East Garden (2), and South Garden (3).

3.3 Field Investigation in Tianyige Museum

A total of four times of field investigation were conducted on Tianyige Museum and its gardens during this study, and the investigation schedule are shown in Table 3-3-1.

Firstly, a preliminary investigation of the entire Tianyige Museum was conducted on July 2018 in order to determine the research objects and contents, as well as the feasibility of the study.

Secondly, after identifying the research objects as the East Garden and South Garden and the research contents of visitor behavior, a mapping survey and the preliminary observations of visitor behavior on the East Garden and the South Garden were conducted on February 2019.

Thirdly, questionnaire survey on visitors, interviews with managers, and the visitor short-stay distribution investigation were conducted on July 2019. The questionnaire survey on the psychological evaluation and satisfaction of visitors in the East Garden and South Garden aimed at deepening the understanding of visitors' experience and evaluation of Tianyige gardens, serving as an auxiliary material for the visitor stay distribution analysis. The interviews were conducted with the deputy director, the tour department staff, and the staff of the Tianyige Museum, with the aim of understanding the history and development, operation and management, and utilization of visitors and citizens of the Tianyige Museum. The records of the interviews are shown in Tables 3-3-2, 3-3-3, 3-3-4. The data analysis of the visitor short-stay distribution investigation on July 2019 are presented in Chapter 5.

Fourthly, further investigation on visitor long-stay distribution in the East and South Garden was conducted on November 2020. The results and data analysis of the visitor long-stay distribution investigation are presented in Chapter 6.

3.4 Conclusions

This chapter introduced the overall situation of the research object: Tianyige Museum and field investigation. The conclusions are as follows.

The research object of this study is the Tianyige Library group (Chapter 4), East Garden and South Garden (Chapter 5 & 6) in the Ningbo Tianyige Museum. Built between 1561 and 1566, Tianyige is now the oldest existing private library in China, and one of the three oldest existing private libraries in the world. The East Garden and South Garden were built in 1986 and 1997 in Tianyige Museum.

A total of four times of field investigation were conducted on Tianyige Museum and its gardens during this study on July 2018, February 2019, July 2019, and November 2020. The investigation on Tianyige Museum consisted of preliminary investigation and observation, mapping survey, questionnaire survey, interview, and visitor stay behavior investigation. Furthermore, a rough investigation on other traditional Chinese gardens were conducted as a horizontal comparison of this study.

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Table 3-3-1. Investigation schedule of Ningbo Tianyige Museum.

Date	Location	Destination	Contents
July 28, 2018	Ningbo	Tianyige Museum	Feasibility study
February 24-26, 2019	Ningbo	Tianyige Museum	Mapping, observation
July 1-10, 2019	Ningbo	Tianyige Museum	Short-stay survey, questionnaire, interview
November 3-8, 2020	Ningbo	Tianyige Museum	Long-stay survey

Table 3-3-2. Interview to Mr Zhang, the deputy director of Tianyige Museum, July 4, 2019.

Question		Answer
1. Role	The role of Tianyige	Tianyige was born in the culture of Moon Lake. Despite its multiple identities such as museum, library as well as tourist spot, it is now the symbol and leading role of Ningbo culture. It will integrate into the Tianyige Museum & Moon Lake Scenic Area in the future, adding splendor to the Ningbo city.
	The role of East Garden and South Garden	East Garden and South Garden play an important role in Tianyige Museum. The gardens increase the booking culture with a good relation of nature and provide good place for visitors.
2. History	The expansion of Tianyige Museum	Tianyige Museum used to be a department for cultural relics conservation in 1950s-1980s, and it was expanded many times.
	The construction of East Garden	East Garden was built on the relics of Wen family. It was designed as an auxiliary garden for Tianyige and stored many ancient buildings and cultural relics.
	East Garden and Chen Congzhou	East Garden was designed by Chen Congzhou and built under his supervision in 1983-86, but the present layout of East Garden is not exactly the same as Chen's original design.
	The construction of South Garden	South Garden was constructed in 1990s when Tianyige Museum was the museum of the city. Its function was to integrate several ancient libraries and buildings together as a garden space. After the construction of South Garden, Tianyige Museum became an independent museum later.
3. Function	The function of Tianyige Museum to visitors	For local people, Tianyige Museum serves as a leisure space for weekend and a destination for student group activities. For people from other places, it is a tourism spot and historical building.
4. Management	The management of East Garden and South Garden	The management of Tianyige Museum garden consists of the architecture management, environment management, tourism management and events organization.
	Management in the future	As a 5A-Class Scenic Area in China, it is important to improve the tourism attraction of Tianyige Museum. With an increasing annual visitor number in the future, reserve plans for large visitor flow must be considered.
5. Future	Future prospects	A new modern museum for book collecting will be constructed in the future. Tianyige Museum and other ancient buildings will be protected with Moon Lake area as a whole historical district.

Table 3-3-3. Interview to Ms Wang, the tour department staff of Tianyige Museum, July 8, 2019.

Question	Answer
1. Visitor number	The annual visitor number was 560,000 in 2017 and 640,000 in 2018. The area of Tianygie Museum is 34000 m^2 and the visitor capacity of the museum is about 2000 per day.
2. Visitor flow on holidays	In general, in big festivals such as Spring Festival, Golden Week and National Holiday, Tianyige Museum will reach the peak visitor flow. The top flow once reached 12,000 in one day. Several plans are prepared to prevent big visitor flow, such as early warning, current limiting and enhancing guidance in the museum.
3. Visitor composition	Visitors from other cities occupy the majority. Most visitors are young people.
4. Entrance fee	People less than 18 years old and more than 70 years old are free to enter the museum. College students and elderly groups in 60-69 have a half price discount of 15 CNY. Adult ticket price is 30 CNY. A limited amount of annual tickets are launched for citizens, but it is not applicable in festivals.
5. Group visitors	Adult groups need no advanced reservation and the group number are unlimited, but there is a special rate for group visitors with travel agency. Student groups under 18 years old are limited to 400 people considering the student safety and the museum capacity.
6. Local school students	Tianyige Museum is a regular destination for spring outings of school students. Almost every student has been to Tianyige Museum for one or two times with their teachers and classmates. Consequently, Tianyige Museum is not only a museum but also a city park to local students.

Table 3-3-4. Interview to Ms Wu, the staff of Tianyige Museum, July 8, 2019.

Question	Answer
1. Access frequency of citizens	Although Tianyige Museum is well known to local people, but it is not their regular choice as a weekend journey destination. For one reason, it needs entrance fee. For another reason, most local people have been to Tianyige Museum when they were students.
2. Impression of Tianyige Museum on citizens	To local people, Tianyige Museum is firstly recognized as a library, and the book collecting culture is well-known to every citizen.
3. First impression of Tianyige Museum on visitors	Whether to local people or to visitors from other places, the first impression of Tianyige Museum is its exquisite garden space.
4. Other favourite local scenic spots	Free scenic spots are more attractive to local people, such as city museum, gallery, parks and so on. They are often larger in space and available by all groups and diverse activities.

CHAPTER 4
COMPARISON OF TIANYIGE GROUP AND SEVEN LIBRARIES

4.1 Introduction

This chapter analyzes the basic situation, construction ideas, architectures and gardens of Tianyige, articulates the imitation of the seven libraries from the perspective of architectures and gardens, and finally conducts the restoration research of three destroyed libraries in architectures and gardens.

4.1.1 Research background and purpose

Ancient China has a long history of library culture. The book collecting history of China began in Shang and Zhou dynasties (1600–256 B.C.), which has continued for more than 3,000 years, with official collections as the main body and private collections flourishing. It has developed a series of methods for the book collection, preservation, utilization and inheritance, and has also established a variety of library buildings, which have played an important role in the development of Chinese culture.

Ancient Chinese library buildings were initially constructed as royal cultural facilities for the purpose of knowledge collection and political authority. Later, private library buildings gradually emerged for the management of private collections, which preserved many valuable books and promoted the academic research and intellectual prosperity of the society [1–2].

The thought of ancient China library science was born in the Spring and Autumn Period (770–476 B.C.). In the late Western Han Dynasty (202 B.C.–8 A.D.), Liu Xiang (劉向) and his son Liu Xin (劉歆) initiated the study of ancient Chinese bibliography and bibliographic classification through *Seven Epitomes* (*Qi lue* 七略), the first documented Chinese library catalog [3]. The regulations of text collation and organization established by Liu Xiang and Xin were summarized as *jiao chou xue* (校讎學) by later generations. After the perfection of woodblock printing in Song Dynasty (960–1279), knowledge organization in ancient China reached its peak in Ming and Qing dynasties (1368–1912). The *Great Compendium of the Yongle Era* (*Yongle dadian* 永樂大典) in Ming Dynasty (1368–1644), the *Comprehensive Collection of Books Past and Present* (*Gujin tushu jicheng* 古今圖書集成) and the *Complete Library of the Four Treasuries* (*Siku quanshu* 四庫全書) in Qing Dynasty

(1644–1912) are all nationwide book compiling activities by the government, profoundly reflecting the intellectual authority of the time.

With the intentions of propagating cultural education as well as prohibiting critics, Emperor Qianlong (1711–1799) of Qing Dynasty compiled *Siku quanshu* and built seven libraries by following the prototype of Tianyige (天一閣) to store the books. This chapter is a study of the seven libraries' imitation of Tianyige from the perspective of imitation of imperial gardens in Qing Dynasty, as well as the restoration research of three destroyed libraries.

The research on the seven libraries' imitation of Tianyige will not only help the conservation of the present four libraries but also provide reference for the research and restoration of the destroyed three libraries. The result of the study is of great importance to the Chinese classical library research, as well as the imitation of imperial gardens in Qing dynasty.

4.1.2 Previous research

The upsurge of contemporary researches on ancient Chinese library history started in the early 1980s. *History of Ancient China Library Course* by Lai Xinxia was published in 1990. Lai made a comprehensive investigation on ancient China library course by combining the history of Chinese text, bibliography and library together for the first time [4]. In 2001, two great works on ancient Chinese library history were published almost at the same time. *Chinese Book Storage Buildings* by Ren Jiyu [5] was compiled under the trisection of historical fact, theory and table. This work is a panoramic display of China's book collection history for thousands of years, as well as the history of ancient Chinese libraries and book collectors. *General History of Chinese Book Collection* by Fu Xuancong and Xie Zhuohua [6] comprehensively discussed the historical facts of ancient Chinese book collections and proposed a new science of Chinese book collection on the basis of systematic demonstration. It is obvious from the previous research that the compilation of *Siku quanshu* and the construction of seven imperial libraries was a big event in ancient Chinese library history, and Tianyige had also made great contributions to ancient China book collections as a private library.

Researches on Tianyige and the seven libraries of *Siku quanshu* were carried out by various experts mainly focusing on the compiling and the preservation of the *Siku quanshu*. Only a few researches were carried out on the comparison among the Tianyige and the seven libraries on imitation of imperial gardens in Qing Dynasty.

Researches on imperial gardens in Qing Dynasty and measurements of historic buildings were carried out earlier by Tianjin University [7], which has collected a number of useful measurement drawings and research achievements. In

the mid-1980s, Peng Yigang, professor of Tianjin University published the *Analysis of the Traditional Chinese Garden* [8]. He studied Chinese classical gardens with modern analysis methods, which could be applied to modern architecture practice. In the late 1980s, Wang Qiheng, professor of Tianjin University started the Chinese classical garden research, published *Studies on Several Problems of Imperial Gardens in Qing Dynasty* [9] and pushed forward the research of imperial gardens in Qing Dynasty.

4.1.3 Research objects and methods

The research objects of this chapter are the Tianyige and the seven libraries (Figure 4-1-1). The seven libraries can be separated into northern four libraries and southern three libraries due to their different locations. Among these eight research objects, three imperial libraries were destroyed in Qing Dynasty. The Tianyige and other four libraries have survived until now for hundreds of years (Table 4-1-1).

Research methods of this chapter contain literature survey, field survey and field mapping. This chapter firstly combined the Tianyige and the seven libraries together as a whole research aspect from the perspective of imitation of imperial gardens in Qing Dynasty and offered a specific case study for imitation of imperial gardens in Qing Dynasty. This chapter also became the first to restore the architectures and gardens of the destroyed three libraries by combining the literature and relics for future research (Figure 4-1-2).

Table 4-1-1. Basic Information of 8 Libraries

No.	Object	Original Site	Location	Completion	Age (Until 2020)	Current Condition
N1	Tianyige (天一閣)	Formal Villa of Fan's Family (范氏舊居)	Zhejiang	1566 AD	454	Existing
N2	Wenyuange (文淵閣)	The Forbidden City (紫禁城)	Beijing	1776 AD	244	Existing
N3	Wenyuarnge (文源閣)	The Old Summer Palace (圓明園)	Beijing	1775 AD	85	Destroyed in 1860
N4	Wenjinge (文津閣)	The Mountain Resort (避暑山莊)	Hebei	1774 AD	246	Existing (Rebuilt in 1954)
N5	Wensuge (文溯閣)	Shenyang Imperial Palace (瀋陽故宮)	Liaoning	1782 AD	238	Existing
N6	Wenzongge (文宗閣)	Jinshan Mountain (金山)	Jiangsu	1779 AD	74	Destroyed in 1853
N7	Wenhuige (文滙閣)	Grand Hall Palace (大觀堂行宮)	Jiangsu	1780 AD	74	Destroyed in 1854
N8	Wenlarnge (文瀾閣)	Shengyinsi Auxiliary Palace (聖因寺行宮)	Zhejiang	1783 AD	237	Existing (Rebuilt in 1880)

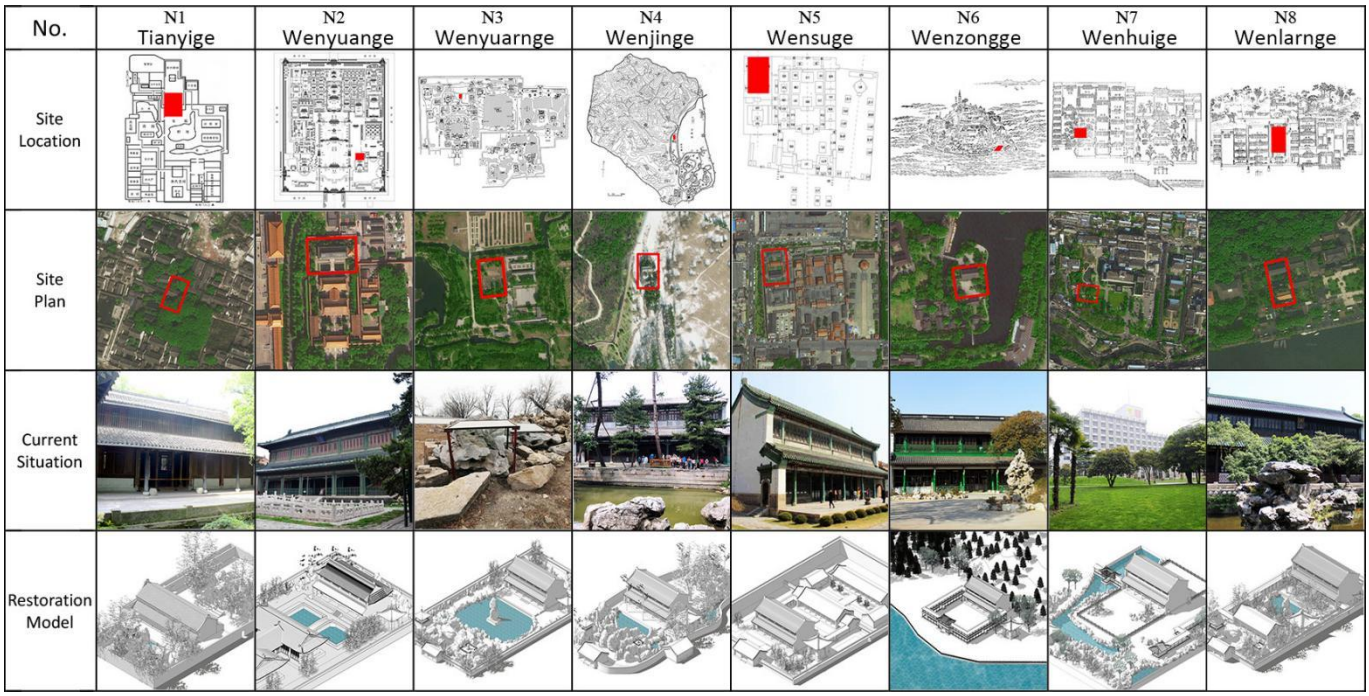


Figure 4-1-1 (Top). Location of 8 Libraries.

Figure 4-1-2 (Bottom). General Layout and Restoration Model of 8 Libraries.

4.2 Architecture and Garden of Tianyige Library Group

Tianyige (N1) is the oldest existing private library in China. Built in 1561-1566 AD, it originally housed the private book collection of Fan Qin (范欽), a high-ranking military official in the Ming Dynasty.

Tianyige is a brick-wood architecture with a double flush gable roof, whose height is 8.5m. The first floor of Tianyige is 6 bays in width and 6 spans in depth, which is quite abnormal for Chinese ancient architecture, with both front and back corridors. The second floor is one bay wide besides the stairs, separated by bookshelves. Borrowing an idea from the *Book of Changes* (*Yi jing* 易經), which suggested in "*Heaven embodied in One gives birth to water, while Earth represented in Six makes it grow* (天一生水，地六成之)" [10], Fan Qin named this architecture "Heaven (*tian* 天) One (*yi* 一) Pavilion (*ge* 閣)" and used 6 bays and spans, hoping to protect the library against fire damage (Figure 4-2-1).

The whole garden was designed to have water available to dismiss fire and protect the books. In front of the library lies a pond which was intended to protect the library against fire. On the back there is a flower bed with grass and tall bamboos. The overall layout is a common compact design due to the cramped space. The small platform in front of the Tianyige links the architecture and the garden together as a transition space. Facing the library there is the main rockery, being the major scenery of the garden. It was constructed with precipitous cliff and narrow caves, small but exquisite so that one can climb up and down by a crooked path. Some vivid rockwork in the rockery resembles nine lions and one elephant, corresponding to the Lion Grove Garden in Suzhou. There is also a pavilion and a platform on the rockery with different heights as the main viewpoints. Another pavilion besides the rockery was newly built in 1934. A small island linked with the main rockery by a small stone bridge stands inside the Tianyi pond, which cannot be landed on, embodying the ancient construction idea as immortals' islands (Figure 4-2-2).

For protecting Tianyige and the books in the long term, Fan Qin had also set up strict rules and regulations of book management. For example, on one plaque inscribed "*Tobacco and Wine are Strictly Forbidden in the Building* (煙酒切忌登樓)", and one family rule said "*the offspring should never separate the books, and the books should never be taken away from the library* (代不分書，書不出閣)" [11]. Owing to the great effort made by the descendants of Fan's family, Tianyige could be well preserved till now. During the compilation of *Siku quanshu* in Qing Dynasty, the Fan's family contributed 641 species of books. The long history and rich collection of Tianyige impressed Emperor Qianlong, and it was finally designated as the prototype of the seven libraries of *Siku quanshu* (Figure 4-2-3).

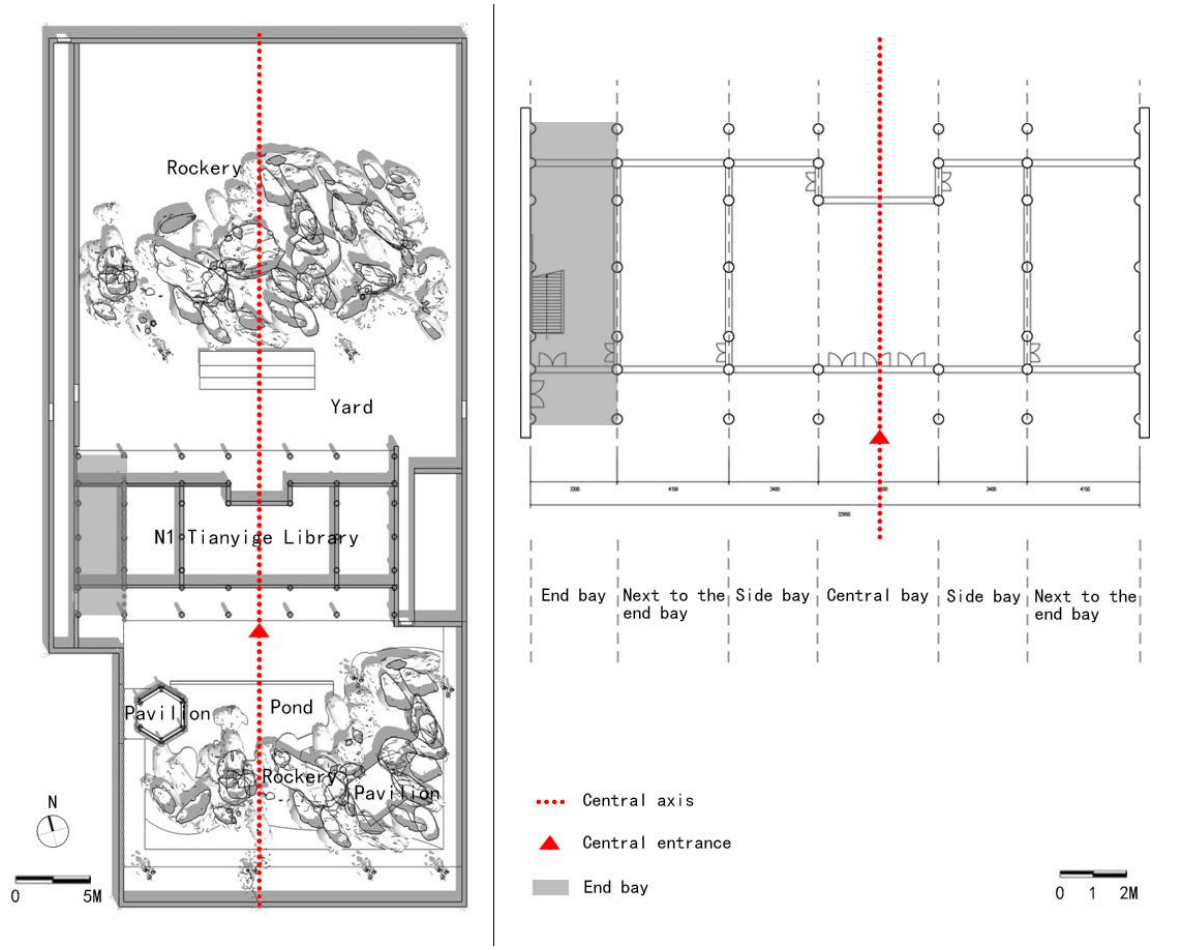


Figure 4-2-1 (Top). Bay Analysis of Tianyige (N1).

Figure 4-2-2 (Bottom). Architecture & Garden of Tianyige (N1).

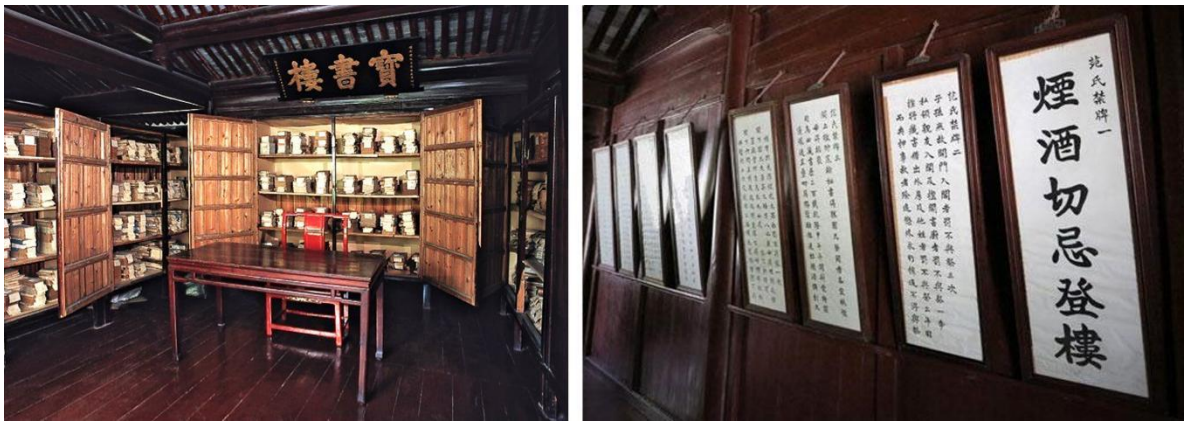


Figure 4-2-3. Indoor scene and plaques of Tianyige. Data source: Tianyige Museum.

4.3 Architectural Configuration of the Seven Libraries

The seven libraries completed and stored the *Siku quanshu* at different time. Although the seven libraries imitated the Tianyige in architecture and gardens, but there are still some differences between each libraries (Table 4-3-1).

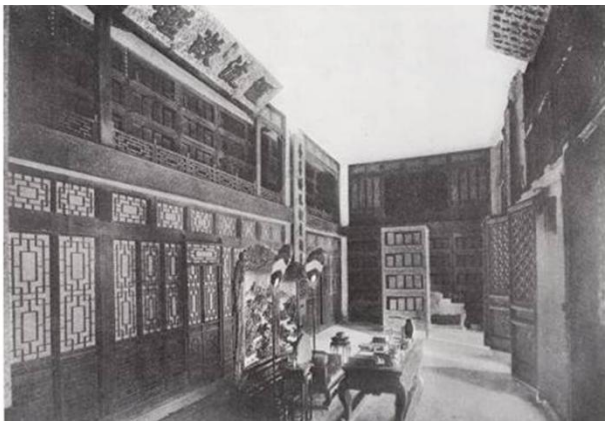
Table 4-3-1. Architectural Configuration of 8 Libraries.

No.	Object	Floor Area (m^2)	Width (m)	Depth (m)	Height (m)	Bay Number	Span Number	Floor	Roof Type
N1	Tianyige	276.78	22.95	12.06	8.50	6	6	2	Flush Gable Roof
N2	Wenyuange	606.60	34.14	17.77	19.39	6	5	3	Gable and Hip Roof
N3	Wenyuarnge	265.35	22.22	11.94	NA	6	5	3	Flush Gable Roof
N4	Wenjinge	365.89	26.02	14.06	14.79	6	5	3	Flush Gable Roof
N5	Wensuge	391.90	25.84	14.76	15.68	6	5	3	Flush Gable Roof
N6	Wenzongge	NA	NA	NA	NA	6	5	3	Flush Gable Roof
N7	Wenhuige	NA	NA	NA	NA	6	5	3	Flush Gable Roof
N8	Wenlarnge	323.44	24.54	13.18	NA	6	5	3	Flush Gable Roof

Below it is the analysis of architectural configuration of the seven libraries, for which Wenyuange in the Forbidden City (紫禁城) in Beijing will be taken as an example (Figure 4-3-1) [12].

Wenyuange (N2) has two floors in appearance and three floors internally, making it bigger and taller than Tianyige. The gable and hip roof and brackets can only be seen in Wenyuange, raising the imperial rank of the building. Based on the mapping data of the current four libraries, the bay of Wenyuange is apparently wider than the other three libraries, probably due to the big size of Wenhuadian (文華殿) in front of Wenyuange. Wenyuange has no platform ahead the architecture but a high foundation and nine steps (Figure 4-3-2). The other three current libraries all have a platform as a transition space between indoor and outdoor.

The ratios of the end bay of the seven libraries are all smaller than those of Tianyige. For one reason, a smaller end bay is more constant for the axial



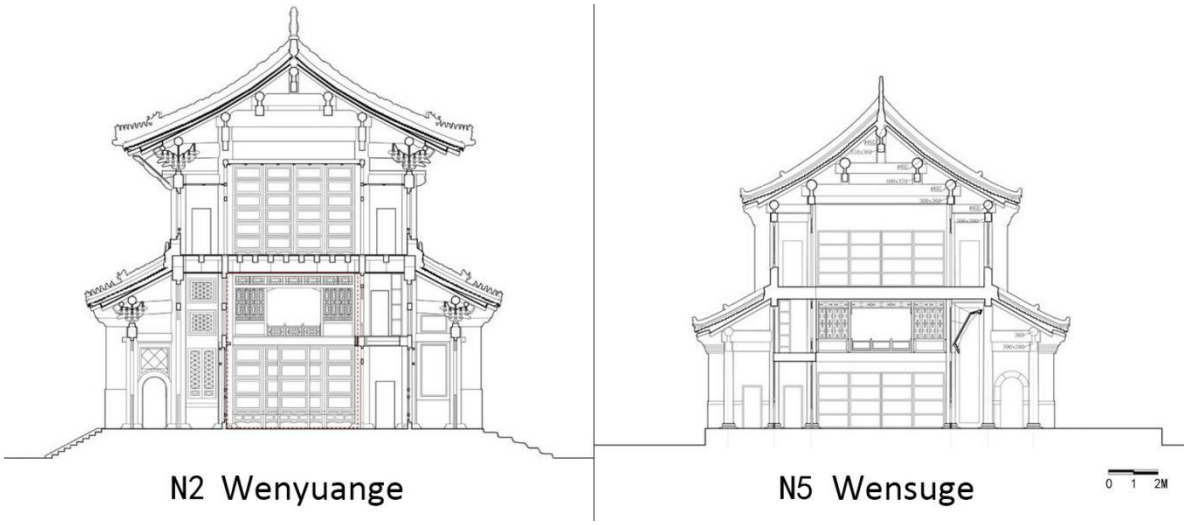


Figure 4-3-1 (Top). Outdoor and indoor Photos of Wenyuange (N2). Data source: *Photographs of Palace Buildings of Peking.*

Figure 4-3-2 (Bottom). Central Bay Section of Wenyuange (N2) & Wensuge (N5).

symmetry of a six bay architecture. For another reason, a smaller end bay in the seven libraries only serves as a staircase, unlike Tianyige.

The extant four libraries are all crowned with black glazed tiles in the middle and green glazed tiles on the edge of the roof, which also imitates Tianyige and means water to protect the library. The central bay of the front corridor all extends one span into the interior space in Wenyuange (N2)、Wensuge (N5) and Wenlarnge (N8), emphasizing the trend of the outer space into the interior space. On the contrary, the back corridor rather than the front corridor of Tianyige extends one span into the interior space (Figure 4-3-3).

4.4 Overall Configuration of the Seven Libraries

The seven libraries can be divided into two types according to their locations and overall configuration: libraries in imperial palaces and libraries in imperial gardens and auxiliary palaces. Wenyuange (N2) and Wensuge (N5) are located in imperial palaces, while the other five libraries are located in imperial gardens and

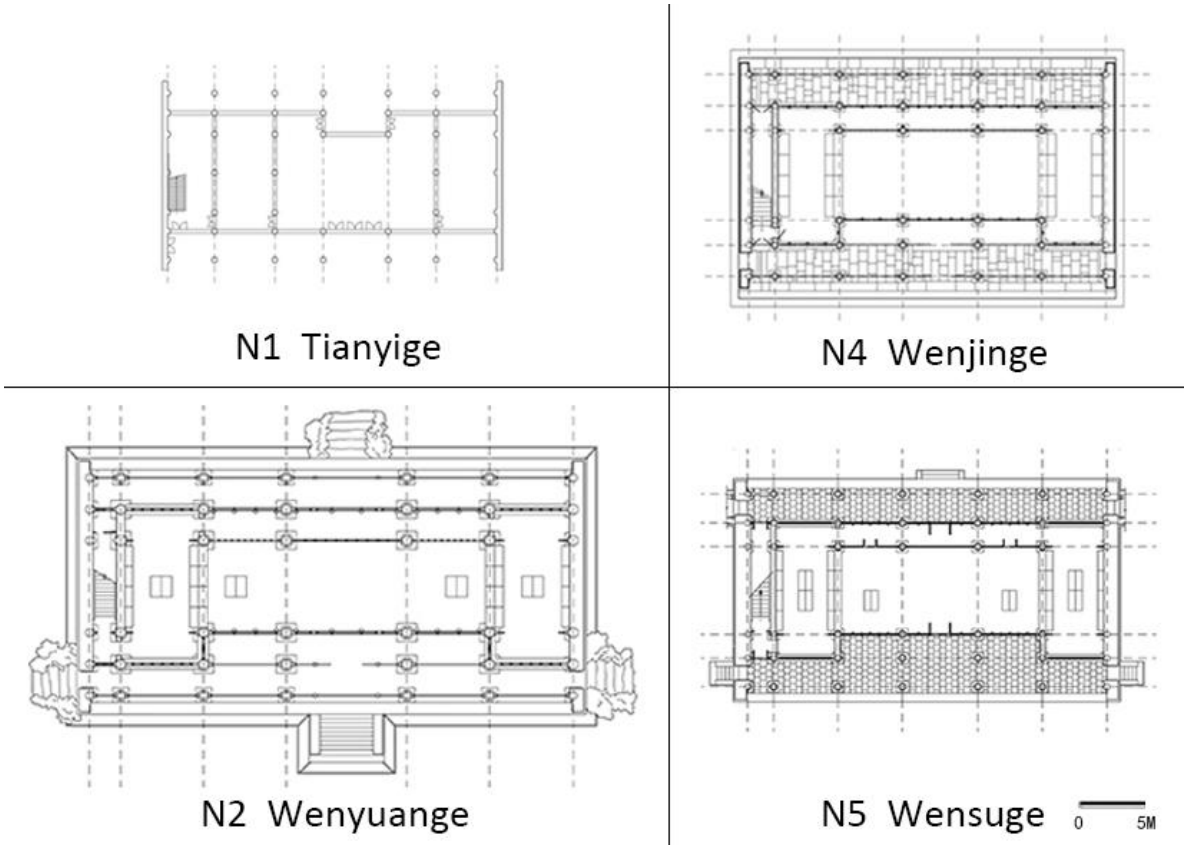


Figure 4-3-3. Ground Floor Plan of N1, N2, N4, N5.

Table 4-4-1. Overall Configuration of 8 Libraries.

No.	Object	Garden Types	Wall Types	Building	Stone Tablet Pavilion	Pavilion and Platform	Outdoor Platform	Water	Rockery	Towering Peak	Flower Bed
N1	Tianyige	Private	Semi-closed	1	None	2	○	○	○	○	○
N2	Wenyuange	Imperial	Semi-closed	1	1	None		○	○		
N3	Wenyuarnge	Imperial	Closed	2	1	2	○	○	○	○	
N4	Wenjinge	Imperial	Closed(Curved)	3	1	2	○	○	○	○	○
N5	Wensuge	Imperial	Closed	7	1	None	○				
N6	Wenzongge	Imperial	Open	1	1	None					
N7	Wenhuige	Imperial	Open	1	1	None	○	○	○		
N8	Wenlarnge	Imperial	Closed	3	2	2	○	○	○	○	

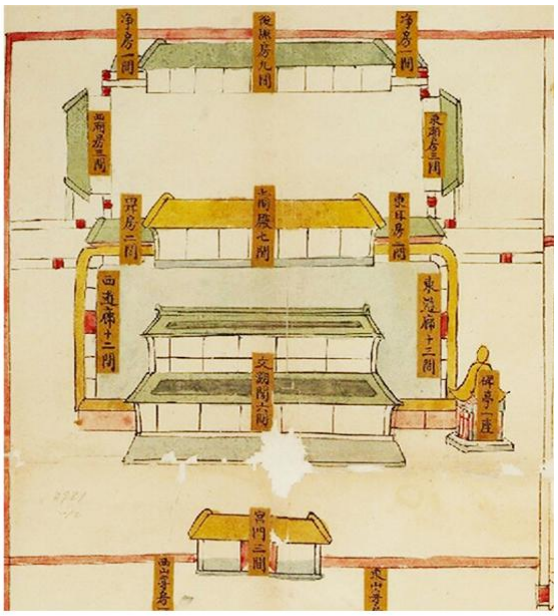
(○:Existing)

auxiliary palaces. Since Tianyige has the main characteristics of gardens in eastern China, the overall configuration of the seven libraries all imitated Tianyige to various extensions (Table 4-4-1).

4.4.1 Libraries in imperial palaces

Wenyuange (N2) is located at the bottom of Wenhuadian Group in the Forbidden City. With a relatively small site and solemn atmosphere of the surrounding architectures, it's quite difficult for Wenyuange to imitate the features of gardens in eastern China. In spite of this, a small pond in front of the library, a small rockwork behind the building and the surrounding trees all show the garden

N2 Wenyuange



N5 Wensuge

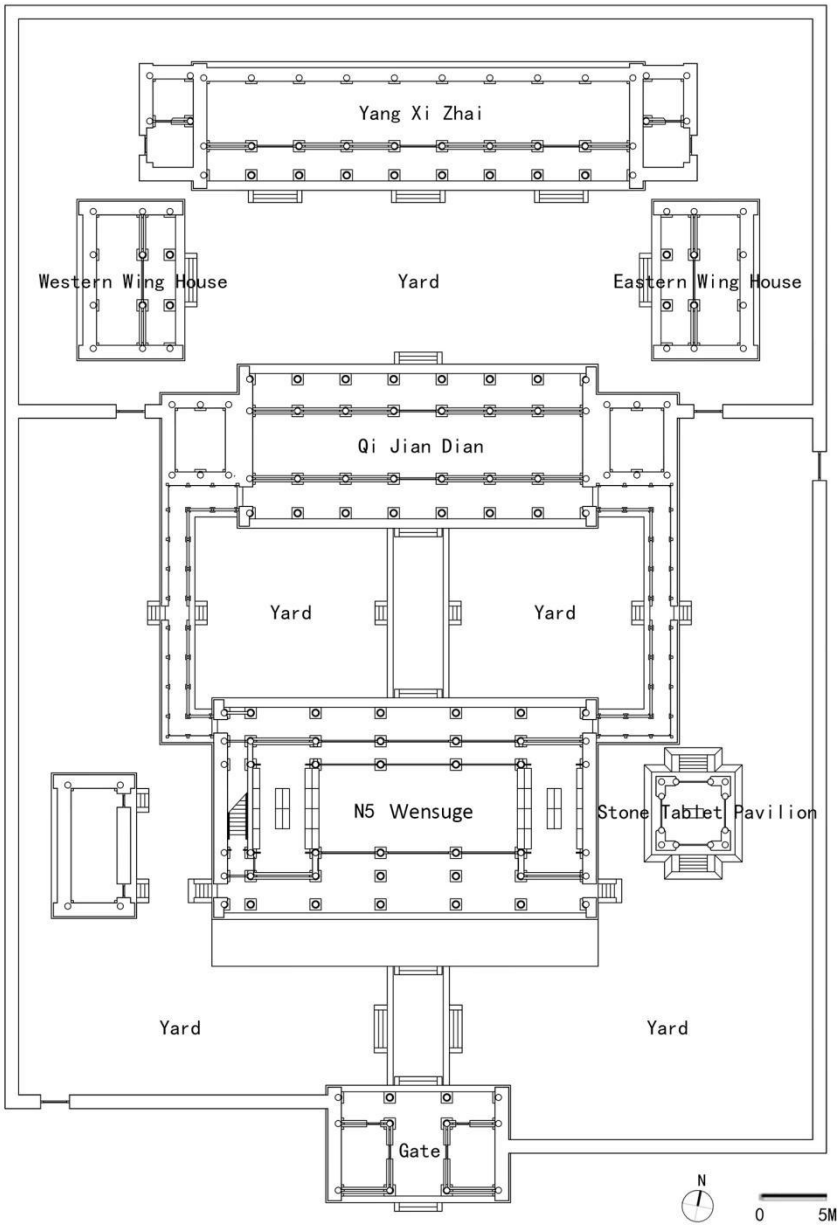


Figure 4-4-1 (Top). Overall Layout of N2 & N5. Data source: The Palace Museum and The First Historical Archives of China.

Figure 4-4-2 (Bottom). Site Plan of Wensuge (N5).

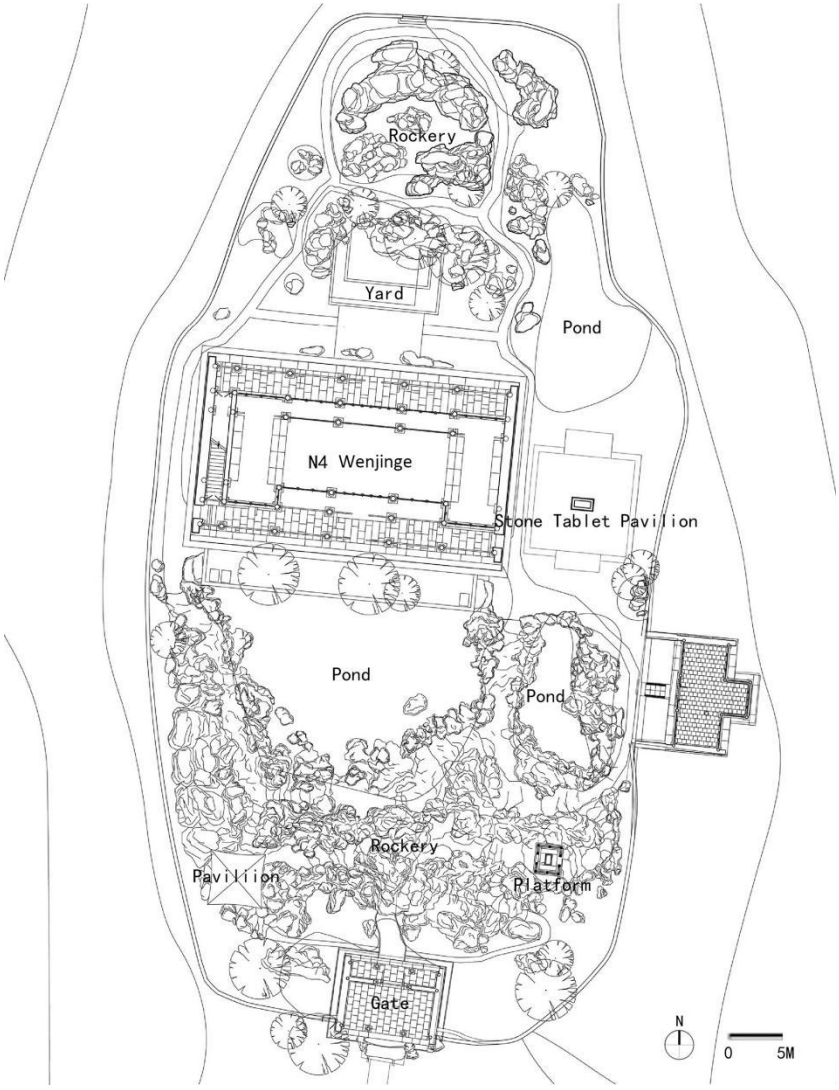


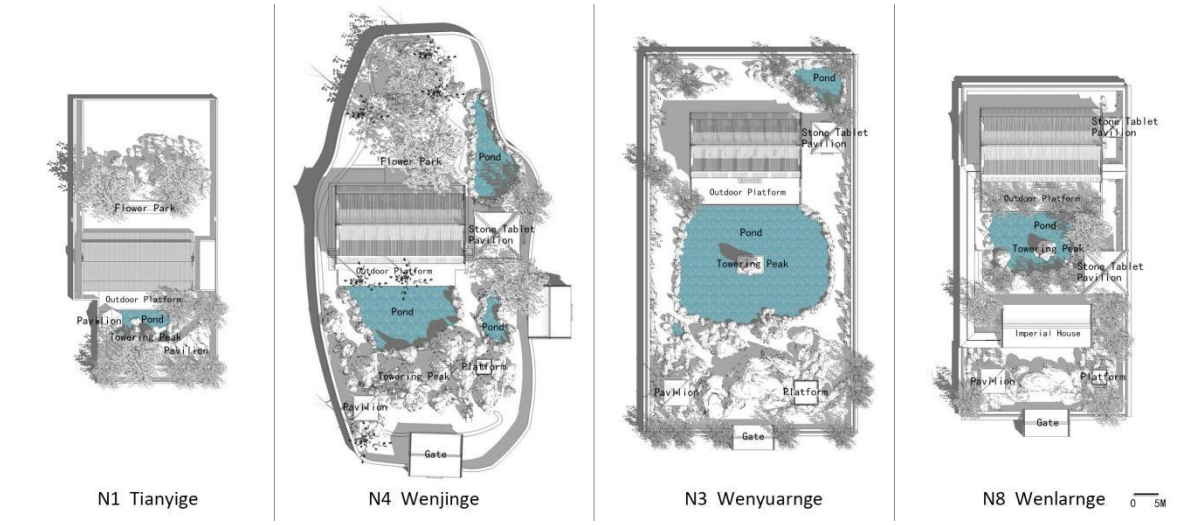
Figure 4-4-3. Site Plan of Wenjinge (N4). Data source: School of Architecture, Tianjin University.

features of Wenyuange without destroying the Wenhuadian Group. Although the Wenyuange Group isn't an independent yard, but the complete group still corresponds to the features of Tianyige Group (Figure 4-4-1).

Wensuge (N5) is located at Shenyang Imperial Palace (瀋陽故宮). Without a previous detailed planning, Shenyang Imperial Palace was built from the eastern part step by step, so there is no river system in the palace [13]. The result is that Wensuge is the only library without any pond and rockery around. The western part of the palace was all built around Wensuge, ensuring Wensuge a large site area and a relatively spacious distance between every two buildings. The Wensuge Group is a "three-*jin* (进)" courtyard (containing three yards in line) and compromises with the solemn atmosphere in the palace (Figure 4-4-2).

4.4.2 Libraries in imperial gardens and auxiliary palaces

The existing libraries in imperial gardens and auxiliary palaces are Wenjinge (N4) in the Mountain Resort （避暑山莊） and Wenlarnge (N8) in Hangzhou. The overall layout of Wenjinge is closest to that of Tianyige among the seven libraries (Figure 4-4-3). For one reason, the building of Wenjinge was the earliest among the seven libraries, without any other reference but Tianyige. For another reason, the



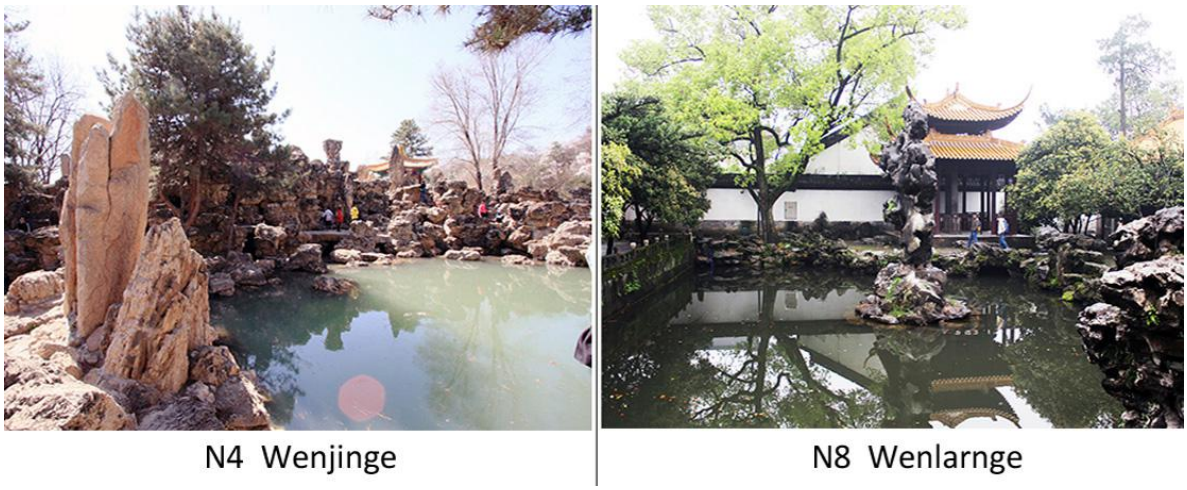


Figure 4-4-4 (Top). Overall Configuration Comparison of N1, N3, N4, N8.

Figure 4-4-5 (Bottom). Ponds of Wenjinge (N4) and Wenlarnge (N8).

general features of Tianyige can all be found in Wenjinge, such as the architectural configuration, platform, stone tablet pavilion, pond, rockery and flower bed.

Wenjinge (N4) was built in a small island in the river, with a curved courtyard wall following the edge of the island, which is unique among the seven libraries. This curved courtyard wall not only adapts to the unique local conditions but also embodies its free layout style, corresponding with the overall layout of the Mountain Resort.

Except for Wenyuange (N2) and Wenzongge (N6), other five libraries all have a small platform in front of the building. Among these five libraries, the platforms of four libraries link the library with the pond as a transition space, besides Wensuge (N5), which has no pond. The platform of Wenjinge is closest to Tianyige in size and scale (Figure 4-4-4).

Among the seven libraries, Wenjinge (N4), Wenyuarnge (N3) and Wenlarnge (N8) contain a pond in front of the building. Other three libraries are all close to a river nearby, which are Wenyuange (N2), Wenzongge (N6) and Wenhuige (N7). Only Wensuge (N5) has no water around.

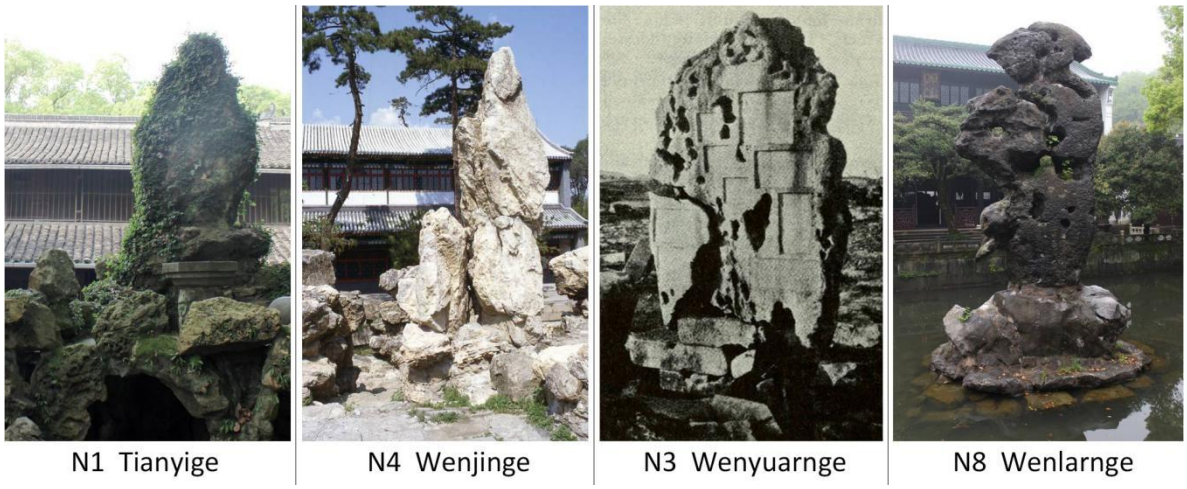


Figure 4-4-6 (Top). Rockery of Wenjinge (N4) and Wenlarnge (N8).

Figure 4-4-7 (Bottom). Towering Peak Comparison of N1, N3, N4, N8.

The pond of Wenjinge (N4) is also close to Tianyige (Figure 4-4-5). Firstly, the size of the pond in Wenjinge is close to the scale of Tianyige. Secondly, Tianyige pond is separated by the rockery, embodying the Chinese classical garden layout of "A Lake With three Hills (蓬萊瀛洲方丈)" as immortals' islands [14]. Wenjinge has three ponds which are close to each other and similar in scale. Wenyuarnge (N3) also has three ponds, but they are far from each other and distinct in scale. While Wenlarnge (N8) has only one pond.

A spectacular rockery stands in the south side of the Wenjinge (N4) pond, which is the biggest rockery among the seven libraries (Figure 4-4-6). Wenlarnge (N8) rockery is in the front patio, which is not the same patio with the library. Although Wenlarnge rockery is small, it also has lower caves and upper platforms, which is similar to Wenjinge and Wenyuarnge (N3). A poem of Emperor Qianlong expressed his slender displeasure against the Wenlarnge rockery for blocking the view of the West Lake [15].

A towering peak stands in the central rockery against the library in Tianyige as the highest focus of the garden, which also blocks the view of the building from the rockery as an implicit aesthetic appeal. Wenjinge (N4) also adopted this unique

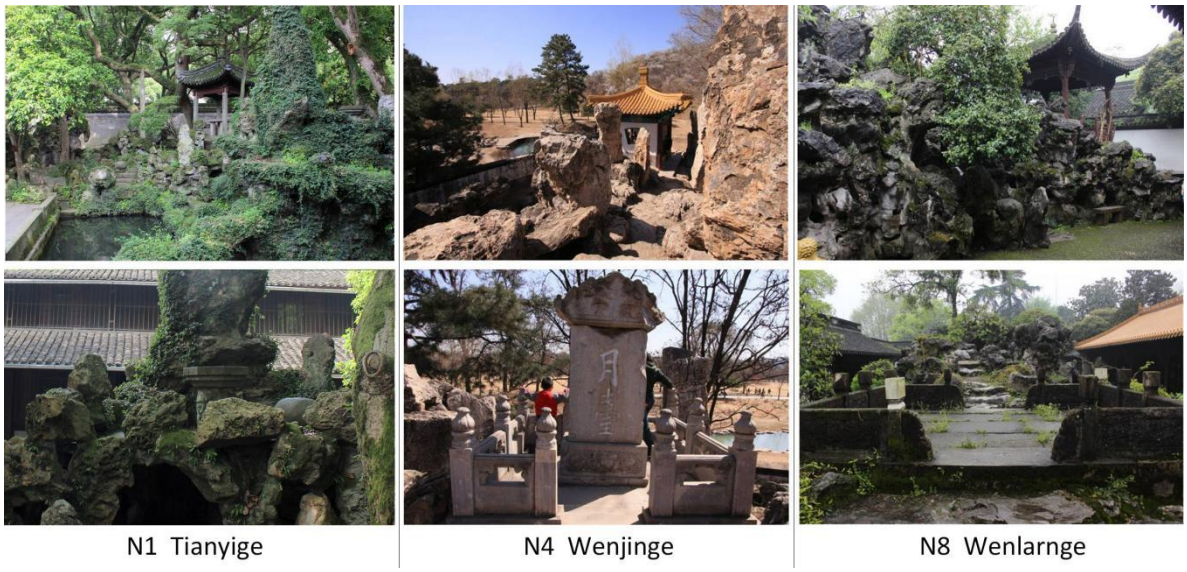


Figure 4-4-8. Pavilions and Platforms Comparison of N1, N4, N8.

technique. In Wenyuarnge (N3) the towering peak was placed in the lake, which is an initiative advance among the seven libraries. The approach of Wenyuarnge peak was later adopted by Wenlarnge (N8) (Figure 4-4-7).

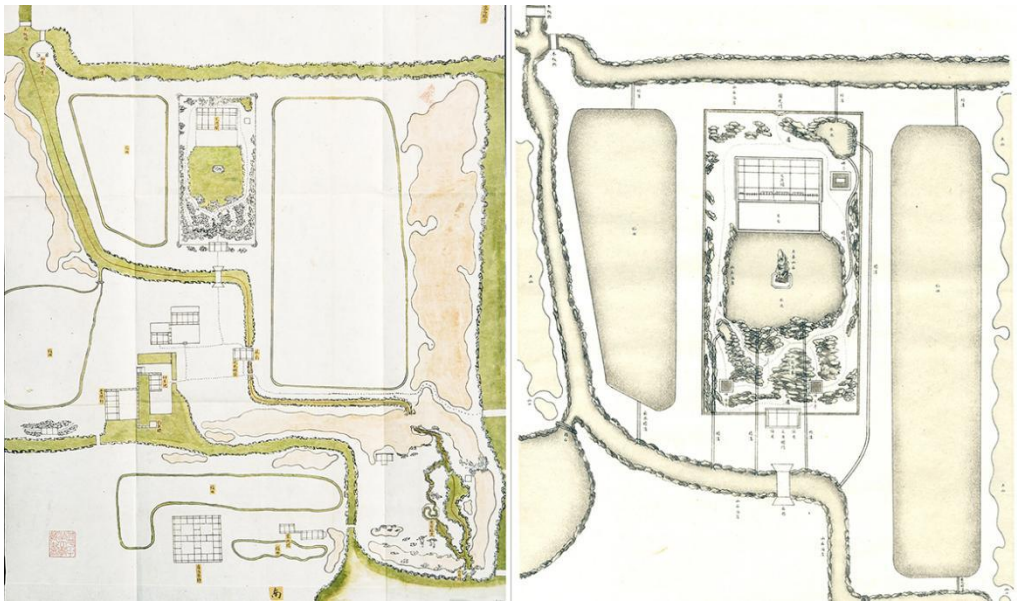
In Tianyige a pavilion and a platform were originally built on the rockery as main view points. This approach was firstly adopted in Wenjinge (N4). In addition, Wenjinge also imitated the configuration of Baojinzhai (寶晉齋), a private villa of the celebrated calligrapher Mi Fu (米芾) of Song Dynasty (960-1276 A.D.). The other libraries all imitated this layout with subtle changes, which can be seen in Wenlarnge nowadays (N8) (Figure 4-4-8).

Wenjinge (N4) has another imitation of Tianyige which is the flower bed and small rockery behind the building. This is also unique in Wenjinge as an evidence of its earliest building fact.

4.5 Restoration of Three Destroyed Libraries

The destroyed three libraries are a major obstacle for the research of the seven libraries that cannot be ignored. Historical relics, literature and images are the remaining research data.

The relic of Wenyuarnge (N3) has been lying in the Ruins of Old Summer Palace (圓明園) for nearly 150 years until now. After recent rediscovery and conservation, the relic of Wenyuarnge has regained its historical value for research. Fortunately, the site map and design map (Figure 4-5-1) of Wenyuarnge were found in the manuscripts of Yangshi Lei (樣式雷) Family, an architect family in charge of imperial architecture planning and design for more than 200 years in Qing Dynasty, which are very helpful in the restoration research [16]. Throughout restoration (Figure 4-5-2), Wenyuarnge was found to be similar with Wenjinge (N4) in the pond, rockery, pavilion and platform, but it originally set a towering peak in the pond which was imitated by Wenlarnge (N8).



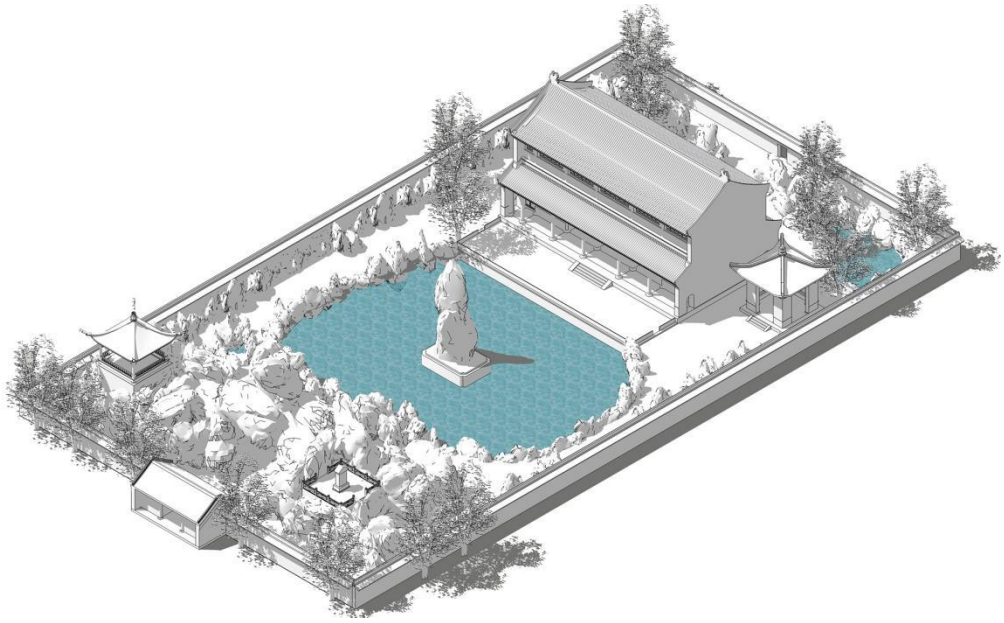
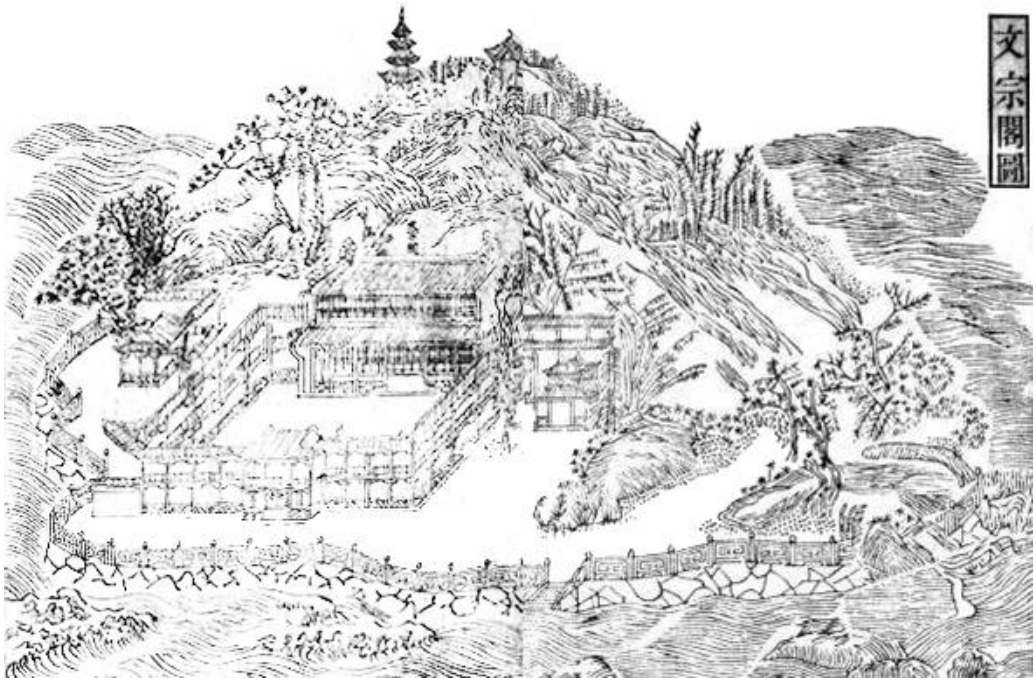


Figure 4-5-1 (Top). Wenyuarnge Manuscripts of Yangshi Lei. Data source: National Library of China.

Figure 4-5-2 (Bottom). Restoration Model of Wenyuarnge (N3).

Although Wenzongge (N6) and Wenhuige (N7) only survived for sixty or seventy years in the world, valuable historical literature and images still exist to this day. Wenzongge (N6) was built in Jinshan (金山) Mountain, Zhenjiang, Jiangsu. The original site of Wenzongge was nowhere to be found on account of the changes of the land and rivers near Jinshan Mountain. Jinshan Temple (金山寺) was rebuilt many times, and the existing main buildings of Jinshan Temple can help locate the general position of Wenzongge. The *Wenzongge Picture* (*Wen zong ge tu* 文宗閣圖) can be found in local records (Figure 4-5-3) [17]. According to the records, Wenzongge was surrounded by double floor corridors, facing the water and back to cliffs. The unique site and the precipitous view embodied its freedom of design and the characteristics of adapting to local conditions (Figure 4-5-4) [18].



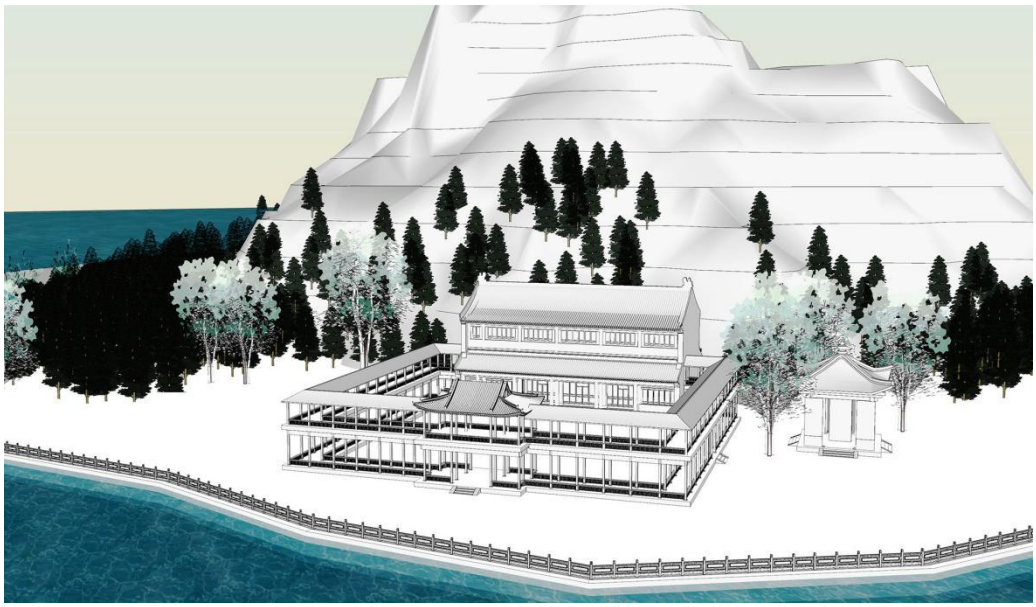


Figure 4-5-3 (Top). *Wenzongge Picture.* Data source: *Chong xiu liang huai yan fa zhi* (1802).

Figure 4-5-4 (Bottom). Restoration Model of Wenzongge (N6).

Wenhuige (N7) was located in Grand Hall Palace (大觀堂行宮), on the west side of Tianning Temple (天寧寺) in Yangzhou, Jiangsu [19–20]. Blending into the surrounding trees and rivers, Wenhuige had no courtyard wall like Wenzongge, different with other libraries according to the *Reading in Wenhuige* (*Wen hui du shu* 文滙讀書) (Figure 4-5-5) [21]. One of the most distinctive features is that the usual pond in front of the building was replaced by a swastika river throughout the imperial garden. Another feature is that the stone tablet pavilion was not placed on the east side of the library as the other libraries, but was placed facing the building, on the other side of the swastika river. Due to the destruction of Grand Hall Palace, only part of Wenhuige can be restored (Figure 4-5-6).

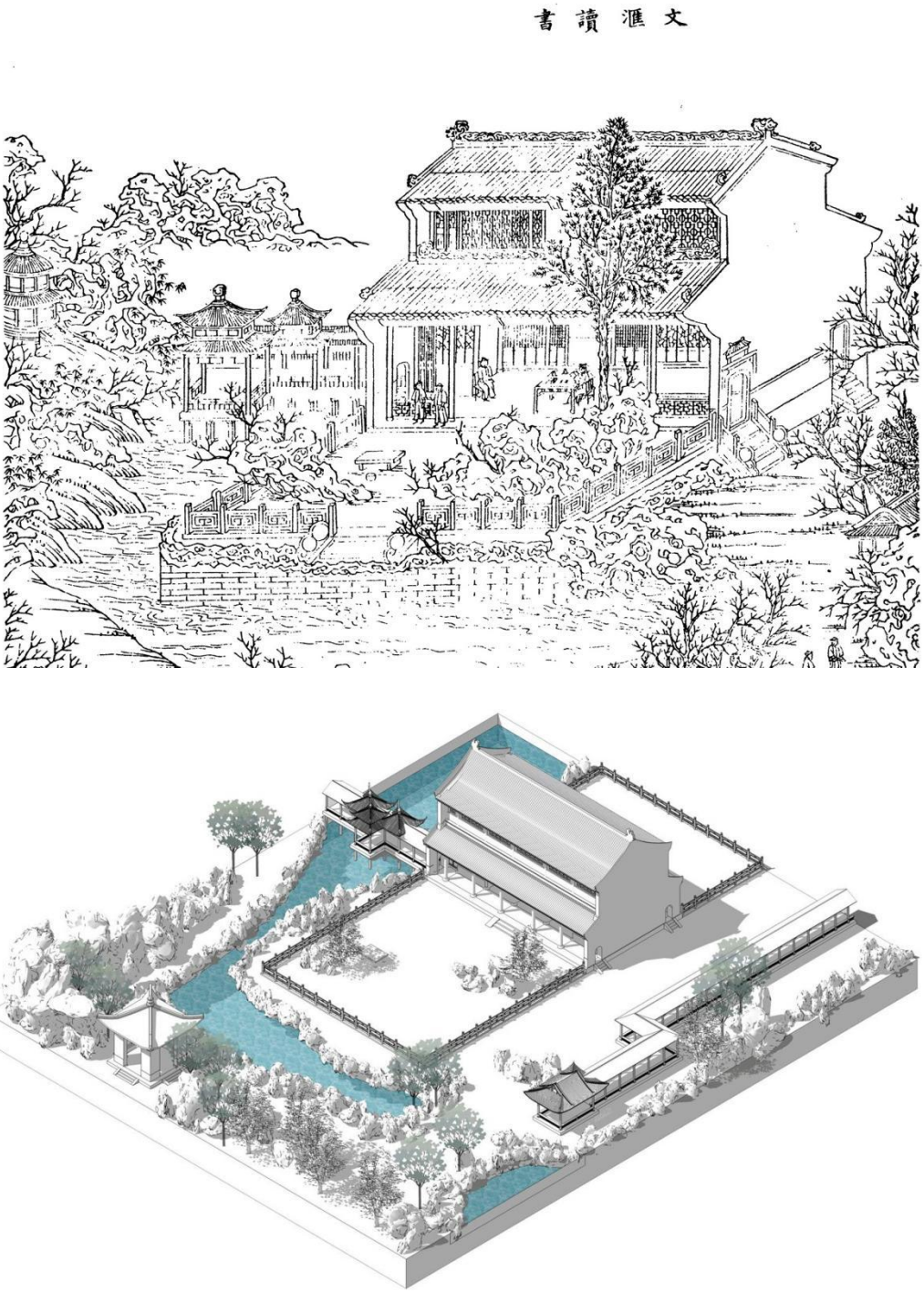


Figure 4-5-5 (Top). *Reading in Wenhuige.* Data source: *Hong xue yin yuan tu ji* (1894).

Figure 4-5-6 (Bottom). Restoration Model of Wenhuige (N7).

4.6 Conclusions

This chapter fully articulates the imitation of Tianyige among the seven libraries of *Siku quanshu*. Firstly, by putting together Tianyige and the seven libraries and integrating the distributed previous research of these eight objects, this chapter has built a systematic structure from the perspective of imitation of imperial gardens in Qing Dynasty. Secondly, the comparison of architectures and gardens of Tianyige and the seven libraries is also the comparison of the south

gardens and north gardens, as well as the private gardens and imperial gardens, which can be in common with other traditional Chinese garden research. Thirdly, the restoration research of the three destroyed libraries based on the literature and field investigation is also an important and innovative achievement in this chapter .

Throughout the research of the seven libraries' imitation of Tianyige, conclusions can be summarized as follows.

(1)As the prototype of the seven libraries, the construction ideas, architectural configurations and overall layout of Tianyige were adopted by the seven libraries to various degrees. The book culture of Tianyige has had profound influences on the seven libraries and other ancient Chinese libraries.

(2)In terms of architectural configuration, the seven libraries adopted the main features of Tianyige like six-bay structure and two-floor appearance and had some initiative advances corresponding with the imperial ranks and atmosphere, such as a bigger size, a smaller end bay and three-floor inner space.

(3)The overall configuration of the seven libraries not only imitated the Tianyige but also distinguished the seven libraries with different values with the characteristics of adapting to local conditions. The garden spaces of the seven libraries were also deeply influenced by Tianyige Garden with southern private garden features.

(4)The restoration of the destroyed three libraries is mainly based on the traditional literature and field investigation. Some rarely known features of the destroyed three libraries were revealed throughout the restoration, such as many close parallels between the Wenyuarnge (N3) and Wenjinge (N4), the unique site location and the precipitous landscape of Wenzongge (N6) and the main feature of fitting the environment of Wenhuige (N7) and so on.

The compilation of *Siku quanshu* and the construction of seven imperial libraries was a big event in the ancient Chinese library history, marking the peak of ancient China library course. The four existing libraries of *Siku quanshu* are the best-known imperial libraries that have survived to this day. Tianyige is the oldest existing private library in China as well as one of the three oldest family libraries in the world. Overall speaking, the seven libraries' imitation of Tianyige is a successful case in imitation of imperial gardens in Qing Dynasty and has become one of the highest peaks in the construction of imperial gardens in Qing Dynasty.

As for the future work, the further preservation of current libraries and the study and restoration of the destroyed libraries can be of great importance. Furthermore, the cultural value of Tianyige and the seven libraries is also worthy of attention. The book collecting history and its spiritual values should be well improved and developed towards the world.

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CHAPTER 5
VISITOR SHORT-STAY IN TIANYIGE MUSEUM GARDENS

5.1 Introduction

Chapter 5 & 6 study the visitor stay distribution and spatial influencing factors in Tianyige garden. Chapter 5 is the study on visitor short-stay behavior (less than one minute), examining the attractiveness of spatial attributes to visitors. Chapter 6 is the study on visitor long-stay behavior (more than one minute), focusing on the influencing factors on visitor stay duration and the attractiveness and pleasantness factors of the garden space.

5.1.1 Background

There is a long tradition of visiting gardens in China. In ancient times, Chinese gardens satisfied people's desire for natural landscapes while serving various recreational and spiritual functions. While imperial and private gardens were built to entertain the elite [1], temple gardens [2] and suburban landscape gardens [3] were easily accessible by the public. However, following the Taiping Rebellion in the mid-nineteenth century, many traditional Chinese gardens gradually declined and fell into disrepair [4]. Scholars began mapping and documenting existing gardens from the first half of the twentieth century [5–8]. These gardens were gradually restored and opened to the public since the foundation of the People's Republic of China in 1949. Contemporary practices of Chinese gardens, such as people's parks, began flourishing with the nationwide greening movement from 1956 [9–11], and the design of many public and cultural buildings incorporated elements and features of Chinese gardens [12–14]. With the flourishing garden culture, Chinese gardens regained their popularity, recently emerging as a significant feature of Chinese tourism and urban life.

5.1.2 Literature review

Traditional Chinese gardens now face the dual challenge of opening to the public while protecting and conserving the garden and its history. In the realm of heritage conservation, some studies on Chinese gardens have traced the historical development of gardens and evaluated their current conservation status [15–17].

Studies on world garden heritage have also paid attention to the development and utilization of garden heritage, such as contemporary landscape and public space design [18–20]. Research on visiting gardens, parks, and green spaces can be divided into two categories: visitor experience or preference, and visitor behavior.

Chinese gardens offer a unique concept of the garden experience [21]. The final chapter of Yuan Ye—the seventeenth-century treatise on Chinese garden design—which deals with "borrowed scenery," provides the best description of visiting a Chinese garden in great detail with imaginative and poetic language [22–23]. Modern scholars like Tong Jun and Chen Congzhou have examined various aspects of the garden experience. Tong emphasized the importance of the garden owner's taste [5], and Chen juxtaposed the song lyrics with garden photography [24–25]. More broadly, research on garden experience has examined a variety of factors, including visual [26–27], auditory [28], walking and sensory [29–30], literary and associative [31], and other physiological and psychological responses [32]. Some studies have also examined experiences in Japanese gardens [33–34]. Recently, space syntax theory has been applied in the analysis of complex configurations of garden space and experience [30,35–37].

Research on visitor preference has been widely applied to evaluate landscapes, parks, and green spaces. Research on visual preference includes landscapes and spatial elements [38–39], as well as the aesthetic preferences [40] and the physiological and psychological responses of participants [41–42]. Scholars have also examined preferences for types of vegetation [43–44] and trees [45–46] in urban parks and green spaces.

Visitor study focuses on recording and analyzing visitor behavior to understand and capture the psychological activities and visiting habits of visitors to, in turn, improve the spatial composition, display layout, and tour route design. Quantitative visitor studies have employed timing and tracking methods [47], as well as automated sensor-based positioning and tracking methods [48]. Visitor behavior studies have investigated a variety of factors, including viewing [49], stopping [50], walking [51], photographing [52–53], facial expressions [54], and external influence factors [55]. Meanwhile, environmental behavior study mainly deals with human behaviors, psychological motivations, and environmental influencing factors in a particular environment to improve environmental and behavioral design [56]. Several scholars have investigated the use of public spaces in cities [57–59], while others have explored visitor distribution and utilization in forest and urban parks [60–62]. Researchers have also identified the correlations between visitor behavior and environmental factors [63–64], as well as the behaviors of the elderly [65–66] and low-income groups [67].

Current studies on Chinese gardens have primarily focused on tracing their

historical development, as well as the spatial composition and artistic conceptions of gardens. However, few studies have explored the utilization of Chinese gardens as public spaces for tourism and recreation [68–70]. Moreover, as urban parks and green spaces become more popular for recreation [71–72], Chinese gardens may become the preferred spaces of traditional Chinese society [18]. This preference has triggered the burgeoning development of Chinese garden research and the construction practices, underscoring the value of the research.

5.1.3 Research aim and objective

The overall aim of the chapter was to identify the openness of the garden space in Ningbo Tianyige Museum and its attractiveness to visitors. The openness of garden space primarily depends on spatial attributes such as dimension, form, scale, accessibility, visibility, functions, and facilities, and it can be assessed based on the way in which visitors utilize the garden space [20]. The analyses focused on the following three research questions:

1. What is the spatial characteristics of Tianyige Museum gardens with different spatial types?
2. How are the visitor stays distributed in the Tianyige Museum gardens?
3. Which spatial attributes have an impact on the visitor stay preferences?

Therefore, the main objectives of this chapter were to (1) analyze the spatial elements and composition of Tianyige Museum gardens; (2) quantitatively analyze the distribution characteristics of visitor stay; and (3) examine the correlations between spatial attributes and visitor stay distribution. By exploring the new relationship between Chinese gardens and modern tourism, this chapter provides useful insights and suggestions for the planning and management of Chinese garden tourism. The findings of this chapter may also contribute to the utilization and development of both Chinese and East Asian gardens.

5.1.4 Research structure

This chapter is structured in five sections. Following this Section 1 introduction, Section 2 introduces the study area, identifies the spatial attributes based on measurements and configurational calculations, and defines the methodology of the study, including the data collection and data analysis methods. Section 3 presents the investigation results of visitor stay distribution and the analyses of correlations between spatial attributes and visitor stay distribution in detail. Section 4 concludes the main findings and discusses spatial characteristics of Tianyige Museum gardens and influencing factors on visitor stay. Finally, the conclusions, suggestions, limitations and future research are presented in Section 5 (Figure 5-1-1).

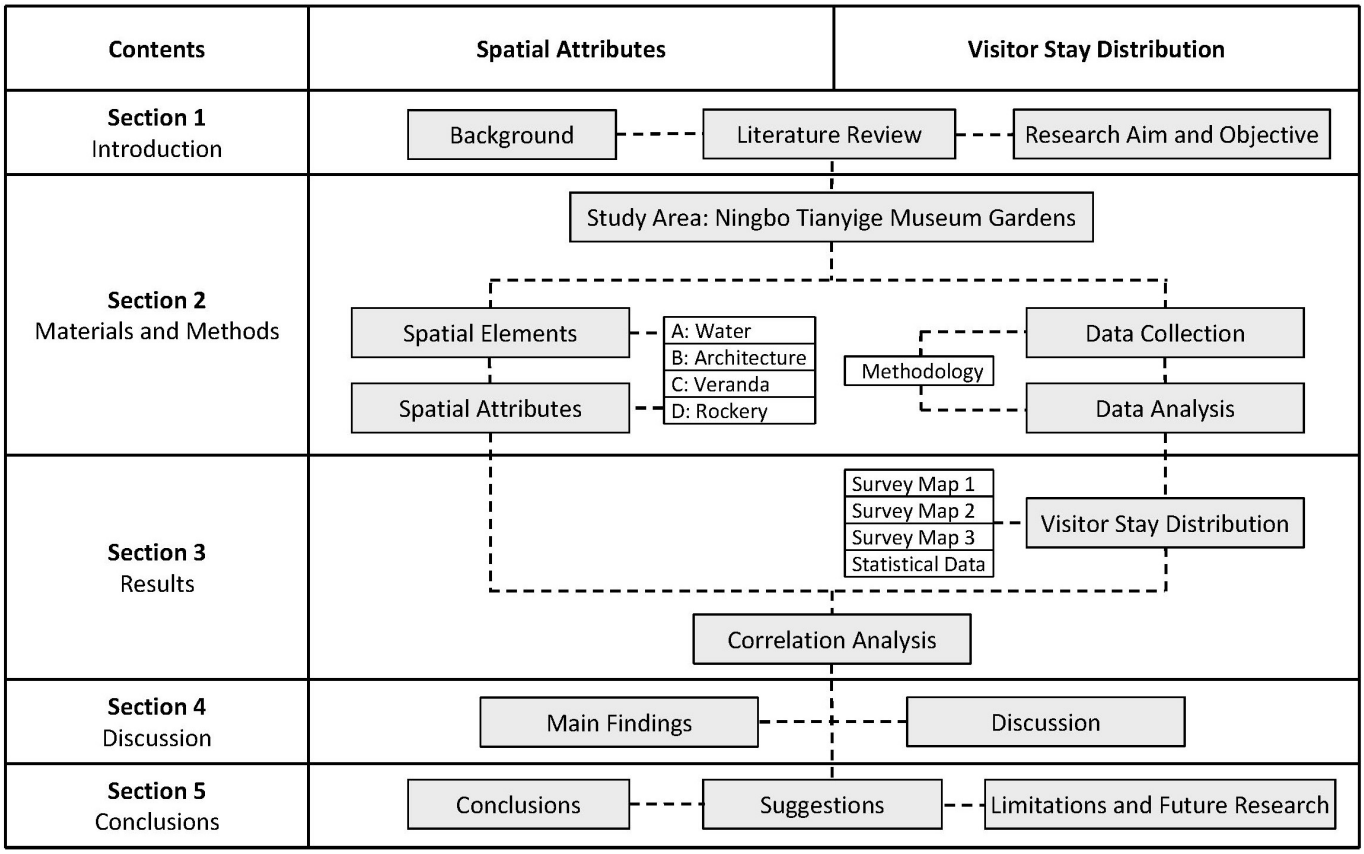


Figure 5-1-1. Research structure and framework.

5.2 Materials and Methods

5.2.1 Study area: Ningbo Tianyige Museum gardens

Tianyige Museum is located in Zhengjiang, Ningbo, China. Featuring the renowned Tianyige (Tianyi Pavilion), Tianyige Museum is dedicated to the art of book collecting and occupies an area of 34,000 m^2. Originally built as the private library of Fan Qin during the Ming Dynasty (1368–1644), Tianyige is now the oldest private library in China.

Figure 5-2-1 presents the site plan of Tianyige Museum. The northern part of the museum is home to the former residence of the Fan family, Tianyige group, and new library; the central part of the museum contains the East Garden and South Garden; while the southern part of the museum contains Chen Ancestral Hall, Qin Ancestral Hall, and the Painting and Calligraphy Gallery. The garden area of the Tianyige Museum (hereinafter, Tianyige garden), which comprises both the East and South Garden, constitutes the research objects of this chapter. Although originally restored in 1959, the East Garden was redesigned several times and finally reconstructed between 1983 and 1986 under the supervision of designer Chen Congzhou [73]. The South Garden was built west of East Garden in 1996, and it was designed as a courtyard with the ancient libraries of the Shuibei Pavilion and Baojing Hall relocated to South Garden for protection [74].

Chen Congzhou, the designer of East Garden, is a famous twentieth-century Chinese architecture and garden scholar [75–76]. Chen Congzhou began studying Chinese gardens in the 1950s and subsequently participated in the restoration of

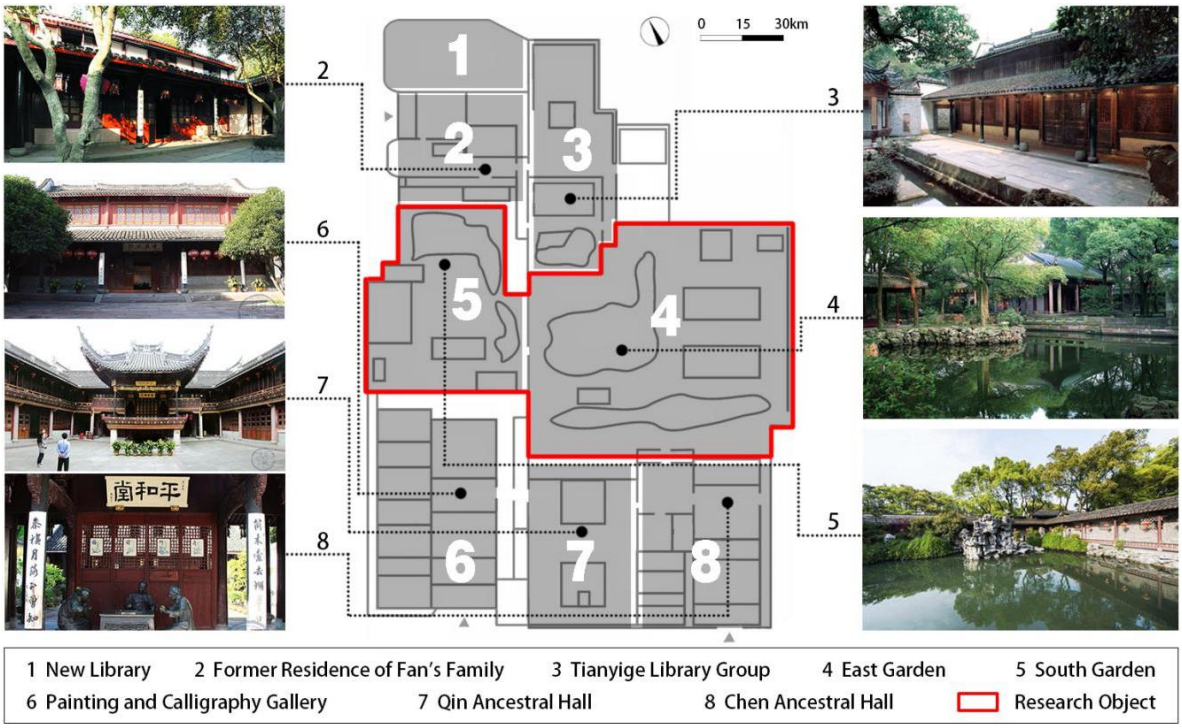


Figure 5-2-1. Plan of Ningbo Tianyige Museum composed of eight architecture and garden groups. The research object Tianyige garden includes East Garden (4) and South Garden (5).

traditional gardens of Suzhou, Yangzhou, and Shanghai in Southeast China. Over the next several decades, he devoted himself to the investigation, research, restoration, and construction of Chinese gardens. Among his garden practices, the most famous are the restoration of Yu Garden in Shanghai, the design of Nan Garden in Kunming, and the reconstruction of Shuihui Garden (Water Painting Garden) in Rugao, Jiangsu. Chen Congzhou had visited Tianyige Museum many times, and the East Garden was built under his careful guidance and supervision from 1983 to 1986 (Figure 5-2-2). However, compared with his other garden practices, there are relatively few studies on the East Garden.

Several factors influenced the selection of Tianyige garden as this chapter's research object. First, Tianyige garden was designed following the classical style of the Tianyige group in the Ming Dynasty, and its scale is similar to that of other Jiangnan gardens — that is, gardens in Southeast China. Compared with other Jiangnan gardens, there are few studies on Tianyige garden. Second, as it is not a historical heritage garden, Tianyige garden is more open in terms of management, and visitors can access the whole garden. Third, unlike the crowded visitor flow of famous gardens in Suzhou, the visitor flow of Tianyige garden is relatively moderate, which is in line with the garden capacity. Apart from ensuring a better visiting experience, a moderate visitor flow could provide reliable investigation data.

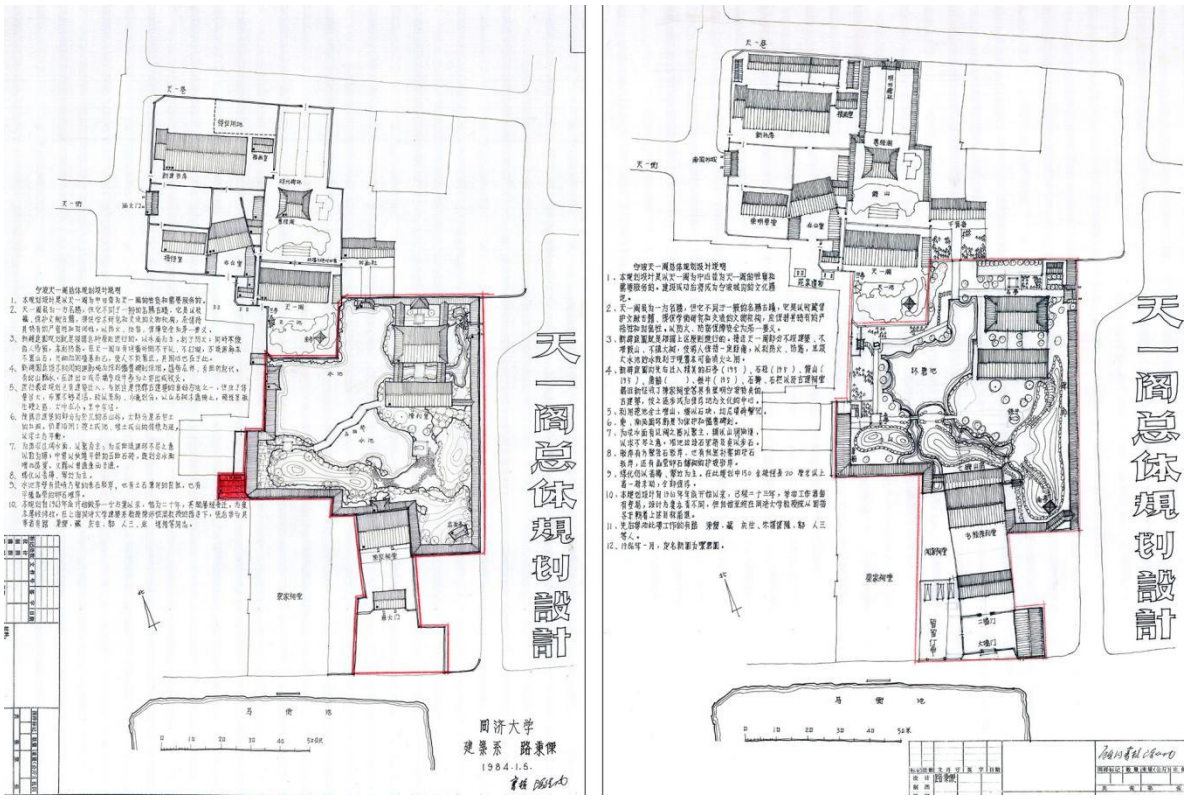


Figure 5-2-2. Design manuscripts of East Garden by Lu Bingjie and Chen Congzhou of Tongji University in 1984. Illustrations by courtesy of Tianyige Museum. Source: Tianyige Museum.

5.2.2 Spatial analysis of the garden

In Figure 5-2-3, the main garden elements are marked with four different legends, and all buildings and entrances are sequenced from 1 to 21. The triangle symbols mark the main entrances of the two gardens. Regarding the four legends, the blue legend shows the pond or water, which occupies a large portion of the garden; the purple legend represents architecture and pavilions; the green legend marks the rockery in the East Garden; and the red legend marks the veranda, which protects and exhibits stone tablets in the courtyard wall.

In regard to the numbers, Numbers 4, 5, 16, 17, and 18 are historical buildings, which were relocated to Tianyige Museum from other places in Ningbo for protection. Numbers 4 and 17 are currently used to exhibit ancient inscriptions and local chronicles. Numbers 5 and 18 are souvenir shops providing a space for short breaks. Number 16 is used as a academic studio and is rarely open to the public. Numbers 2 and 9 are two larger stone structures known as A Hundred Goose Pavilion and Eight Lion Pavilion, while Numbers 10, 11, and 19 are three small pavilions. Numbers 3 and 21 are lavatories. Figure 5-2-4 shows eight illustrations of the main elements in Tianyige garden.

In terms of planting, camphor trees were planted on the original site of the East Garden several decades before the garden was built and retained in the design of the East Garden [73]. In addition to water and architectural features, the South Garden is also decorated with trees. As the planting of trees was widely distributed across Tianyige garden, they are not marked on the site plan.

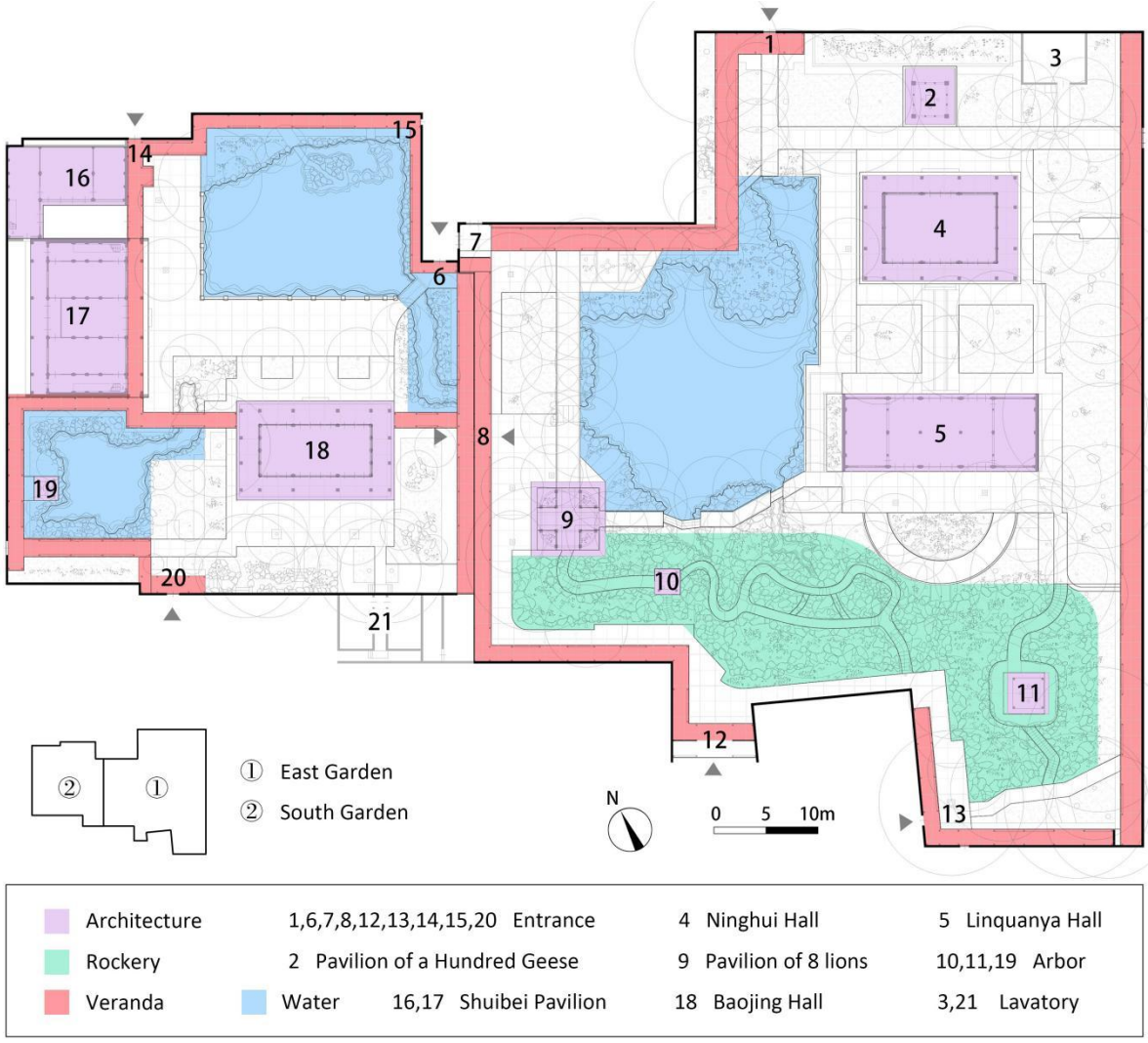


Figure 5-2-3. Plan of Tianyige garden with garden elements. Sequence number from 1 to 21.

Figure 5-2-4. Illustrations of main garden elements in Tianyige garden. Sequence numbers corresponding the elements in Figure 5-2-3.

Examination of the museum's main tour route revealed the following. After entering through the northwest museum gate—the main entrance—visitors pass through the northern part of the museum and enter the East Garden via entrance No. 1. Following the completion of their tour of the East Garden, visitors usually leave the garden via entrance No. 12 or 13 and enter the southern part of the museum. Later, the visitors return to the South Garden via entrance No. 20 and passed through entrance No. 6 or No. 14 to enter the northern part of the museum, where their tour ends. Additionally, entrance No. 8 is an important gate connecting the East Garden and South Garden.

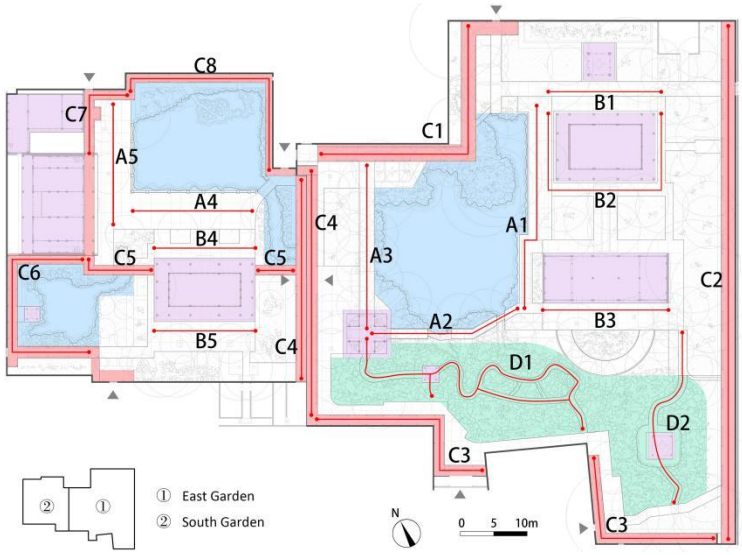
According to the four main spatial elements presented in Figure 5-2-5—namely, water, architecture, veranda, and rockery [18,77]—accessible open space was classified into four space types per the influence of the nearest elements presented in Figure 5-2-5. Accessible open space mainly refers to the outdoor pavements and semi-open spaces, such as that under eaves and in verandas. Inaccessible space—such as water, vegetation, and rockery hills—and the interior spaces of buildings are not included. The spatial diagrams of the four types illustrate the relationship between the space and its nearest spatial elements.

The research further divided the four types of space into smaller units according to the relationship between the space and the surrounding and visible elements in Table 5-2-1, thereby ensuring the internal unity of the spatial characteristics and elemental composition of each garden unit. Using the aforementioned approach, the research selected twenty space segments as the basic units of the garden space: A1–A5 for Type A: water space, B1–B5 for Type B: Architecture space, C1–C8 for Type C: Veranda space, and D1–D2 for Type D: Rockery space. Figure 5-2-6 shows the plans of the twenty garden units comprising Tianyige garden. Considering the width of the garden path typically ranges between 1.5 and 3 meters, each unit was divided into 1.5-meter square grids, so that visitor stay data could be recorded per grid of the garden unit [78].

5.2.3 Measurement attributes of the garden units

Spatial attributes were identified from existing research on gardens and urban parks [30,60], including measurement and configurational attributes, which were assumed to be related to tourist stay distribution. Scenery attributes like planting and trees are not included due to the high density and complex interactions of scenery in the small garden area.

Space type	Type A	Type B	Type C	Type D
Name	Waterside Space	Architecture Space	Veranda Space	Rockery Space
Main spatial elements				
Space plan				
Space Diagram	Space Water	Hall Space	Wall Space	Rockery Space



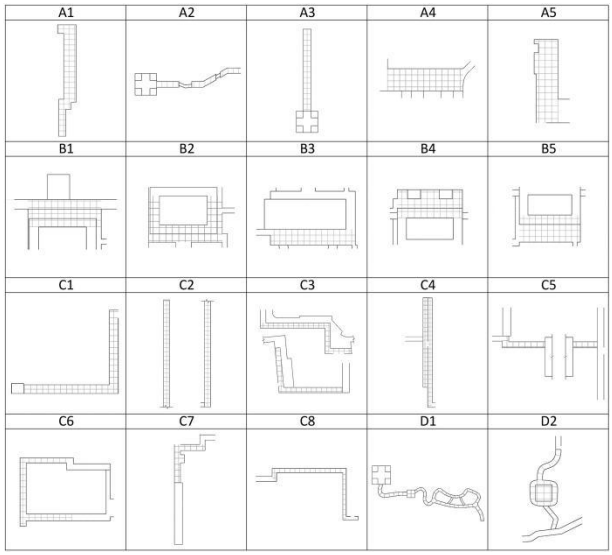


Figure 5-2-5 (Top). Classification of accessible open garden space according to the four main spatial elements, with spatial elements plans, space plans and diagrams.

Figure 5-2-6 (Bottom). Plans of twenty garden units of four types in Tianyige garden, with 1.5-meter square grids.

Table 5-2-1. Relationship with spatial elements of twenty garden units.

Type	Unit	Main element	Roof	Adjacent elements	Other visible elements
Type A	A1	Water	Fully open	Water, Architecture	Veranda, Rockery
	A2	Water	Fully open	Water, Rockery	Architecture, Veranda
	A3	Water	Fully open	Water, Grass	Veranda, Rockery
	A4	Water	Fully open	Water, Pavement	Architecture, Veranda
	A5	Water	Fully open	Water, Architecture	Veranda
Type B	B1	Architecture	Partial roof	Architecture, Grass	Veranda
	B2	Architecture	Partial roof	Architecture, Grass	Water, Veranda
	B3	Architecture	Partial roof	Architecture, Grass	Water, Veranda, Rockery
	B4	Architecture	Partial roof	Architecture, Pavement	Water, Veranda
	B5	Architecture	Partial roof	Architecture, Grass	Water, Veranda
Type C	C1	Veranda	Full roof	Wall, Water	Architecture, Rockery
	C2	Veranda	Full roof	Wall, Grass	Architecture, Rockery
	C3	Veranda	Full roof	Wall, Rockery	None
	C4	Veranda	Full roof	Wall, Pavement, Grass	Water, Architecture, Rockery
	C5	Veranda	Full roof	Water, Grass	Architecture
	C6	Veranda	Full roof	Wall, Water	Architecture
	C7	Veranda	Full roof	Wall, Pavement	Water, Architecture
	C8	Veranda	Full roof	Wall, Water	Architecture
Type D	D1	Rockery	Fully open	Rockery	Water, Architecture
	D2	Rockery	Fully open	Rockery	None

Measurement attributes refer to the basic parameters of the garden units, such as dimension, scale, and facility. The length, width, perimeter, enclosure length, enclosure height, and seating length were measured based on the garden plan. The length/width (L/W), width/height (D/H), and enclosure ratio (enclosure length/ perimeter) were calculated by the measured parameters. Among these attributes, the width and L/W determine whether the garden unit is a path or a domain—that is, whether the garden unit is a longitudinal and continuous path with a unidirectional axis or a centralized domain area characterized by multidirectional axes [79-81]. The D/H and enclosure ratios indicate the field of vision and sense of closure [82-83].

Seating in the garden can be divided into primary seating and supplementary or secondary seating [84]. Primary seating refers to fixed benches and chairs placed in carefully selected and demarcated locations, as well as in the veranda. Supplementary or secondary seating refers to various informal sitting opportunities, including stairways, pedestals, steps, and low railing, which integrate into the surrounding environments. Figure 5-2-7 shows the seating plan of Tianyige garden.

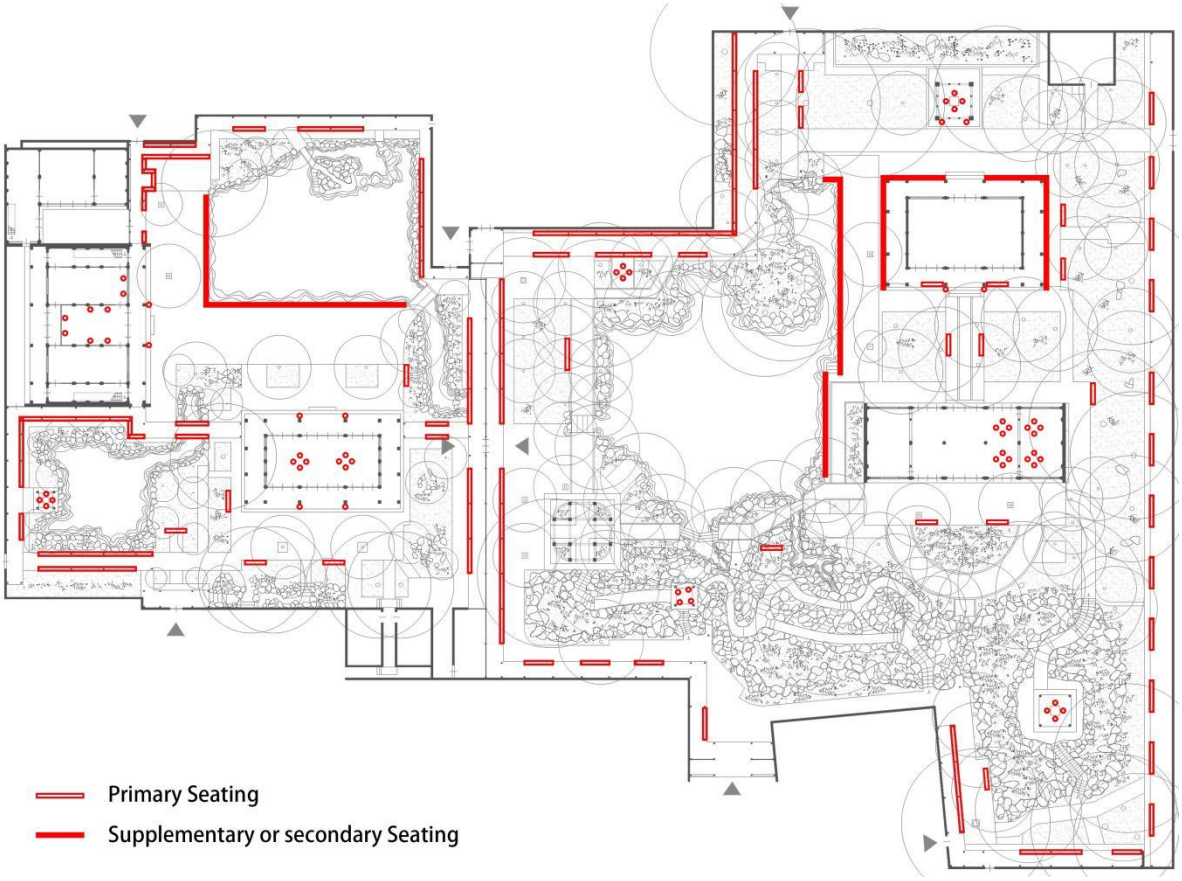


Figure 5-2-7. Seating plan of Tianyige garden, containing primary seating and supplementary or secondary seating.

Table 5-2-2. Measurement attributes of twenty garden units (in meters from length to seating).

Type	Unit	Length	Width	Perimeter	Enclosure length	Enclosure height	Seating	L/W	D/H	Enclosure ratio
Type A	A1	30.9	3.5	68.8	14.3	5.0	30.0	6.657	0.700	20.8%
	A2	20.2	1.5	43.4	20.2	3.5	2.0	13.467	0.429	46.5%
	A3	22.3	2.3	49.2	0	3.0	3.0	9.696	2.867	0
	A4	18.8	5.5	48.6	0	4.0	18.8	3.418	2.625	0
	A5	19.4	5.5	49.8	24.5	5.0	10.4	3.804	1.100	50.0%
Type B	B1	17.1	6.4	47.0	11.1	4.5	19.6	2.672	1.422	23.6%
	B2	17.1	4.1	69.4	24.7	4.5	25.6	4.171	0.911	35.6%
	B3	21.3	4.3	51.2	24.0	3.6	4.0	4.953	1.194	46.9%
	B4	15.3	6.7	44.0	11.0	4.0	2.0	2.284	1.675	25.0%
	B5	15.3	6.8	44.2	11.0	4.0	4.0	2.250	1.700	24.9%
Type C	C1	42.8	1.9	89.4	44.7	3.0	60.2	NA	0.633	50.0%
	C2	78.5	1.9	160.8	80.4	3.0	34.8	NA	0.633	50.0%
	C3	63.6	1.3	129.8	97.4	3.0	29.5	NA	0.433	75.0%
	C4	68.6	1.4	142.8	71.4	3.0	49.9	NA	0.467	50.0%
	C5	17.9	1.5	38.8	9.7	4.0	13.1	NA	1.350	25.0%
	C6	38.0	1.3	78.6	45.8	3.0	40.1	NA	0.433	58.3%
	C7	14.8	1.5	32.6	16.3	3.0	18.9	NA	0.500	50.0%
	C8	37.8	1.3	78.2	67.0	3.0	20.3	NA	0.433	85.7%
Type D	D1	67.0	0.9	135.8	NA	2	1.0	NA	0.500	80.0%
	D2	24.0	1.2	50.4	NA	2	1.0	NA	0.500	80.0%

Table 5-2-2 shows the measurement attributes of the twenty garden units. As the garden units in Types C and D appear to be paths, their L/W parameter was not calculated. Moreover, the D/H and enclosure ratio of Type D are estimated values due to the vegetation and rockeries.

5.2.4 Configurational attributes of the garden units

Configurational attributes refer to the relationship between one space and other spaces in the topological structure. The space syntax theory was adopted to calculate the configurational attributes of the garden units with the convex map [85].

In space syntax theory, connectivity is the number of connections of a given node to other nodes. Choice calculates how likely a given node may be passed through between all nodes in the system. It can be defined as the ratio between the number of shortest paths through node *i* and the total number of all shortest paths in the model, as shown in (1).

$$Choice_i = \frac{\{\#\, shortest\ paths\ through\ i\}}{\{\#\, all\ shortest\ paths\}} \tag{1}$$

Integration examines the degree to which a given node is integrated or segregated from the whole system (global integration) or a partial system comprising nodes a few steps away (local integration). It is measured by the Real Relative Asymmetry (RRA) [86] as follows (2 - 5):

$$Integratio\, n_i = \frac{1}{RRA_i} \tag{2}$$

$$RRA_i = 2\frac{MD_i - 1}{D_N(N-2)} \tag{3}$$

$$D_N = 2\frac{N\left(\log_2\left(\frac{N+2}{3}\right)-1\right)+1}{(N-1)(N-2)} \tag{4}$$

$$MD_i = \frac{D_i}{N-1} \tag{5}$$

where N is the total number of nodes, D_N is the normalization parameter, and MD (mean depth) is the average number of steps from a given node *i* to any other nodes.

The depth is the basic concept of a topological distance between nodes. The depth d_{ij} means the least number of syntactic steps needed to reach from space *i* to space *j*. The concept of depth can be extended to global depth, the sum of all depths from a given origin, as follows (6):

$$D_i = \sum_{j=1}^{N} d_{ij} \quad (6)$$

Consistent with global depth, the local depth only summarizes the distance between that particular node and the nodes within a search radius.

The convex space of the garden was divided using AutoCAD software. Spaces located several topological steps out of the garden in Tianyige Museum were included in the convex map considering the connections between the garden area and other parts of the museum. Using DepthMap 0.7.0 software, connection, choice, and integration with a radius of 3 and 5 were calculated in the convex map presented in Figure 5-2-8 (a, b, c, d). In Figure 5-2-8, the two nodes directly connected by a solid line indicate that the topological distance between them is 1; in other words, they can access each other in one step. Different colors represent the different ranges of the calculation values. The area of the Tianyige garden is demarcated by the dotted line.

Table 5-2-3 presents the calculation values of connectivity, choice, and integration of the twenty units based on the analysis of the convex map. When a garden unit is divided into multiple convex spaces, the average value of all the convex spaces is adopted as the calculation result.

Table 5-2-3. Configurational attributes of twenty garden units (calculations of convex map).

Type	Unit	Connectivity	Choice [Norm] R3	Choice [Norm] R5	Integration [HH] R3	Integration [HH] R5
Type A	A1	6	.229	.270	2.015	1.382
	A2	2	.152	.083	1.137	1.039
	A3	3	.163	.163	1.604	1.218
	A4	3	.166	.235	1.726	1.299
	A5	5	.226	.260	1.814	1.281
Type B	B1	7	.447	.333	2.195	1.328
	B2	6	.216	.183	1.896	1.311
	B3	5	.456	.287	1.924	1.242
	B4	6	.340	.316	1.917	1.350
	B5	5	.397	.258	1.793	1.206
Type C	C1	3	.258	.184	1.599	1.052
	C2	3	.144	.183	1.457	1.218
	C3	6	.302	.148	1.538	1.201
	C4	5	.141	.114	1.459	1.174
	C5	3	.136	.111	1.636	1.233
	C6	2	.167	.164	1.121	0.965
	C7	4	.176	.142	1.504	1.143
	C8	3	.128	.067	1.184	0.990
Type D	D1	3	.145	.115	1.325	1.031
	D2	2	.133	.071	1.062	1.004

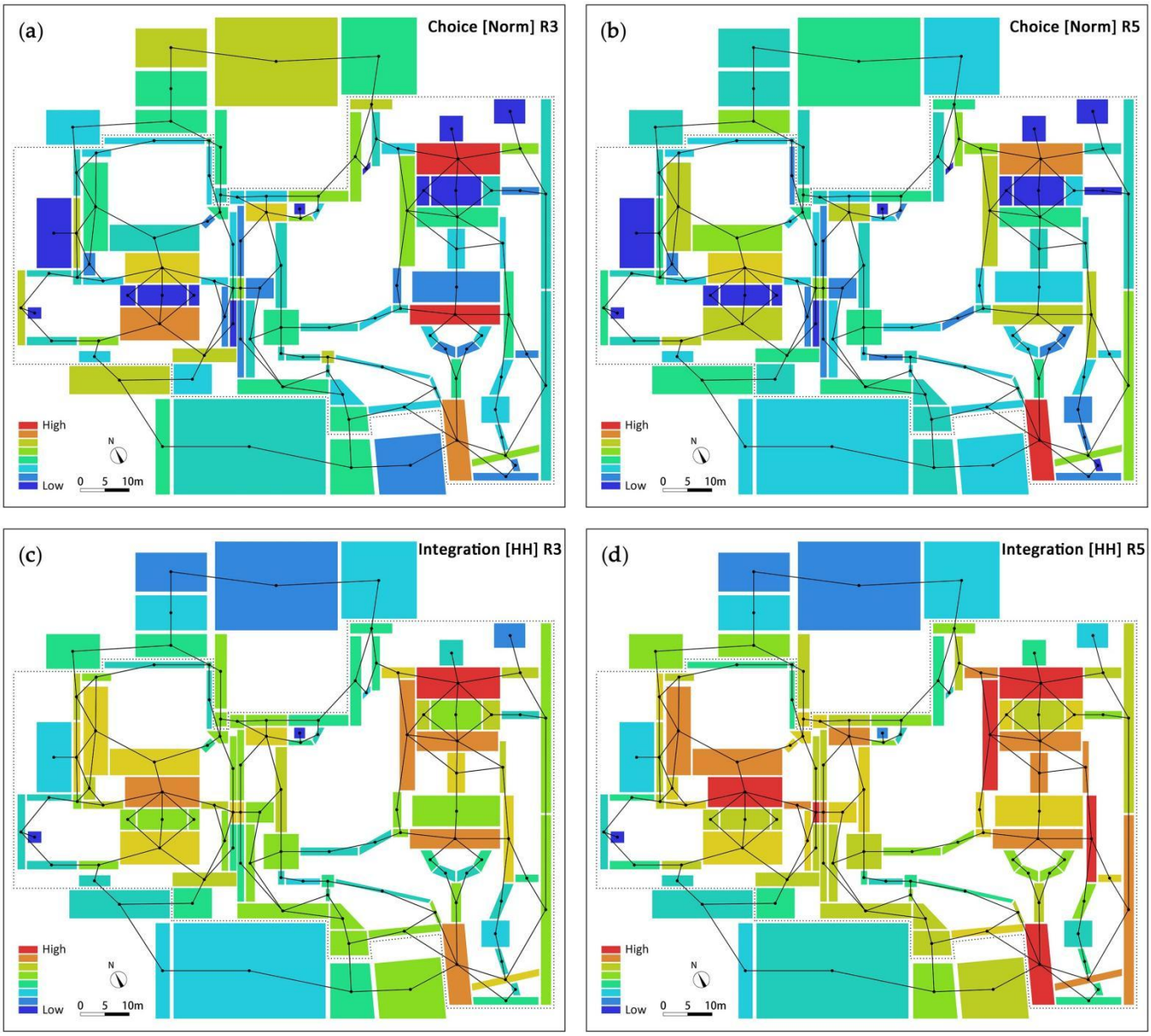


Figure 5-2-8. Convex map calculations of Tianyige garden: (a) Choice [Norm] with a radius of 3; (b) Choice [Norm] with a radius of 5; (c) Integration [HH] with a radius of 3; (d) Integration [HH] with a radius of 5.

5.2.5 Data collection

The investigation of visitor stay distribution in Tianyige garden was conducted over a ten-day period from July 1 to July 10, 2019. The investigation took place during the high season of tourism in Ningbo, which coincides with the school summer vacation. The weather was typically overcast and rainy, with the temperature ranging between 22℃ and 30℃. The research methods were literature review and field observation.

By surveying the previous studies, a questionnaire survey report of visitors from 2017 to 2020 conducted by Tianyige Museum and Ningbo University [87–90] is available on Tianyige Museum's official website. The report serves as a supplemental material and is helpful for comprehensively grasping the visitor composition and general information in Tianyige Museum in the last four years.

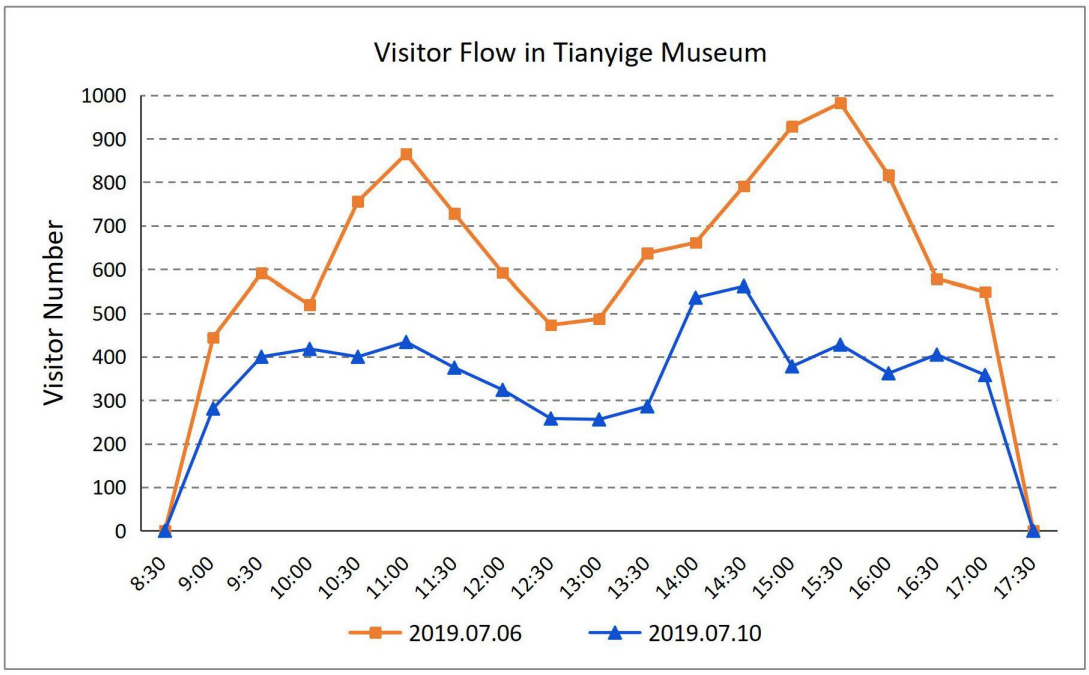


Figure 5-2-9. Visitor flow in Tianyige Museum in July 6 (Saturday), and July 10 (Wednesday), 2019. Data source: Tianyige Museum, author's drawing.

According to the findings of the questionnaire survey report of Tianyige Museum from 2017 to 2020, the number of annual visitors increased each year except for 2020, making for an average of approximately 570,000 visitors per year. The museum saw an equal amount of male and female visitors. Nearly 30 percent of visitors were part of tour groups, and about 70 percent were first-time visitors. The majority of visitors were students, followed by retirees. In terms of companion relationships, the majority visited with relatives, followed by clients and colleagues. Nearly 70 percent of visitors noted a preference to travel in summer and autumn. The main purposes of their visit were gaining cultural experience, children's play, and family activities. In respect of visitor impressions, most visitors noted the museum's cultural atmosphere and unique garden characteristics. Visitors also suggested increasing tourism interactions and providing more open space.

Visitor flow data for Tianyige Museum were collected on July 6, 2019 (Saturday) and July 10, 2019 (Wednesday). This chapter selected one workday and one weekend day to conduct a comparison. On the two days of observation, the number of people in Tianyige Museum was collected in real time at half-hour intervals via mobile devices using the museum's official app [91]. Figure 5-2-9 shows the daily visitor flow on July 6, 2019, and July 10, 2019. According to the collected data, visitor flow on the weekend (July 6) was almost double that on the workday (July 10). In terms of daily visitors, visitor flow was highest around 10:00 – 11:30 am and 2:00 – 4:00 pm, and lowest at 12:00 – 13:30 pm.

Based on field investigation and observation over the ten days, this chapter categorizes visitors into three categories: individual guests, tour groups with guides, and primary school student groups with teachers. Visitor activities included sightseeing, watching exhibitions, relaxing, socializing, photography, live-streaming, and picnicking. On some weekends and summer weekday

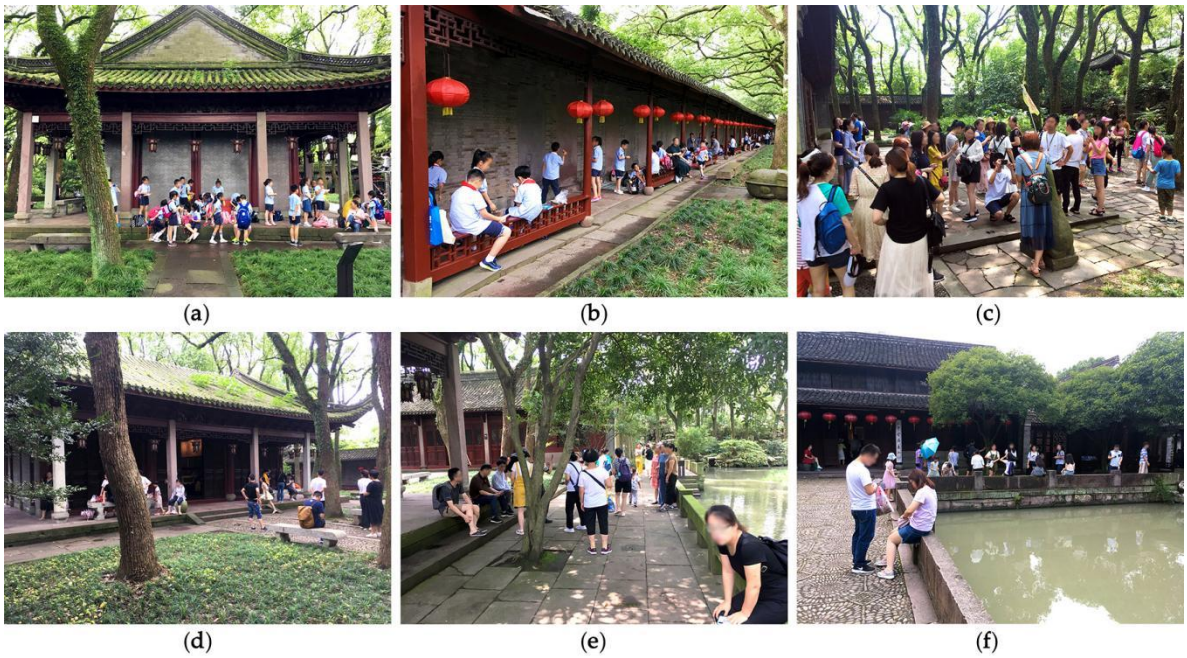
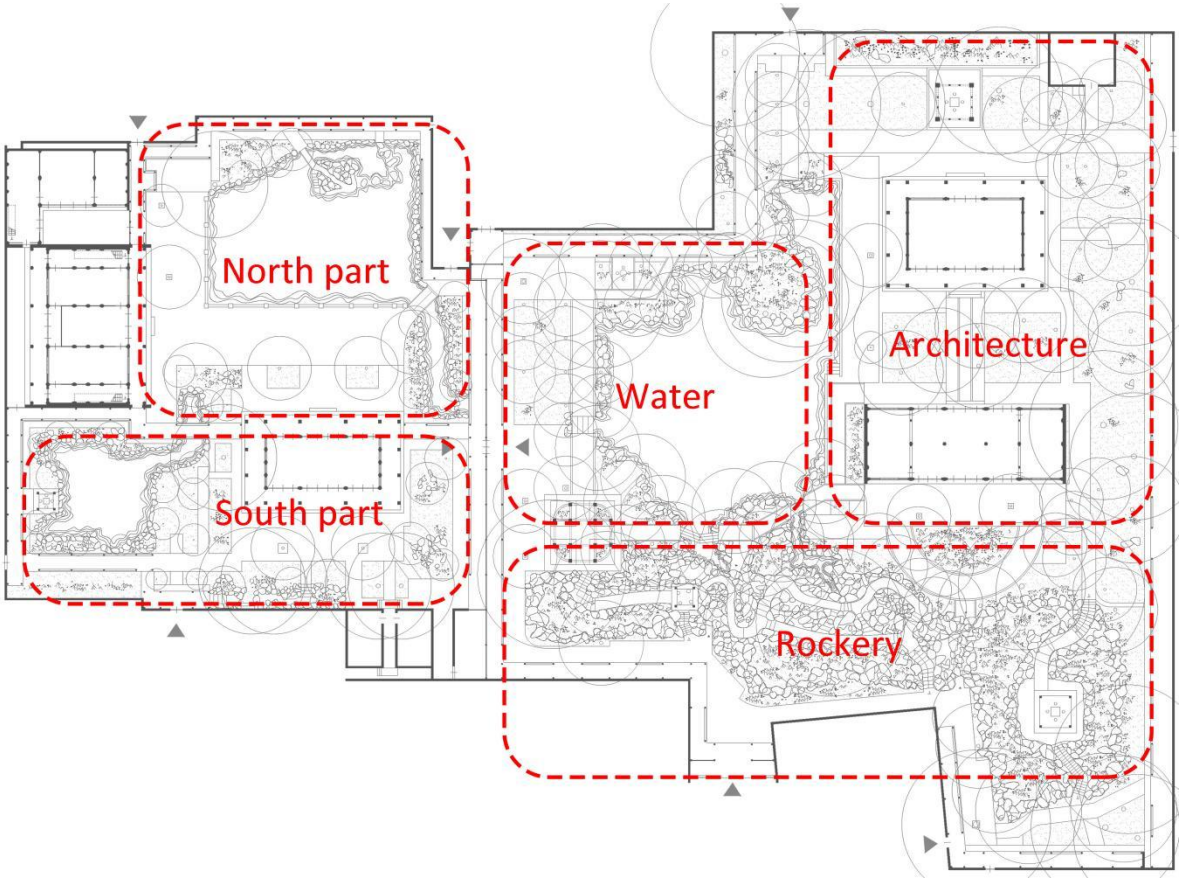


Figure 5-2-10. Illustrations of visitors and activities in Tianyige garden: (a) Student groups resting under the eaves of Ninghui Hall (B2) of the East Garden; (b) Student groups playing in verandas (C2) of the East Garden; (c) Tour groups at Linquanya Hall (B3) of the East Garden; (d) Individual visitors at Ninghui Hall (B2) of the East Garden; (e) Visitors staying in waterside space (A1) of the East Garden; (f) Visitors staying in waterside space (A4 and A5) of the South Garden.

mornings, primary school students and their teachers could be seen in the garden enjoying outdoor activities like visiting, sketching, and picnicking (Figure 5-2-10).

Based on field observation, visitors preferred to stay at their favorite places to enjoy the scenery, take photographs, or rest. Accordingly, visitor stay was recorded to analyze how attractive different spaces were to visitors. Three periods out of the dates in Figure 5-2-9 were chosen to record visitor stay: namely, the morning of July 6, 2019 (Period 1); the afternoon of July 6, 2019 (Period 2); and the afternoon of July 10, 2019 (Period 3). The three periods included weekdays and weekends and differed in terms of visitor composition. Previous studies on visitor temporal-spatial behavior in Chinese gardens found that visitors spent an average of 30 – 60 seconds in most areas of the garden [30]. Based on the field observation, most short stays in Tianyige garden lasted up to 30 seconds if the visitor wished to take a photograph or have a short rest. Therefore, 30 seconds was identified as a minimum valid stay period in the recording of data.

To record visitor stay distribution in the whole garden, the garden was divided into five observational areas: water, architecture, and rockery parts in the East Garden, and the northern and southern yards of the South Garden (Figure 5-2-11). The area of each part is suitable for mobile observation by the recorder with high efficiency. Field observation and recording of visitor stay were conducted in one part at a time. During a period of ten minutes of observation in each part, visitors who stayed for more than 30 seconds were recorded on the garden plan with their visitor numbers and locations manually. The final visitor stay data comprise 1,061 valid cases in the three periods.



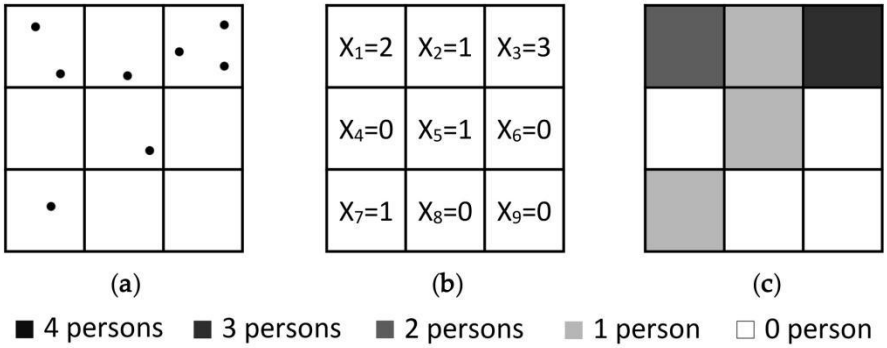


Figure 5-2-11 (Top). Five observational areas in Tianyige garden: water, architecture, and rockery parts in the East Garden, and the northern and southern yards of the South Garden.

Figure 5-2-12 (Bottom). Calculation method of stay visitor number in grids: (a) Original records with one dot as a stay visitor; (b) Calculation of stay visitor number in each grid; (c) The shading of grids representing the number of visitor stays.

5.2.6 Data analysis

Figure 5-2-12 (a, b, c) illustrates the process of dividing the visitor stay record data into each grid and the calculation methods. Figure 5-2-12 (a) shows the original records of visitor stays, each dot representing one stay of a visitor. In Figure 5-2-12 (b), the number of visitor stays was calculated in each grid. In Figure 5-2-12 (c), the shading of each grid represents the number of visitor stays in the observational periods.

This chapter then calculated the visitor numbers and grid numbers of the

twenty garden units and analyzed the visitor stay density and dispersion of each unit. Visitor stay density refers to the average number of visitor stays in one grid of the garden unit, while visitor stay dispersion refers to the degree to which visitor stays were scattered in different grids of the garden unit. Visitor stay density and dispersion in each garden unit were calculated using statistical methods. More specifically, the number of visitors in grid i was considered as the variable x_i, the total number of people in the garden unit was the sum of sample m, and the number of grids in the unit was sample size n.

The mean $\bar{x}$, standard deviation s, and coefficient of variation v_s of each unit were calculated using to the following formulas (1 – 3):

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{m}{n} \tag{7}$$

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}} \tag{8}$$

$$v_s = \frac{s}{\bar{x}} \tag{9}$$

where $\bar{x}$ represents the mean visitor stay of the unit, s represents the standard variation of visitor stays of the unit, and v_s represents the coefficient of variation in visitor stays of the unit. The mean represents the visitor stay density of the unit, while the standard deviation and coefficient of variation reflect the degree to which visitor stays are evenly distributed [92].

After calculating the mean visitor stay and coefficients of each garden unit, scatter plot and box plot diagrams were used to analyze the data distribution and identify outliers in the mean and coefficients values. Outliers of the mean and coefficients values were excluded from the model after inspection. Scatter plot diagrams were examined before each correlation test to avoid abnormal scenarios. Pearson correlation tests were conducted to analyze the correlations between visitor stay distribution and spatial attributes. All analyses were performed using IBM SPSS Statistics Version 22 software.

5.3 Results

5.3.1 Descriptive statistics

Figure 5-3-1 (a, b, c) comprises three distribution maps of visitor stay on July 6 and July 10, 2019. Visitors in Figure 5-3-1 (a) primarily consisted of groups of primary

school students in Period 1 (Saturday morning of July 6, 2019). Figure 5-3-1 (b) presents the visitor stay distribution during the peak hour in Period 2 (Saturday afternoon, July 6, 2019). Visitors mainly consisted of group and individual visitors. At this time, visitors tended to gather in central areas such as the architecture and water space and were relatively evenly distributed. Figure 5-3-1 (c) shows the visitor stay distribution in Period 3 (Wednesday afternoon of July 10, 2019). There were significantly fewer visitors on weekdays compared to the weekend, and visitors were generally scattered throughout the garden.

The visitor stay distribution statistics of the twenty garden units in the three maps presented in Table 5-3-1 were calculated based on the data in Figure 5-3-1 (a, b, c). The mean of each path refers to the average number of visitors in each grid, which represents the visitor density of each unit. The standard deviation and coefficient of variation indicate the visitor stay dispersion of the unit. In this respect, the standard deviation is the absolute value of dispersion degree, while the coefficient of variation is the relative value of dispersion considering the mean of each unit, enabling comparison.

Figure 5-3-2 presents the box plots of mean visitor stay and coefficients of variation in three periods. In Figure 5-3-2 (a), outlier C5 appears in Maps 2 and 3. In Figure 5-3-2 (b), outlier D2 appears in Map 2, and outlier C2 appears in Map 3. Based on an evaluation of the outlier units in the garden plan, C5 is the only veranda unit that is not adjacent to the garden wall and open on both sides, and it connects the main buildings and entrances in the South Garden with a higher accessibility. D2 and C2 are the two longest units in the rockery and veranda space, resulting in uneven visitor stay distribution. Accordingly, these three values can be considered abnormal and are discarded from the entire series to prevent them from influencing further analysis.

5.3.2 Correlations between stay density and spatial attributes

This section analyzed the correlations between visitor stay density and spatial attributes of the twenty garden units using a Pearson correlation test. The outlier C5 of the mean value in Maps 2 and 3 was excluded from the test. As Table 5-3-2 shows, the results of the Pearson correlation test indicate that the mean visitor stay is significantly positively related to choice R5 in Map 2, $r = 0.488$, $p < 0.05$, integration R3 in Map 2, $r = 0.580$, $p < 0.01$, and integration R5 in Map 2, $r = 0.517$, $p < 0.05$. It is significantly negatively associated with length in Map 2, $r = -0.496$, $p < 0.05$, as well as length in Map 3, $r = -0.490$, $p < 0.05$. It is also weakly positively related to choice R3, width, and seating and negatively connected to enclosure ratio. Results revealed no correlation between mean visitor stay and L/W or D/H.

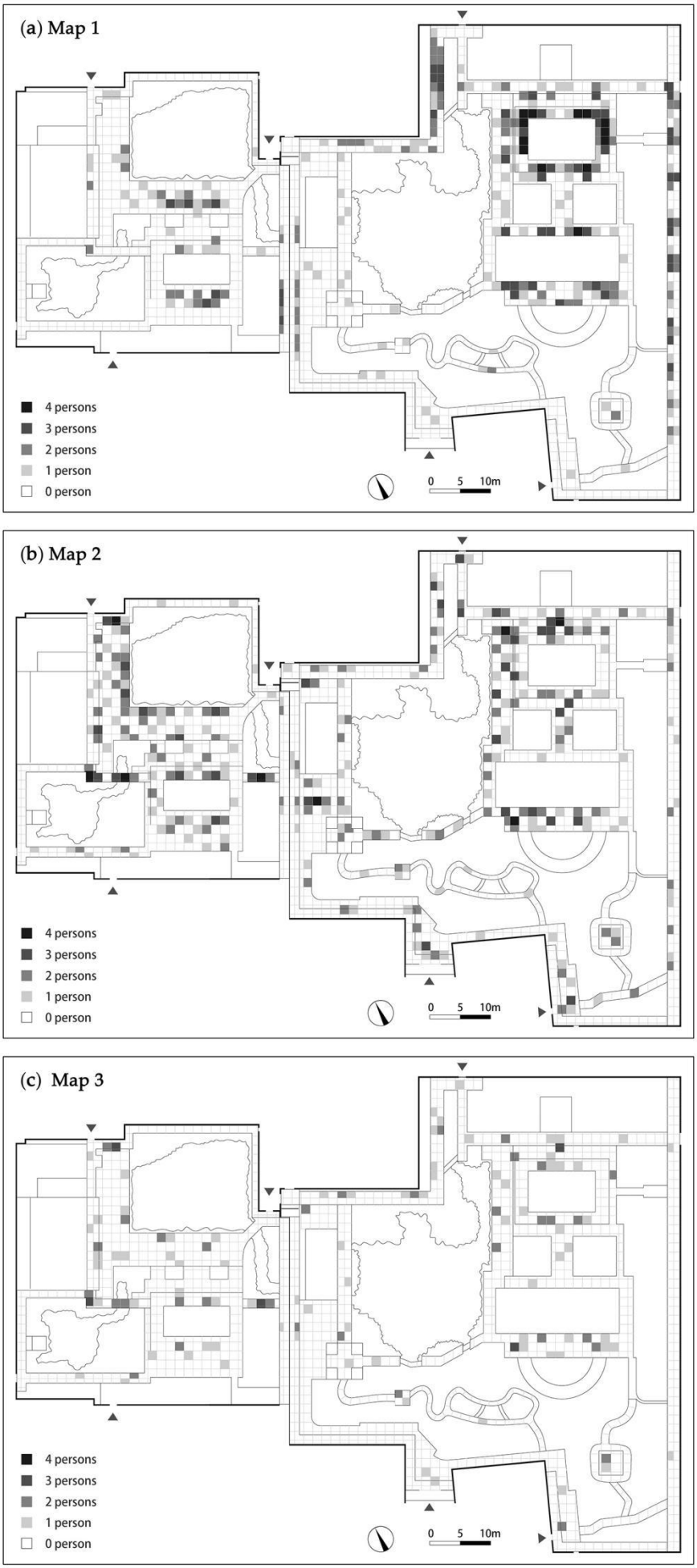


Figure 5-3-1. Visitor stay distribution maps in three periods: (a) Map 1 in the Saturday morning of July 6, 2019; (b) Map 2 in the Saturday afternoon of July 6, 2019; (c) Map 3 in the Wednesday afternoon of July 10, 2019.

Table 5-3-1. Visitor stay distribution statistics of twenty garden units in three periods.

Type	Unit	Grid	Visitor Number			Mean			Standard Deviation			Coefficient of Variation		
			Map 1	Map 2	Map 3	Map 1	Map 2	Map 3	Map 1	Map 2	Map 3	Map 1	Map 2	Map 3
Type A	A1	44	20	34	7	.455	.773	.159	.820	1.097	.479	1.802	1.419	3.013
	A2	11	1	8	1	.091	.727	.091	.302	.786	.302	3.319	1.081	3.319
	A3	23	7	17	6	.304	.739	.261	.470	.810	.541	1.546	1.096	2.073
	A4	46	27	33	9	.587	.717	.196	.909	.981	.500	1.549	1.368	2.551
	A5	38	11	44	12	.289	1.158	.316	.611	.945	.574	2.114	.816	1.816
	Sum	162	66	136	35	.407	.840	.216	.744	.977	.507	1.828	1.163	2.347
Type B	B1	49	50	43	14	1.020	.878	.286	1.331	1.130	.645	1.305	1.287	2.255
	B2	49	78	29	13	1.592	.592	.265	1.485	.888	.605	.933	1.500	2.283
	B3	38	47	38	17	1.237	1.000	.447	1.125	1.139	.760	.909	1.139	1.700
	B4	45	8	25	6	.178	.556	.133	.490	.867	.457	2.753	1.559	3.436
	B5	46	20	22	7	.435	.478	.152	.886	.781	.420	2.037	1.634	2.763
	Sum	227	203	157	57	.894	.692	.251	1.236	.979	.590	1.383	1.415	2.351
Type C	C1	42	36	26	15	.857	.619	.357	1.072	.909	.618	1.251	1.468	1.731
	C2	71	66	23	2	.930	.324	.028	1.125	.650	.167	1.210	2.006	5.964
	C3	44	5	29	5	.114	.659	.114	.321	.888	.387	2.816	1.347	3.395
	C4	47	41	26	6	.872	.553	.128	1.013	.829	.397	1.162	1.499	3.102
	C5	12	3	27	17	.250	2.250	1.417	.622	1.545	1.084	2.488	.687	.765
	C6	25	1	9	4	.040	.360	.160	.200	.638	.473	5.000	1.772	2.956
	C7	11	2	10	6	.182	.909	.545	.405	1.446	1.036	2.225	1.591	1.901
	C8	20	3	11	5	.150	.550	.250	.366	1.099	.786	2.440	1.998	3.144
	Sum	272	157	161	60	.577	.592	.221	.934	.960	.591	1.619	1.622	2.674
Type D	D1	40	6	8	4	.150	.200	.100	.427	.464	.379	2.847	2.320	3.790
	D2	26	3	5	3	.115	.192	.115	.431	.567	.431	3.748	2.953	3.748
	Sum	66	9	13	7	.136	.197	.106	.426	.503	.397	3.132	2.553	3.745
Sum		727	435	467	159	.598	.642	.219	.998	.951	.558	1.669	1.481	2.548

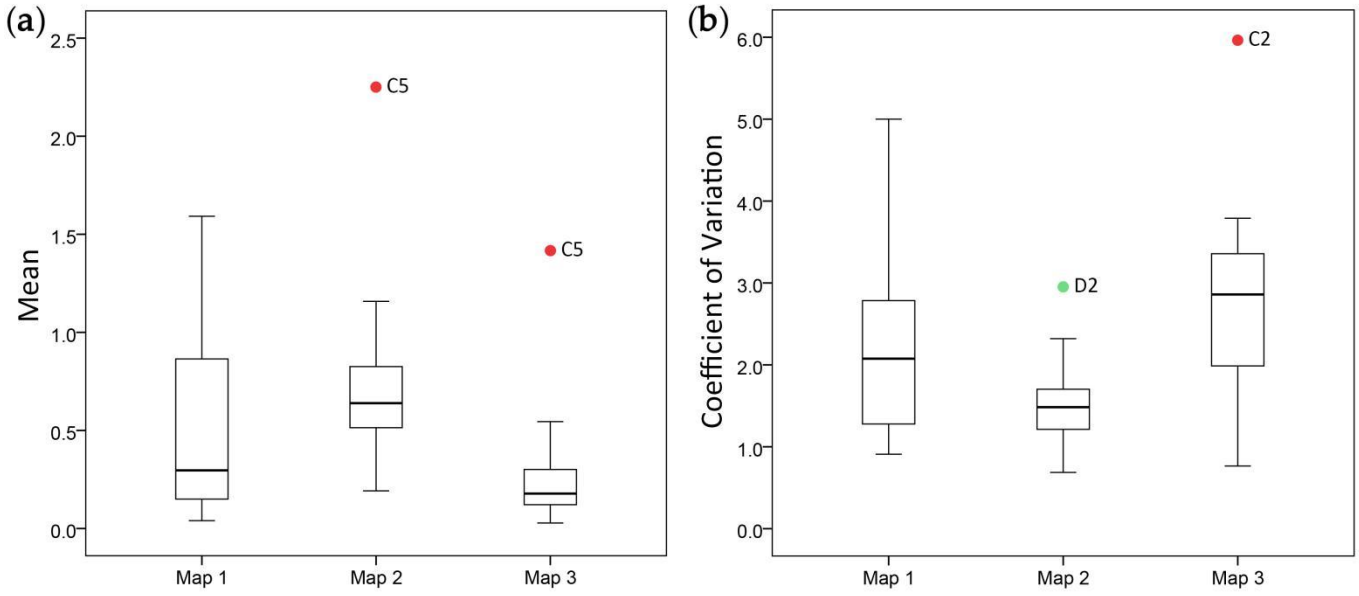


Figure 5-3-2. Box plots of visitor stay mean and coefficient of variation in three periods: (a) Box plots of visitor stay mean, with an outlier C5 in Map 2 and 3 ; (b) Box plots of visitor stay coefficient of variation, with outliers D2 in Map 2 and C2 in Map 3.

Table 5-3-2. Pearson correlation test with visitor stay mean and spatial attributes.

Mean	Pearson Correlation (r)			
	Choice [Norm] R3	Choice [Norm] R5	Integration [HH] R3	Integration [HH] R5
Map 1 (N=20)	.380	.394	.552*	.445*
Map 2 (N=19)	.413	.488*	.580**	.517*
Map 3 (N=19)	.302	.229	.331	.104

Mean	Pearson Correlation (r)					
	Length	Width	L/W (N=9)	D/H	Enclosure ratio	Seating
Map 1 (N=20)	.018	.326	-.113	.104	-.271	.329
Map 2 (N=19)	-.496*	.417	.172	.277	-.398	-.074
Map 3 (N=19)	-.490*	.140	.192	.112	-.119	.023

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5-3-3. Pearson correlation test with visitor stay mean and spatial attributes in two groups.

Mean		Pearson Correlation (r)					
		Length	Width	L/W (N=9)	D/H	Enclosure ratio	Seating
Type A&B	Map 1 (N=10)	-.128	.113	-.113	-.154	.163	.474
	Map 2 (N=10)	.312	-.108	.172	-.196	.423	.041
	Map 3 (N=10)	.023	.072	.192	.069	.268	.022
Type C&D	Map 1 (N=10)	.510	.737*	NA	.086	-.444	.681*
	Map 2 (N=9)	-.322	.360	NA	-.090	-.401	.383
	Map 3 (N=9)	-.718*	.245	NA	.054	-.311	.121

*. Correlation is significant at the 0.05 level (2-tailed).

Considering the significant difference in the width and L/W attribute values of the twenty units in Table 5-2-2, this chapter conducted further correlation analysis of two groups (Table 5-3-3). The first group comprised water and architecture spaces (Types A and B), where most of the units are spacious and more likely to be an area rather than a path. The second group comprised veranda and rockery spaces (Types C and D), which are characterized by long and narrow paths.

Results show that the correlations in Types C and D are more significant than those in Types A and B. The mean visitor stay of Types C and D is significantly positively related to the width in Map 1, $r = 0.737$, $p < 0.05$, and seating in Map 1, $r = 0.681$, $p < 0.05$, and negatively associated with length in Map 3, $r = -0.718$, $p < 0.05$. It is also weakly negatively connected to the enclosure ratio. The mean visitor stay of Type A and B is weakly positively connected to enclosure ratio in Map 2 and seating in Map 1.

Table 5-3-4. Pearson correlation test with visitor stay coefficient of variation and spatial attributes.

Map 1 (N=20)				
Pearson Correlation (r)	**Coefficient of Variation 1**	**Mean 1**	**Length**	**Width**
Coefficient of Variation 1	1	-.792**	-.019	-.358
Mean 1	-.792**	1	.018	.326
Length	-.019	.018	1	NA
Width	-.358	.326	NA	1
Map 2 (N=18)				
Pearson Correlation (r)	**Coefficient of Variation 2**	**Mean 2**	**Length**	**Width**
Coefficient of Variation 2	1	-.845**	.545*	-.377
Mean 2	-.845**	1	-.597**	.368
Length	.545*	-.597**	1	NA
Width	-.377	.368	NA	1
Map 3 (N=18)				
Pearson Correlation (r)	**Coefficient of Variation 3**	**Mean 3**	**Length**	**Width**
Coefficient of Variation 3	1	-.856**	.437	-.318
Mean 3	-.856**	1	-.387	.099
Length	.437	-.387	1	NA
Width	-.318	.099	NA	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

5.3.3 Correlations between stay dispersion and spatial attributes

This section analyzed the correlations between the visitor stay dispersion and spatial attributes of the twenty garden units using a Pearson correlation test. Outliers C5, D2, and C2 in Maps 2 and 3 were excluded from the test. The coefficient of variation of visitor stay was assumed to be related to length and width attributes, causing uneven accessibility in different parts of the garden unit.

According to the Pearson correlation test results presented in Table 5-3-4, the coefficient of variation of visitor stay is significantly and negatively associated with mean of visitor stay in Map 1, $r = -0.792$, $p < 0.01$, Map 2, $r = -0.845$, $p < 0.01$, and Map 3, $r = -0.856$, $p < 0.01$. It is also weakly positively associated with length (significantly in Map 2, $r = 0.545$, $p < 0.05$) and negatively associated with width.

Considering that the confounding mean visitor stay variable is related to both the coefficient of variation and spatial attributes (length and width), this chapter employed a partial correlation test to mitigate misleading information from the confounding variable. The partial correlation coefficient between X and Y, controlling for Z, is written as $r_{yx.z}$ in Formula (4):

$$r_{yx.z} = \frac{r_{yx} - (r_{yz})(r_{xz})}{\sqrt{1 - r_{yz}^2}\sqrt{1 - r_{xz}^2}} \quad (10)$$

where ryx, ryz, and rxz are zero-order coefficients between all the variables (Y and X, Y and Z, X and Z) [92]. The mean visitor stay values, which are unrelated to the coefficient of variation or spatial attributes, were excluded from the partial correlation test and identified as NA.

Table 5-3-5 presents the results of the partial correlation test, controlling for mean visitor stay. The significant correlation with length in Map 2 disappeared (r = 0.094), indicating that the correlation may be due to the controlling variable. Therefore, mean visitor stay partially explains the correlation between the coefficient of variation of visitor stay and spatial attributes of the twenty gardens units examined in this chapter.

Table 5-3-5. Partial correlation test with visitor stay coefficient of variation and spatial attributes, controlling the visitor stay mean.

Coefficient of Variation	Control	Correlation (r)				
		Mean 1	Mean 2	Mean 3	Length	Width
Map 1 (N=20)	None	-.792**			-.019	-.358
	Mean 1				NA	-.174
Map 2 (N=18)	None		-.845**		.545*	-.377
	Mean 2				.094	-.132
Map 3 (N=18)	None			-.856**	.437	-.318
	Mean 3				.222	NA

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

5.3.4 Characteristics of stay distribution and garden space

Figure 5-3-3 shows the characteristics of visitor stay distribution and the four types of garden space. Figure 5-3-3 (a) presents a comparison of visitor stay density in the four types of garden space in column charts. Figure 5-3-3 (b) compares visitor stay dispersion in the four types of garden space in column charts. Figure 5-3-3 (c) presents the average values of the attributes of the four types of garden space and four typical garden units in radar charts. Six spatial attributes related to the visitor stay density were taken as axis variables: integration R3, choice R5, width, length, enclosure ratio, and seating. A unified scale was adopted in the radar chart axis by calculating the percentages of variable values comparing the maximum. The dotted line represents the total average values.

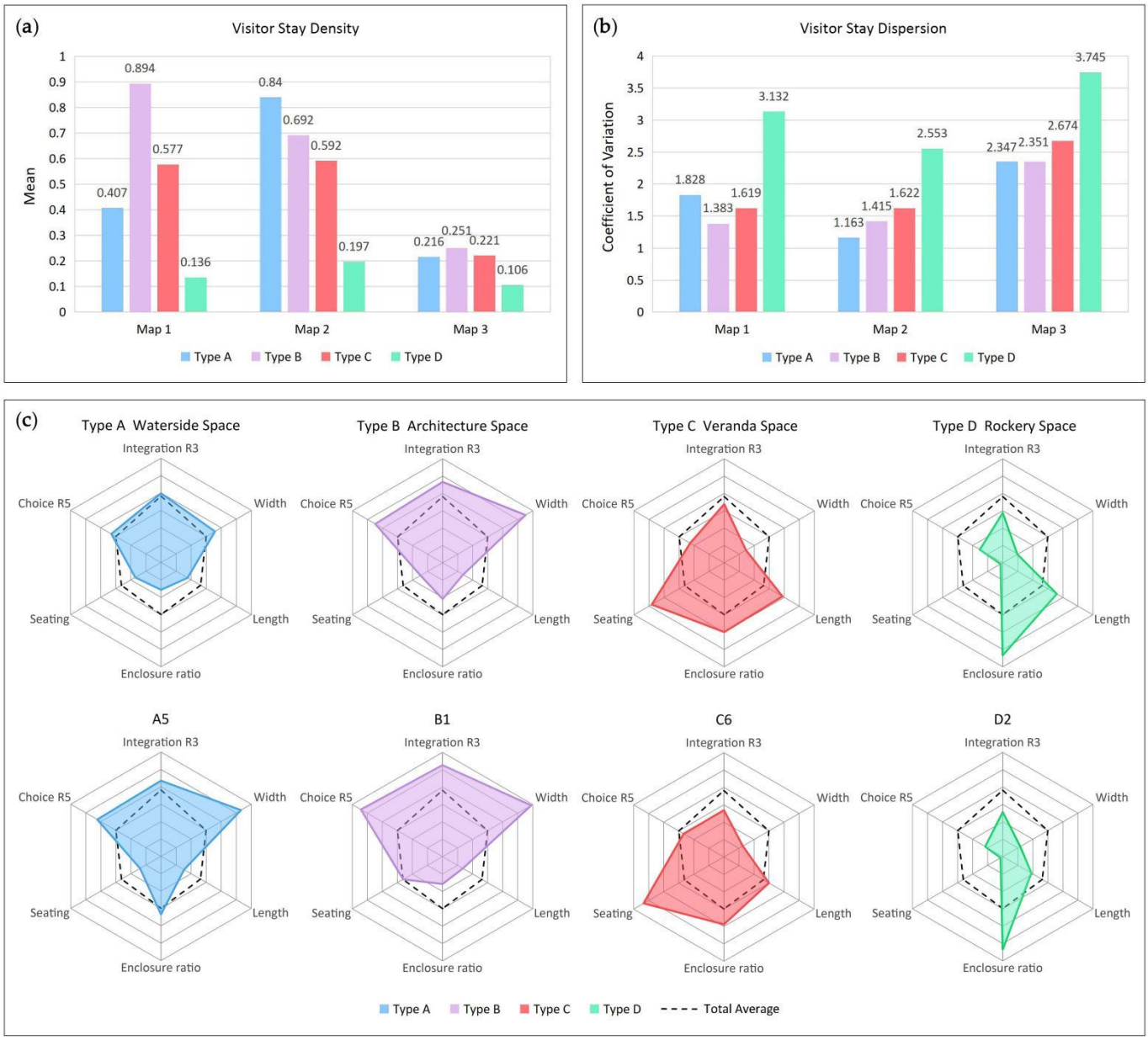


Figure 5-3-3. Characteristics of visitor stay distribution and four types of garden space: (a) Visitor stay density of four types in column charts; (b) Visitor stay dispersion of four types in column charts; (c) Characteristics of four types of garden space and four typical garden units in radar charts.

As Figures 5-3-3 (a) and (b) show, water and architecture spaces (Types A and B) have the highest visitor stay density and lowest visitor stay dispersion. The visitor stay density of veranda space (Type C) is lower than that of the water and architecture spaces (Type A&B), followed by rockery space (Type D), which has the highest visitor stay dispersion. Meanwhile, Figure 5-3-3 (c) shows that the four types of garden space have distinctive attributes. The four typical garden units (A5, B1, C6, D2) at the bottom of Figure 5-3-3 (c) show the individual cases which can represent the four types. Among them, A5 and C6 are typical water and veranda spaces in the South Garden, while B1 and D2 are typical architecture and rockery spaces in the East Garden.

5.4 Discussion

5.4.1 Main findings

The main findings of this chapter can be summarized in five points as follows. First, visitor flow on weekends was almost twice that on weekdays; peak hours are 10:00 – 11:30 am and 2:00 – 4:00 pm, while off-peak hours are 12:00 – 13:30 pm. On weekends (Maps 1 and 2), architecture and water spaces enjoyed high visitor flow, while veranda space occasionally experiences high visitor flow from particular student groups. On weekdays (Map 3), visitors were relatively evenly distributed in the architecture, water, and veranda spaces.

Second, in respect of visitor groups, individual guests and tour groups preferred water space, followed by architecture space and then veranda space. Primary school student groups preferred architecture spaces, followed by veranda space. Essentially, most visitors were more interested in the beautiful scenery of the garden, resulting in the water space being more popular among general visitors. As primary school students usually played in groups, they tended to prefer spacious open spaces with shelter and adequate seating facilities.

Third, there is a correlation between visitor stay density and six spatial attributes: integration, choice, width, length, enclosure ratio, and seating. The visitor stay density of all types is significantly positively related to integration R3 and R5 and choice R5 in Map 2 and negatively associated with length in Maps 2 and 3. The visitor stay density of veranda and rockery types is significantly positively related to width and seating in Map 1 and negatively associated with length in Map 3.

Fourth, visitor stay dispersion is significantly negatively related to visitor stay density. A partial correlation test controlling for visitor stay density revealed no correlation between visitor stay dispersion and length and width.

Fifth, the four types of garden space have distinctive attributes and can be divided into two groups: centralized, spacious, and highly accessible open space, like Types A and B; and narrow, longitudinal paths with low accessibility and abundant seating facilities like Types C and D. The two groups reflect different patterns of visitor stay distribution.

5.4.2 Spatial composition of Tianyige garden

Although the composition and style of Chinese gardens have varied across different historical periods, Chinese gardens have retained distinctive features referred to as “garden genes.” Tong Jun identifies the basic elements of a garden based on the Chinese character “園” (garden). He says, “The outer circle (口) resembles a courtyard wall, and within the circle are buildings (土), ponds (口),

rockery and trees (衣) [5]." Liu Dunzhen similarly summarized the basic concept of a garden as comprising a combination of rockery, ponds, trees, and houses, under the guiding principle of a poetic and artistic concept [7]. Quantitative studies comparing ancient and modern gardens have identified five basic elements of Chinese gardens: buildings, plants, rockery, water, and garden paths or squares [18,77]. This chapter identified four garden elements: water, architecture, veranda, and rockery. As most verandas in Tianyige garden are the combination of the courtyard wall and veranda surrounding the entire garden, they were considered as an independent spatial element. Similarly, several other studies have focused on the veranda space of Chinese gardens [93-95].

Regarding the proportion of each garden element comprising a Chinese garden, Wu [77] indicates that the area of buildings is typically much smaller than other garden elements if the residential buildings outside the garden are excluded. Analyzing the proportion of elements from a three-dimensional perspective, Yang [18] found that plants and water make up the largest proportion of the garden, followed by buildings. In a quantitative analysis of the elements of the Tianyige East Garden, Liu [96] similarly found that the total area occupied by buildings was smaller than both that of rockery space and garden paths. However, the results of this chapter show that architecture space — that is, buildings — has the highest visitor stay density. This finding is due to the high accessibility and functionality of architectural space, as well as the inaccessibility of water and rockery spaces. As noted in the second chapter of Yuan Ye, "the first step to set up the foundation of a garden is to decide the location of the main building" [97]. Indeed, the buildings play the most fundamental role in Chinese gardens.

The layout of Tianyige garden closely resembles that of Jiangnan gardens insofar as the layout of the East Garden is centers on water. Similar examples include the northwestern part of Zhan Garden in Nanjing, the central part of the Lingering Garden in Suzhou, the western part of Lion Grove Garden in Suzhou, the central part of Master-of-Nets Garden in Suzhou, and Yipu Garden in Suzhou [98]. However, the layout of the East Garden is slightly different from the aforementioned examples in terms of the axial organization of garden elements. In traditional gardens, the main building usually served as the living room while providing the best view of the garden. Accordingly, the main building is conventionally located in the central area in front of the main theme of the garden scenery, close to the water and facing the main axis of the pond and rockery. Contrary to convention, the two buildings in the East Garden do not face the main view of the garden (i.e., the water and rockery scenery); rather, they are located parallel to the axis of the water and rockery. One reason for this break with tradition is that the buildings in the East Garden have become exhibition spaces.

Moreover, these buildings were relocated from elsewhere in Ningbo, their size too big to match the garden scale. Positioning the two buildings such that they faced the pond and rockery directly would have undermined the balance of the garden—the oversized building disrupting the broadness of the water and rockery [73]. This clever axial organization also provides an alternative tour route, enriching the traditional centralized layout.

The rockery in Tianyige garden is buried in thick woods and huge buildings, rendering an overall view of the rockery impossible and emphasizing the depth of garden space. Camphor trees were planted in the East Garden, creating the atmosphere of a wild mountain forest, similar to that of the Canglang Pavilion in Suzhou [98]. However, unlike the complicated verandas separating the garden space in the Suzhou gardens of the middle and later Qing Dynasty, the verandas in Tianyige garden are simple and linear, surrounding the garden with walls. The simple verandas, soil and stone rockery, and square pond embody the garden form and configuration of the Ming Dynasty [99].

Despite sharing several similarities with other traditional Jiangnan gardens, Tianyige garden is unique in three ways. First, Tianyige garden is home to a collection of historical items, with a variety of ancient buildings, stone pavilions, stone tablets, and other historical items having been relocated from other parts of Ningbo to the garden for protection [74]. Second, the intended function of Tianyige garden is unique compared to traditional gardens insofar as it was originally designed to serve the museum and its visitors. In this respect, the garden is actually a subsidiary of the museum intended to reduce the potential overwhelming of the ancient Tianyige Library. Third, Tianyige garden follows the gardening ideology of adhering to local conditions. Rather than following the style of traditional gardens, Tianyige garden has absorbed the local characteristics of Ningbo—for instance, it uses local stones in the rockery and retains the original camphor trees [73]. Therefore, Tianyige Garden is a valuable exploration of contemporary Chinese garden design.

5.4.3 Attractiveness and openness of the garden space

In terms of the attractiveness of garden elements, previous studies [100–101] have examined the visitor stay points and attractiveness of garden elements in the Master-of-Nets Garden and Lingering Garden in Suzhou. These studies found that most visitors to the Master-of-Nets Garden preferred to stay in the building areas (including indoor space, external platforms, and spaces under the eaves) and that the water elements had the highest attractiveness. However, due to the small area and compact layout of the Master-of-Nets Garden, several elements are likely to have multiple influences on visitors. As such, the attractiveness of the garden

elements in the Lingering Garden appears similar to that of Tianyige garden, although the Lingering Garden has a much higher proportion of buildings. In other words, the buildings in the Tianyige garden attract the most visitors despite occupying a smaller area proportion than those of the Lingering Garden.

As most of the main scenery—the best viewpoints—in Tianyige garden can be found around the water area, visitor stay density is highest in the water space in Map 2 (Figure 5-3-3-a). Architecture space also attracts a large number of visitors because it functions exhibition space, resulting in high visitor stay density in architecture space in all three maps. Veranda space shows a moderate visitor stay density due to its provision of seating facilities and good views of the scenery. However, visitor stay distribution was found to vary across different parts of veranda space; for instance, the most popular veranda unit was C5, which has high accessibility and a wide vision. Rockery space had the fewest visitors, with visitor stay primarily concentrated in the pavilions. As such, rockery space was found to be the least attractive space to most visitors.

The three time periods examined in this chapter reflect different visitor stay distribution situations. Map 2 of the weekend period and Map 3 of the weekday period are most typical, while Map 1 is unique insofar as it shows how primary school student groups utilized the garden. In respect of the latter, architecture and veranda spaces provided students with spacious shelters and abundant seating facilities for a variety of activities, including picnics, painting, and socializing, reflecting the flexible utilization of the garden space for both individuals and large groups.

According to the upper three attributes (choice R5, integration R3, and width) and the lower three attributes (length, enclosure ratio, and seating) in the radar charts of Figure 5-3-3 (c), the four types of space can be divided into two groups: Types A and B, in which the upper three attribute values are larger than average and lower three attribute values are smaller than average; and Types C and D, in which the upper three attribute values are smaller than average and lower three attribute values are larger than average. Units in Types A and B are centralized, spacious, and highly accessible open spaces, while units in Types C and D units are longitudinal narrow paths with low accessibility and abundant seating facilities. The two groups thus reflect different patterns of visitor stay distribution.

Accessibility (integration and choice) was found to be significantly positively related to visitor stay density in all garden units. As accessibility can determine the proportion of first-time visits to a space, it serves as a basic factor in determining whether a space is popular to visitors [30]. However, high visitor flow does not necessarily lead to high visitor stay density. Indeed, while veranda unit C3 is located on the main tour route and close to the south entrance of the East Garden

with high accessibility, it has low visitor stay density and only serves as a pass space. Therefore, other influencing factors are also important in visitor stay distribution.

While both length and width are related to visitor stay density, width is more interpretable and found to be particularly significant in Types C and D. The average widths of water space (3.7 m) and architecture space (5.7 m) are wider than the total average width (3.1 m) of garden space, as is the typical case of unit A5 (5.5 m) of water space and unit B1 (6.4 m) of architecture space. This may be another important reason for higher visitor stay density in Types A and B. Existing research on urban forest parks also indicates that visitors prefer paths wider than 3 m, and the relationship between path use and length is yet to be identified [60].

Enclosure ratio is related to visitor stay density insofar as it directly affects the visibility of the surrounding environments and scenery, and the visual characteristics of a space play a decisive role in spatial attraction [30]. The correlation results of this chapter indicate that the enclosure ratio is weakly positively related to visitor stay density in Types A and B, which have enclosure ratios below 50 percent, and weakly negatively related to visitor stay density in Types C and D, where most enclosure ratios are above 50 percent. This may indicate that a moderate enclosure ratio is more conducive to visitor stay distribution.

Seating is also an important attribute related to visitor stay distribution, especially in veranda space. In this chapter, accessibility and width, which are supposed to promote visitor stay behaviors, were found to be below average in the veranda space, except for seating. Existing studies suggest that visitors tend to stay on verandas that provide good views of the main scenery or water [102-103]. This may account for the high visitor stay density of veranda space units C1, C5, and C7.

5.4.4 Visitors and activities

Visitor flow is essential to the experience of a garden. Tianyige Museum saw almost 739,000 visitors in 2019 [89]. In contrast, Shanghai's commercial areas of Yu Garden — which was also restored by Chen Congzhou — saw some 40 million visitors in 2019 [104], making the garden overcrowded throughout the year. Evidently, each Chinese garden has an optimal visitor capacity, which is essential to making it a high-quality green public open space in the city rather than a tourist hotspot.

This chapter divided visitors into three categories: individual visitors, group visitors, and student groups. Another study of visitors in Tianyige Museum [105] classified users more comprehensively, including book borrowers, museum visitors, patriotic activity participants, exhibition visitors, and other academic and

social activities participants. This reflects the fact of Tianyige Museum's multiple identities, including a library, museum, historical archive, exhibition hall, tourist attraction, as well as base for local primary and secondary school excursions and activities. It also demonstrates how Chinese garden space can be adapted to serve multiple functions and activities.

Compared with visitor activities in urban parks [106], Tianyige garden is not used for exercise and is less popular for socializing, with most visitors immersed in the garden environment. This finding indicates that the Tianyige garden environment aligns with the culture surrounding book collection and historical relics and that the garden also provides a green open space for rest and recreation in the museum.

5.5 Conclusions

Through examining the correlations between spatial attributes and visitor stay distribution in the gardens of Ningbo Tianyige Museum, this chapter revealed the openness of this garden space and its attractiveness to visitors. Results reveal that the garden's architecture and water spaces enjoyed a highly dense and evenly distributed visitor stay. Veranda space had a lower stay density, followed by rockery space. Visitor stay density is significantly negatively related to visitor stay dispersion, and there is a correlation between stay density and six spatial attributes: integration, choice, width, length, enclosure ratio, and seating. The results of this chapter indicate that Tianyige garden is a classical-style garden with innovations in terms of its spatial composition [73-74]. The distinctive attributes of the four types of garden space reflect different patterns of visitor stay distribution. Tianyige garden can cater to diverse visitor groups and provide a space for a wide range of activities [20], demonstrating the openness of Chinese gardens as urban public spaces [107-109].

This chapter could contribute to the visitor studies as well as environmental behavior studies in Chinese gardens and other urban green space [64-65]. The findings of this chapter could also provide useful insights for the planning and management of Chinese garden tourism [29-30]. Furthermore, this chapter is of great value with respect to the utilization of green public open spaces in cities. With the proposal of constructing high-quality “Park City” in China [110-111], Chinese gardens will play a critical role in creating a natural atmosphere, humanized environment, a pleasant and picturesque urban life, and a healthy and ecological city.

Based on its findings, this chapter provides the following suggestions for improving the traveling experience and utilization of Chinese gardens. First,

visitors tend to find wider spaces more open and attractive; however, it is important that the scale matches the overall layout and style of the garden. Concerning the narrow and winding garden paths, tour routes with signposting can serve to reduce the accessibility to avoid heavy visitor traffic, thereby improving visitor experience. Second, architecture and water spaces are quite popular among visitors, which means that these two types of space should be appropriately arranged and connected by verandas, thereby balancing the attractiveness of the entire garden space. Third, better route design can improve the accessibility and visibility of marginal spaces like verandas. Other attractive elements like architecture and water can be combined with verandas or "borrowed scenery" to improve the visual experience of the landscape from the veranda. Fourth, more functions and facilities — such as supplementary or secondary seating — can be added to architecture and water spaces to improve visitor activities and experience.

This chapter had three limitations. First, the research has a relatively small sample size, with only twenty garden units extracted from the garden as samples due to the overall garden scale. Second, this research did not control for other unknown factors that may influence the visitor stay behaviors; different seasons and climatic conditions were also not considered. Third, this research only conducted qualitative observation and analysis of visitor activities. A more detailed behavioral study may better explain the communal nature and utilization of garden space at the Tianyige Museum. Future research should examine the correlations between the length of visitor stay and spatial attributes, thereby elucidating the spatial requirements of different lengths of visitor stay and facilitating the identification of optimal rest stops in the garden. Researchers should also examine the unique attributes and advantages of Chinese classical garden space to propose strategies to improve the traveling experience and utilization of gardens in China.

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CHAPTER 6
VISITOR LONG-STAY IN TIANYIGE MUSEUM GARDENS

6.1 Introduction

Chapter 5 & Chapter 6 study the visitor stay distribution and spatial influencing factors in Tianyige garden. Chapter 5 is the study on visitor short-stay behavior (less than one minute), examining the attractiveness of spatial attributes to visitors. Chapter 6 is the study on visitor long-stay behavior (more than one minute), focusing on the influencing factors on visitor stay duration and the attractiveness and pleasantness factors of the garden space.

6.1.1 Background

With the deepening understanding of the humanism, low-carbon development, as well as the integration of cities with nature, China proposed to build a high-quality "Park City" with urban public green space as the main system in 2018 [1–2]. The main body of a Park City is people, so the users' needs are the starting point and central mission for the construction of a Park City. Serving as the most important urban green space in the city, gardens, parks and other green spaces provide citizens with benefits of recreation, ecology, culture, aesthetic value, and positive health impacts. Since 2019, the global pandemic caused by COVID-19 is putting pressure on cities throughout the world to rethink how they should develop and operate. It also highlights the public health benefits of gardens, parks and green spaces, and the necessity of daily access to urban green space [3]. The study on the visitors' demands and activities in the garden, as well as on the openness and attractiveness of Chinese garden space, is of great value to comprehensively understand and construct the high-quality, people-oriented public green space system in the city.

6.1.2 Literature review

As a unique landscape type in China, Chinese gardens, together with urban parks, green spaces and urban forest parks, make up the landscape system in urban open space. Traditional Chinese gardens range from the huge imperial gardens such as the Summer Palace in Beijing and popular public scenic areas such

as the West Lake in Hangzhou, to the many small private gardens embedded in traditional residences in Suzhou, Yangzhou and other cities. Some imperial gardens, such as the Summer Palace in Beijing [4–5] and the Summer Resort in Chengde [6], have become large urban parks and recreation destinations for citizens, while being famous world heritage sites and tourist attractions. In recent years the design of urban landscape and many building types such as residential areas, educational and medical institutions, museums and cultural centers, resort hotels has all incorporated elements and features of Chinese gardens.

In the past twenty years, studies on the utilization of Chinese gardens as open spaces have become increasingly important, with the following three main themes [7]. The first theme is the study on the users' travelling experience of Chinese gardens, including visual [8–9], auditory [10], walking and sensory [11–12], and other physiological and psychological responses. Although the research objects are traditional gardens, there is a lack of research on the relationship between user behaviors and traditional garden space. The second theme is users' evaluation of Chinese gardens, including the Post Occupancy Evaluation (POE) on the utilization and satisfaction of the garden space [13], and the Recreation Opportunity Spectrum (ROS) approach based on users' needs [14–16]. The third theme is activity studies in Chinese gardens of general users and specific groups, such as environmental behavior studies [17–19] and investigations on senior group activities [20–21]. Most research objects in the latter two themes are large urban parks reconstructed from gardens, and behavioral studies in small scale Chinese gardens are rare. Moreover, most behavioral studies are simply descriptive statistics, and there are still insufficient studies on the impact of garden space and environment factors on the visitor behaviors.

6.1.3 Research aim and objective

To address the aforementioned gaps, the overall aim of this chapter was to identify the openness of the garden space in Ningbo Tianyige Museum and its attractiveness to visitor stay. In the previous chapter on Tianyige Museum gardens [22], the correlations between spatial attributes and visitor short-stay were analyzed, and this chapter mainly analyzed the long-stay behaviors with garden space. The analyses focused on the following three research questions:

1. How are the visitor long-stays distributed in the Tianyige Museum gardens?

2. What is the long-stay characteristics of Tianyige Museum gardens with different spatial types?

3. Which factors have an impact on the visitor long-stay distribution and duration?

Therefore, the main objectives of this chapter were to (1) quantitatively analyze the distribution and duration of visitor long-stay in Tianyige Museum gardens; (2) compare the visitor long-stay behaviors of different spatial types; and (3) examine the influencing factors of visitor stay distribution and duration using correlation analysis and regression model. By revealing the visitor demands and openness values of garden space, this chapter has important implications for the tour planning, crowd flow management and local improvement of Chinese gardens. This chapter is also of great value to the construction of people-oriented urban green space and high-quality human settlements.

6.2 Conceptualization of Long-stay Influencing Factors

The concept of open space begins with "urban public open space", which includes subsystems such as streets, piazzas, parks, and landscapes. The broader sense of urban open space should also include any place that can provides public life, such as public facilities, shopping centers, commercial streets, markets and performing arts venues. Later the research on open space gradually expanded to more spaces for specific populations such as higher education campuses, institutional or corporate grounds, residential open areas, neighborhood/community parks/ gardens and other systems.

The structure of a place can be categorized as space and character, which is equally applicable to open space. The openness in space refers to the three dimensional structures and elements of an open place, such as the shape, dimension, enclosure, accessibility. The openness in character means the rich qualities, details and atmosphere of an open place, and it is more essential to people's sense and feeling. The research methods for open space can be divided into physical space analysis, psychological analysis on user's cognition and motivation, Post Occupancy Evaluation on the utilization of the place, and environmental behavior analysis.

Environmental behavior studies examine the relationships between human behavior and the natural and built environment. The environment provides nonverbal cues for human actions, so any activity has spatial aspects, implying movements and relations to places [23–24]. The degree of response to the environment also varies from different activities. Both long-stay and sitting activities are more demanding on the physical environment than are those related to walking, standing and short-staying [25]. The long-stay distribution and duration of visitors have different demands on the garden space. The stay location mainly depends on the attractiveness of the place, and the stay duration is

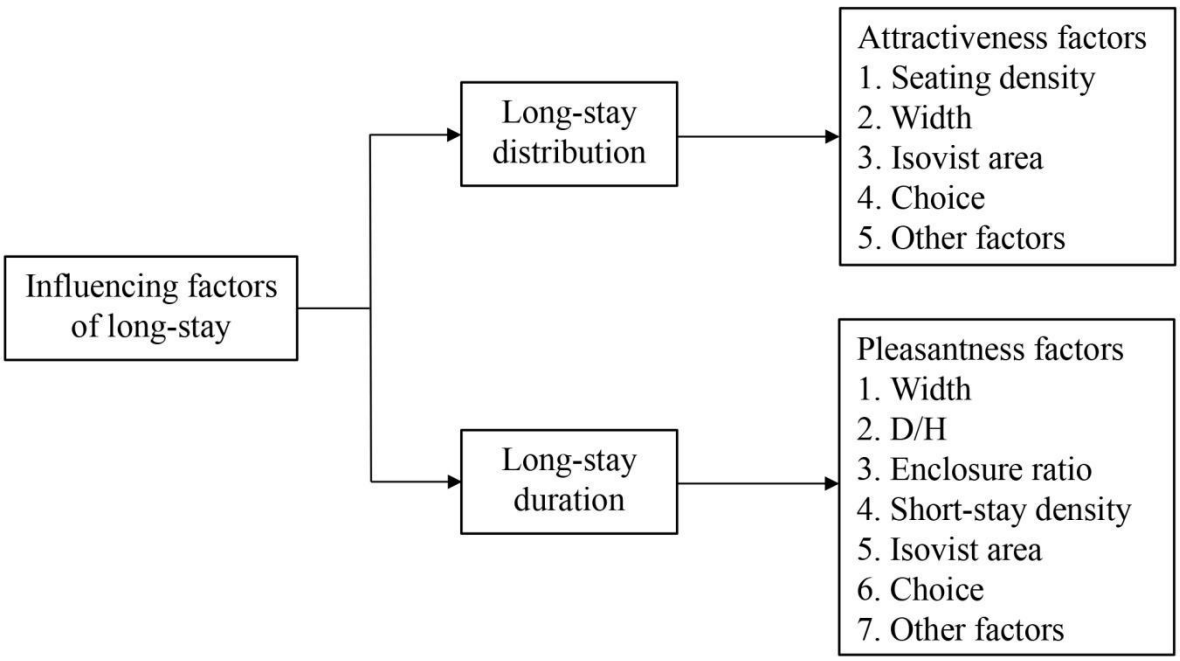

Figure 6-2-1. Conceptualization of long-stay influencing factors.

determined by the pleasantness and attachment of the place [26–27]. The two together reflect the level of openness and availability of garden space (Figure 6-2-1).

The facilities, spatial features, scenery, and crowd flow factors can all be attractive to long-stay of visitors in the garden. The attractiveness of facilities lies in the resting opportunity offered by the seats. The attractiveness of space is relevant to the width in that a spacious and centripetal space rather than a narrow space will inspire people to stop travelling and stay for a while [24,28]. The attractiveness of the scenery is largely dependent on the possibilities for seeing, which is a question of overview or field of vision. An open view in the garden usually creates a good visual effect [9,11]. The attraction of crowd flow lies in both increasing the global probability of staying and causing the self-reinforcing effect on activities. Four predictor variables of place attractiveness were respectively selected among the above four aspects: seating density, width, isovist area (field of vision), and choice (passing through probability). The specific calculation methods of four predictor variables will be discussed afterwards.

The comfort and stability of physical space, the protection from insecurity, and the attractiveness of the environment jointly define the pleasantness and attachment of the place that inspire people to stay for a longer duration [28–30]. A comfortable physical space offers protection against negative climatic conditions, assures acceptable conditions for the outdoor activities, and is designed with high-quality details to give a feeling of sense of place. The stability of a place lies both in the internal factors of a space such as dimensions and forms, and the external changing factors such as the visitor density and crossing crowd through space. The sense of security is related both to the protection from the surrounding environment especially at the back, and the opportunities of being able to view the space and the events going on in a proper distance and overview [31]. A good scenery brings the high attractiveness as well as the pleasantness and attachment

to the place. Six predictor variables of place pleasantness and attachment were selected among the above four aspects, namely, width, D/H, enclosure ratio, short-stay density, isovist area, and choice. The former three variables describes the spatial dimensions, the short-stay density and choice are the external factors for the stability of a space, and the isovist area measures the scenery level of a space.

6.3 Materials and Methods

6.3.1 Study area: Ningbo Tianyige Museum gardens

Tianyige Museum is located in Zhengjiang, Ningbo, China. Featuring the renowned Tianyige (Tianyi Pavilion), Tianyige Museum is dedicated to the art of book collecting and occupies an area of 34,000 m^2. Originally built as the private library of Fan Qin during the Ming Dynasty (1368–1644), Tianyige is now the oldest private library in China.

The central garden area of the Tianyige Museum (hereinafter, Tianyige garden), which comprises the East and South Garden, constitutes the research objects of this chapter. Although originally restored in 1959, the East Garden was redesigned several times and finally reconstructed between 1983 and 1986 under the supervision of designer Chen Congzhou [32]. The South Garden was built west of East Garden in 1996, and it was designed as a courtyard with the ancient libraries of the Shuibei Pavilion and Baojing Hall relocated to South Garden for protection [33].

6.3.2 Spatial analysis of Tianyige garden

In Figure 6-3-1, four main garden elements are marked with different legends: The blue legend shows the pond or water, which occupies a large portion of the garden; the purple legend represents architecture and pavilions; the green legend marks the rockery in the East Garden; and the red legend marks the veranda, which protects and exhibits stone tablets in the courtyard wall. The triangle symbols mark the main entrances of the two gardens.

According to the four main spatial elements presented in Figure 6-3-1—water, architecture, veranda, and rockery—accessible open space was classified into four space types per the influence of the nearest elements [34–35]. Accessible open space mainly refers to the outdoor pavements and semi-open spaces, such as that under eaves and in verandas. Inaccessible space—such as water, vegetation, and rockery hills—and the interior spaces of buildings are not included. The four types of space were further divided into smaller units according to the relationship between the space and the surrounding elements, thereby ensuring internal unity

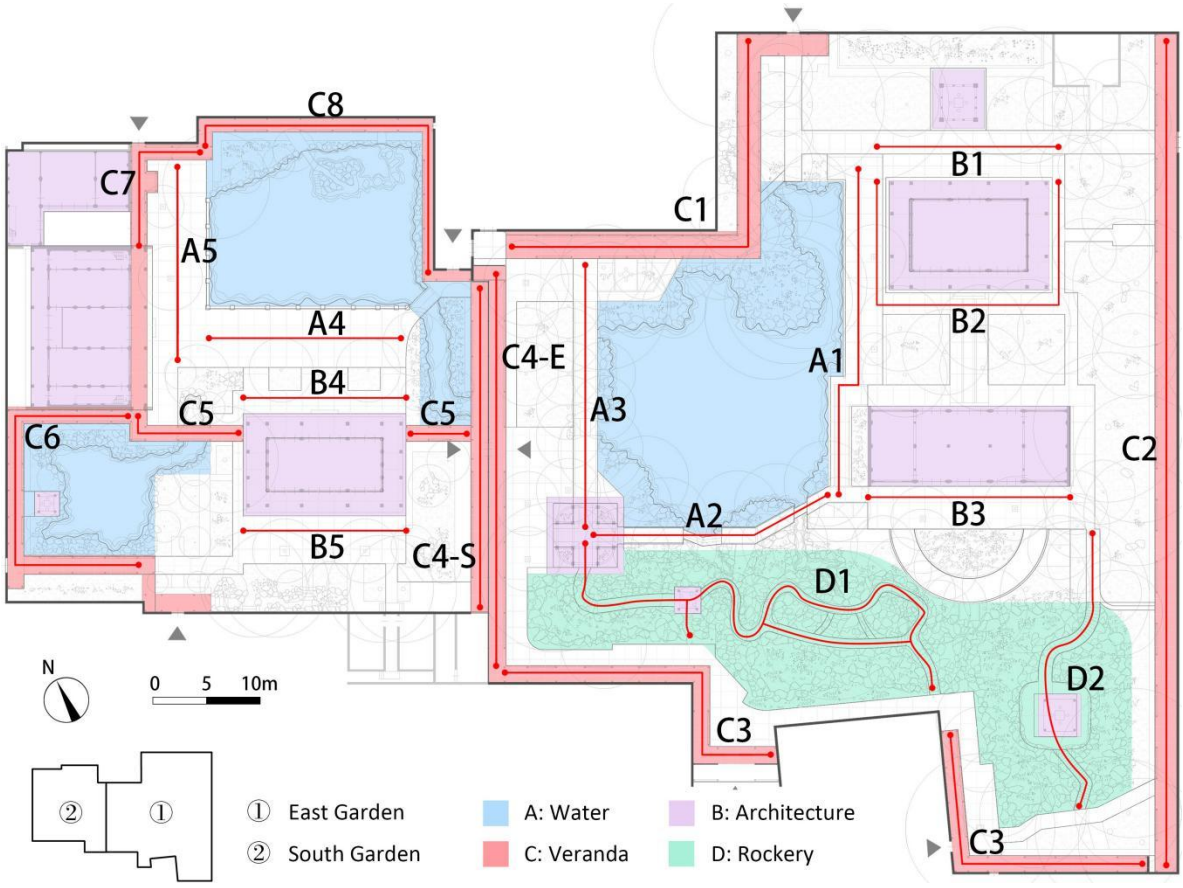

Figure 6-3-1. Plans of twenty garden units of four types in Tianyige garden.

of the spatial characteristics and elemental composition of each garden unit. Using the aforementioned approach, this chapter selected twenty segments as the basic units of the garden space: A1–A5 for Type A: water space, B1–B5 for Type B: Architecture space, C1–C8 for Type C: Veranda space, and D1–D2 for Type D: Rockery space (Figure 6-3-1).

6.3.3 Calculation methods of predictor variables

Seating in the garden can be divided into primary seating and supplementary or secondary seating [25]. Primary seating refers to fixed benches and chairs placed in carefully selected and demarcated locations, as well as in the veranda. Supplementary or secondary seating refers to informal sitting opportunities in a variety of forms, including stairways, pedestals, steps, and low railing, which integrate into the surrounding environments. Figure 6-3-2 shows the seating plan of Tianyige garden.

The seat density is the total length of seating divided by the stay line length in the unit. The stay line refers to the edge zone where visitors can stay for a period of time, such as the shoreline of the water area, the facade line of the architecture, the central line or axis of the veranda, and the perimeter of the pavilion in the rockery. The edge zone offers most of the seating opportunities in the garden for long-stay visitors [25].

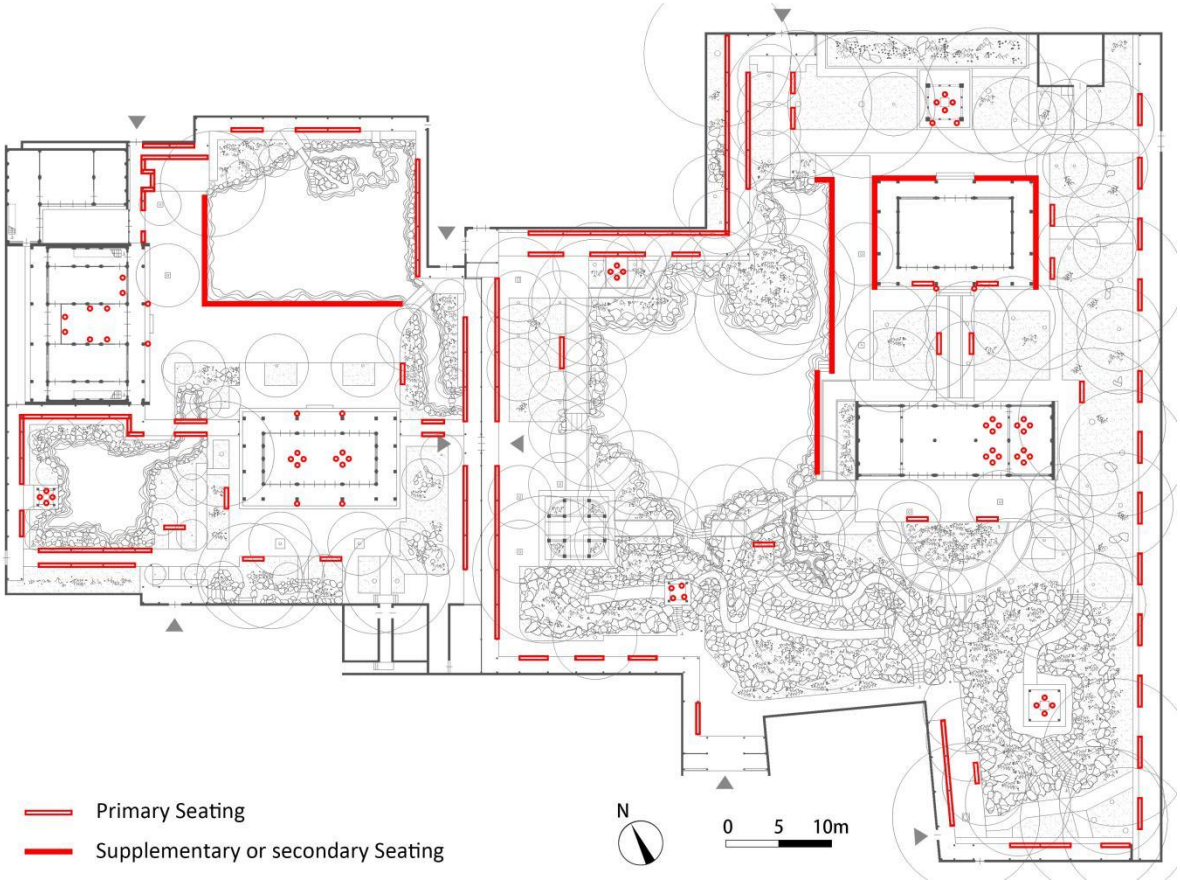

Figure 6-3-2. Seating plan of Tianyige garden, with primary seating and secondary seating.

The width of the space is measured on the garden plan and can describe the spaciousness of the space where the activity occurred. The adjacent pavement space is also taken into account when calculating the width of the veranda space considering the practical situation.

The isovist area is the field of vision of one point, measuring the visual accessibility of the garden space. The visual accessibility of space is analyzed by the Visual Graph Analysis (VGA) map in Space Syntax theory. According to the Space Syntax theory, an isovist is a set of all points visible from a given vantage point in space and with respect to an environment. In the VGA map, the garden space is articulated into a fine grid and isovists of each cell on the grid are then drawn or computed. The isovist area of a garden unit is the average isovist area of all the cell in the unit. The isovist area of rockery pavilion is the estimated value based on the practical observation because the rockery is excluded from the VGA map as an obstruct object of vision. Figure 6-3-3 (a) shows the VGA map calculations.

The accessibility of the garden space is analyzed by the convex map in Space Syntax theory, and it can forecast the crowd flow of different places. A convex map was utilized to analyze the relationship between one space and other spaces in the topological spatial structure of the system. In the convex map, the garden space is divided into a set of convex spaces, and then these convex spaces are converted to a system containing a series of connecting nodes with only topological properties. The depth is the basic concept of a topological distance between nodes. The

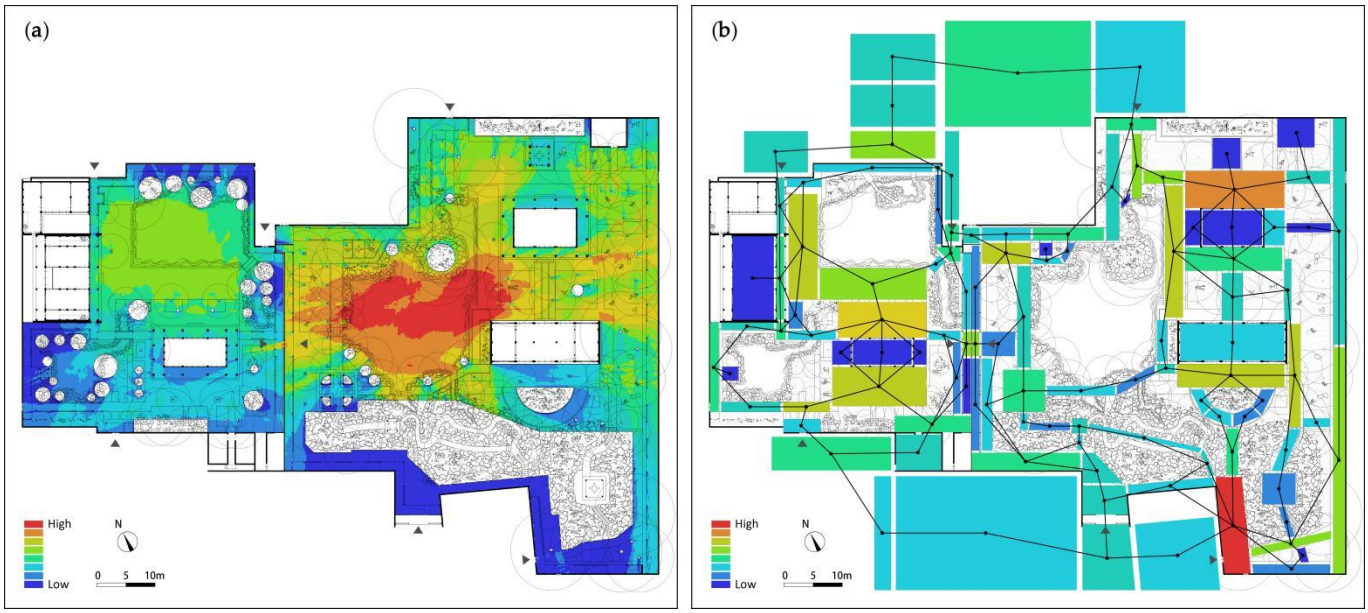

Figure 6-3-3. Calculations of VGA and convex map of Tianyige garden: (a) VGA map showing the visual accessibility; (b) Convex map of Choice [Norm] with a radius of 5.

integration and choice capture the structural importance of a node in a system, indicating the space's potential for to-movement and through-movement, respectively. Specifically, choice captures how likely a given node may be passed through in journeys from all nodes to all other nodes in the system. Therefore, the choice, or the passing through probability, is employed to measure and forecast the visitor crowd passing through the space in this chapter. According to the previous research, the Choice [Norm] R5 is assessed to be more close to the practical situation. Figure 6-3-3 (b) shows the convex map calculations.

Table 6-3-1 shows the predictor variables of visitor stay distribution of the twenty-one garden units in Tianyige Garden. The garden unit C4 is divided into C4-E (C4 of East Garden) and C4-S (C4 of South Garden) considering the significantly different variation of width and isovist area values.

Table 6-3-2 shows the predictor variables of visitor stay duration of the twenty-one garden units in Tianyige Garden. The D/H and enclosure ratio have been measured in the previous research, and the visitor stay density of Map 2 in the previous research is employed as the short-stay density, describing the weekend period visitor stay with a interval of more than 30 seconds [22].

6.3.4 Data collection

The investigation of visitor long-stay distribution and duration was conducted in November 7 (Saturday) and November 8 (Sunday), 2020. The weather was typically sunny and overcast, with the daytime temperature ranging between 18℃ and 24℃. The investigation was conducted after the the global pandemic occurred, but the visitor flow was close to the historical level during the off season owing to the effective prevention and control. The visitor composition was generally similar to that in the previous investigation with three categories: individual guests, tour groups with guides, and primary school student groups with teachers.

Table 6-3-1. Predictor variables of visitor stay location in Tianyige Garden.

Type	Unit	Seating (m)	Stay line (m)	Seating density	Width (m)	Isovist area (m^2)	Choice [Norm] R5
Type A	A1	30.0	30.0	1.000	3.5	1122	0.270
	A2	1.4	20.2	0.069	1.5	872	0.083
	A3	3.6	22.3	0.161	3.7	1008	0.163
	A4	19.2	19.2	1.000	5.5	738	0.235
	A5	10.0	14.0	0.714	5.5	742	0.260
Type B	B1	18.0	15.6	1.154	6.4	685	0.333
	B2	5.0	15.6	0.321	4.1	834	0.183
	B3	4.0	19.0	0.211	4.3	455	0.287
	B4	2.0	15.3	0.131	6.7	565	0.316
	B5	2.0	15.3	0.131	6.8	278	0.258
Type C	C1	60.1	40.8	1.473	3.4	720	0.184
	C2	34.8	78.5	0.443	1.9	628	0.183
	C3	29.2	61.4	0.476	3.1	86	0.148
	C4-E	30.1	36.1	0.834	5.2	718	0.123
	C4-S	19.8	30.9	0.641	2.2	309	0.118
	C5	13.0	16.6	0.783	2.8	460	0.111
	C6	40.6	37.5	1.083	1.5	159	0.164
	C7	18.8	14.2	1.324	5.9	515	0.142
	C8	20.3	36.3	0.559	1.7	224	0.067
Type D	D1	2.0	10.0	0.200	2.5	660	0.115
	D2	2.0	16.0	0.125	6.0	50	0.071

Table 6-3-2. Predictor variables of visitor stay duration in Tianyige Garden.

Type	Unit	Width (m)	D/H	Enclosure ratio	Short-stay density	Isovist area (m^2)	Choice [Norm] R5
Type A	A1	3.5	0.700	20.8%	.773	1122	0.270
	A2	1.5	0.429	46.5%	.727	872	0.083
	A3	3.7	2.867	0	.739	1008	0.163
	A4	5.5	2.625	0	.717	738	0.235
	A5	5.5	1.100	50.0%	1.158	742	0.260
Type B	B1	6.4	1.422	23.6%	.878	685	0.333
	B2	4.1	0.911	35.6%	.592	834	0.183
	B3	4.3	1.194	46.9%	1.000	455	0.287
	B4	6.7	1.675	25.0%	.556	565	0.316
	B5	6.8	1.700	24.9%	.478	278	0.258
Type C	C1	3.4	0.633	50.0%	.619	720	0.184
	C2	1.9	0.633	50.0%	.324	628	0.183
	C3	3.1	0.433	75.0%	.659	86	0.148
	C4-E	5.2	0.467	50.0%	.553	718	0.123
	C4-S	2.2	0.467	50.0%	.553	309	0.118
	C5	2.8	1.350	25.0%	2.250	460	0.111
	C6	1.5	0.433	58.3%	.360	159	0.164
	C7	5.9	0.500	50.0%	.909	515	0.142
	C8	1.7	0.433	85.7%	.550	224	0.067
Type D	D1	2.5	0.500	80.0%	.200	660	0.115
	D2	6.0	0.500	80.0%	.192	50	0.071

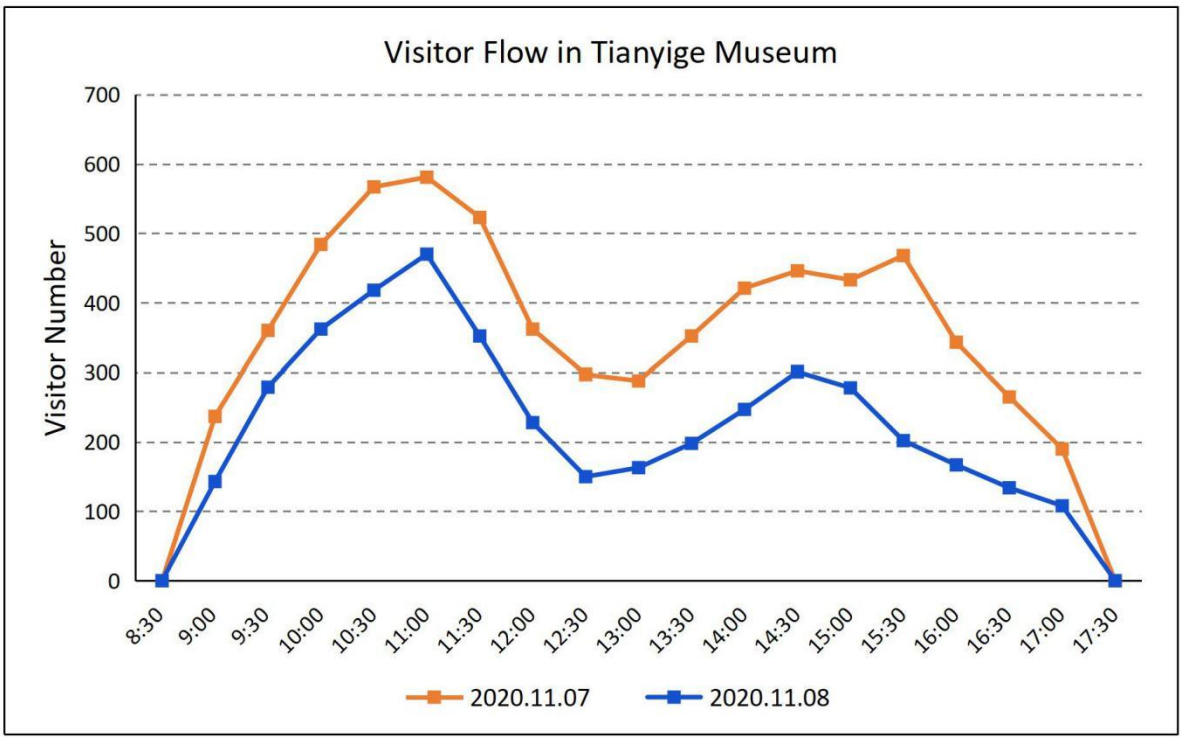

Figure 6-3-4. Visitor flow in Tianyige Museum in 7 and 8 November 2020. Data source: Tianyige Museum, author's drawing.

Visitor flow data for Tianyige Museum were collected during the investigation period. The number of people in Tianyige Museum was collected in real time at half-hour intervals via mobile devices using the museum's official app [36]. Figure 6-3-4 shows the daily visitor flow on November 7 and 8, 2020. According to the Figure 6-3-4, visitor flow on November 7 slightly exceeds that on November 8. In terms of daily visitors, visitor flow was highest around 10:00–11:30 am and 2:00–4:00 pm, and lowest at 12:00–13:30 pm.

Through field observations, short-stay and long-stay were classified according to different visitor stay behaviors. Most short-stay visitors just stood and stopped for a moment, enjoying the scenery, taking photos, or taking a short break, and the short-stay activities would not last long usually. Accordingly, short-stay activities showed how attractive different spaces were to visitors. Long-stay visitors tended to stand for a while or sit in a good place, and their activities included resting, chatting, picnicking, staring at smartphones and other entertainment, and the longest stay lasted more than one hour through observation. Previous studies on visitor temporal-spatial behavior in Chinese gardens found that visitors spent an average of 30–60 seconds in most areas of the garden [12]. Another study found that most visitor stayed within one minute at each stationary point in Master of Nets Garden [37]. Therefore, a stay duration of one minute was used to demarcate the short-stay and long-stay activities in this chapter.

A mobile observation method was adopted in the investigation. The mobile observation area was chosen in units A1 and C1 in East Garden and units A4 and C7 in South Garden to generally cover the whole garden area. Either a single visitor stay or a small group of visitor stay was identified as one stay case. The stay

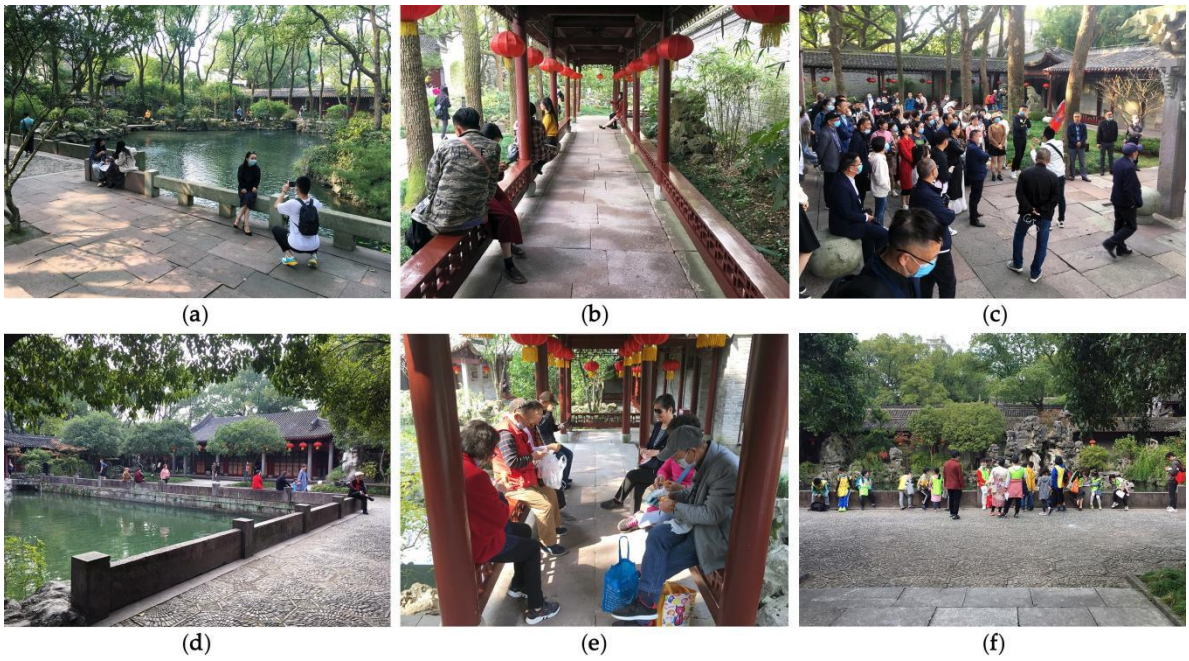

Figure 6-3-5. Illustrations of long-stay visitors and their activities in Tianyige garden: (a) Individual visitors resting in unit A1 water space of East Garden; (b) Individual visitors resting in unit C1 veranda space of East Garden; (c) Tour groups stopping in unit B1 architecture space in East Garden; (d) Individual visitors resting in units A4 and A5 water space of South Garden; (e) Senior groups charting in unit C5 veranda space of South Garden; (f) Student groups resting in unit A4 water space of South Garden.

location, the number of visitors, and the beginning time of stay of each case were recorded when a long-stay behavior was observed. Each long-stay case was tracked until the departure and the end time was recorded. To ensure data independence, large tour groups with guides or interpretive staff and student groups with teachers were not included in the observation, because the presence of interpreters or teachers may influence visitor stay. Finally, we conducted 279 observations of long-stay cases containing 683 visitors and totally 4,640 minutes of stay duration on November 7 and 8, 2020. Figure 6-3-5 (a,b,c,d,e,f) show the illustrations of long-stay visitors and their activities in Tianyige garden.

6.3.5 Data analysis

The statistical method was employed to calculate the visitor number proportion of the case, visitor stay number and duration, visitor stay density and and average length of stay of four spatial types. Visitor long-stay distribution and duration in four spatial types were compared with charts and graphs.

Pearson correlation test and regression model were employed to analyze the correlations between visitor stay distribution and duration and their influencing factors. Scatter plot and box plot diagrams were examined before correlation test to avoid abnormal scenarios. All analyses were performed using IBM SPSS Statistics Version 22 software.

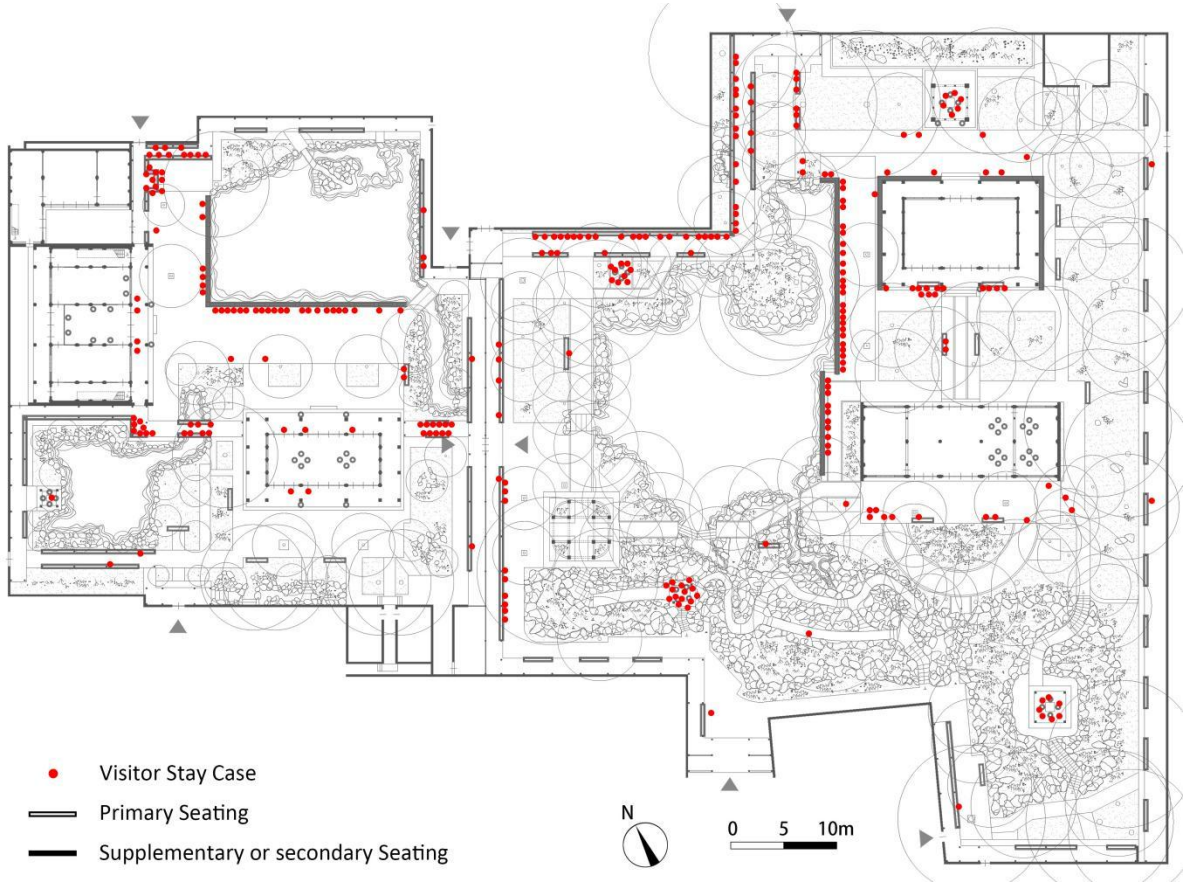

Figure 6-4-1. Distribution map of 279 long-stay cases in Tianyige garden on November 7 and 8, 2020.

6.4 Results

6.4.1 Descriptive statistics

Figure 6-4-1 shows the distribution map of 279 long-stay cases in Tianyige garden on November 7 and 8, 2020. The visitor number and length of stay varied per case, containing totally 683 visitors and 4,640 minutes of stay duration.

In Table 6-4-1, the visitor long-stay statistics of twenty-one garden units in four spatial types were calculated based on the distribution map of Figure 6-4-1. The visitor stay number of each unit is the sum of visitor number in each case of the unit. The visitor stay density is the visitor stay number divided by the stay line length in the unit, and it means the average visitor number in one meter of the unit. The total stay duration is the sum of products of visitor number and stay duration in each case of the unit. The average stay duration is the total stay duration divided by the visitor stay number of the unit.

Figure 6-4-2 shows the pie chart of visitor number percentage of 279 long-stay cases. The visitor number of each case ranges from 1 person to 8 persons. 48 percent of long-stay cases were consisted of two visitors, followed by three visitors reaching 21 percent and one visitor reaching 16 percent. The proportion of more than four visitors in a case decreased significantly.

Table 6-4-1. Visitor long-stay statistics of twenty-one garden units in four spatial types.

Type	Unit	Case number	Visitor stay number	Visitor stay density	Total stay duration (min)	Average stay duration (min)
Type A (Water)	A1	41	108	3.600	488	4.519
	A2	1	2	0.099	14	7.000
	A3	10	22	0.987	299	13.591
	A4	24	65	3.385	265	4.077
	A5	11	22	1.571	72	3.273
	Sum	87	219	2.072	1138	5.196
Type B (Architecture)	B1	20	44	2.821	303	6.886
	B2	16	31	1.987	162	5.226
	B3	14	43	2.263	137	3.186
	B4	5	9	0.588	48	5.333
	B5	2	3	0.196	15	5.000
	Sum	57	130	1.609	665	5.115
Type C (Veranda)	C1	42	93	2.279	698	7.505
	C2	2	5	0.064	32	6.400
	C3	2	4	0.065	22	5.500
	C4-E	13	26	0.720	222	8.538
	C4-S	2	5	0.162	105	21.000
	C5	27	88	5.301	906	10.295
	C6	3	5	0.145	75	15.000
	C7	19	41	2.887	300	7.317
	C8	3	4	0.110	21	5.250
	Sum	113	271	0.769	2381	8.786
Type D (Rockery)	D1	15	42	4.200	253	6.024
	D2	7	21	1.313	203	9.667
	Sum	22	63	2.423	456	7.238
	Total	279	683	1.209	4640	6.794

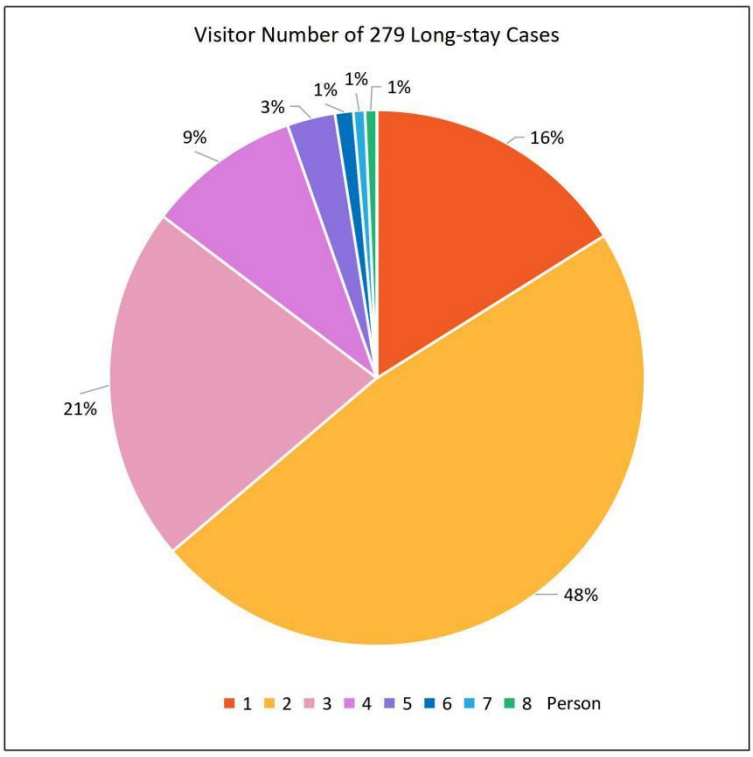

Figure 6-4-2. Percentage of visitor number in 279 long-stay cases of Tianyige garden.

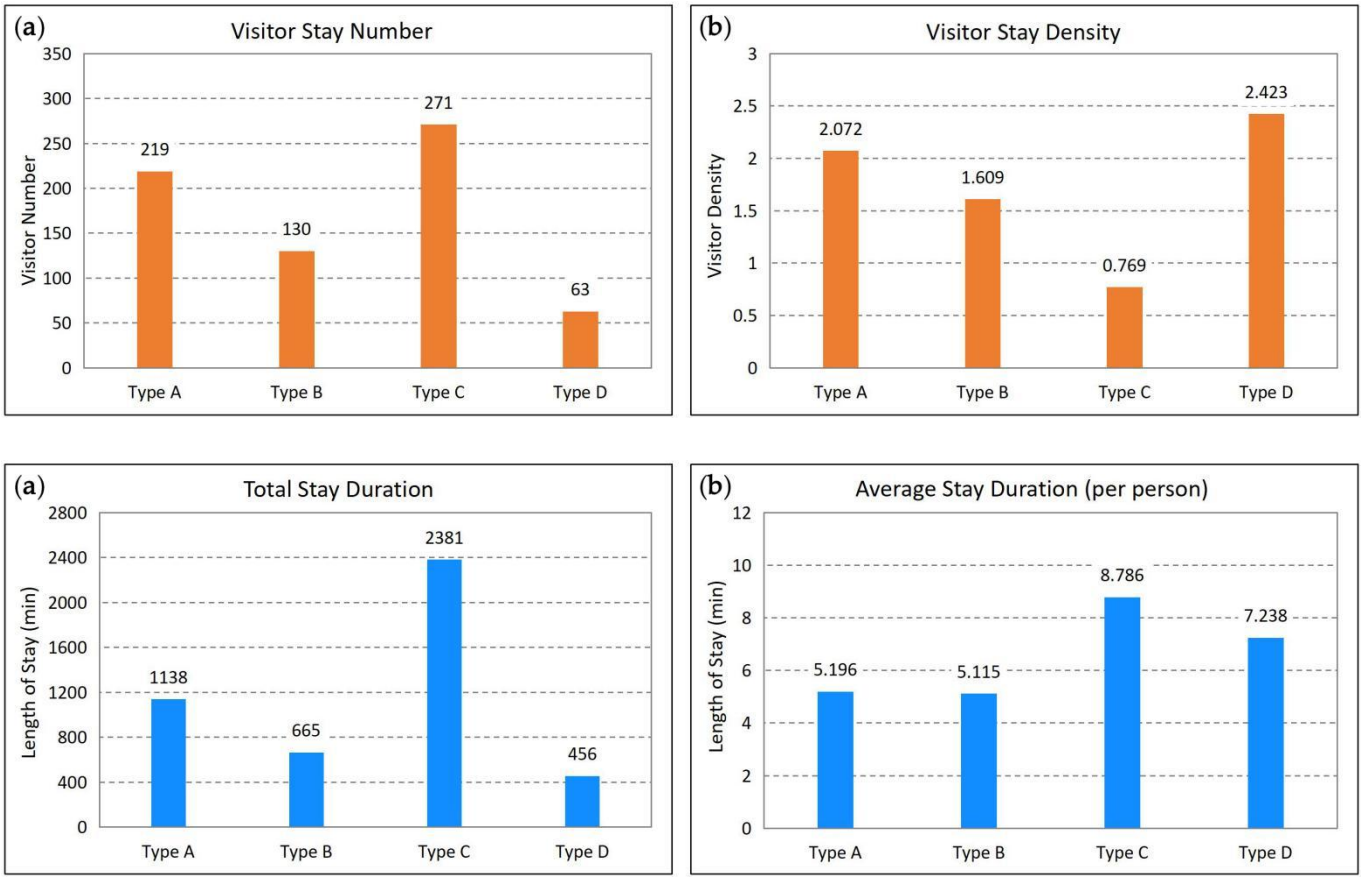

Figure 6-4-3 (Top). Visitor stay number and visitor stay density comparison of four spatial types: (a) Visitor stay number; (b) Visitor stay density.

Figure 6-4-4 (Bottom). Total stay duration and average stay duration comparison of four spatial types: (a) Total length of stay; (b) Average length of stay (per visitor).

Figure 6-4-3 (a,b) show the visitor stay number and density comparison of four spatial types. The visitor stay number of Type A and C is larger than that of Type B and D. Visitor stay number in Type C reached 271. The visitor stay density of Type A and D is higher than Type B and C. Type C has the lowest visitor density.

Figure 6-4-4 (a,b) show the total stay duration and average stay duration comparison of four spatial types. The total stay duration of Type C is longest, reaching the sum of other three types. The second longest total stay duration is in Type A. The average stay duration of Type A and B is shortest and near 5 minutes. Type C has the longest average stay duration for nearly 9 minutes.

The stay duration of 683 visitors ranged from 2 minutes to 40 minutes. The average stay duration was 6.794 minutes, and the median duration was 5 minutes. Figure 6-4-5 (a,b) show the visitor number comparison of different stay duration and four spatial types. In Figure 6-4-5 (a), the visitor number in 4-6 minutes is largest, followed by 1-3 minutes. In Figure 6-4-5 (b), visitor number of three stay duration was compared. In Type A, most visitors stayed less than 6 minutes, which is similar in Type B. Type C saw a different stay duration distribution that the visitor number stayed in 1-6 minutes and 7-12 minutes is nearly same, and visitor number stayed for more than 13 minutes is largest in four spatial types.

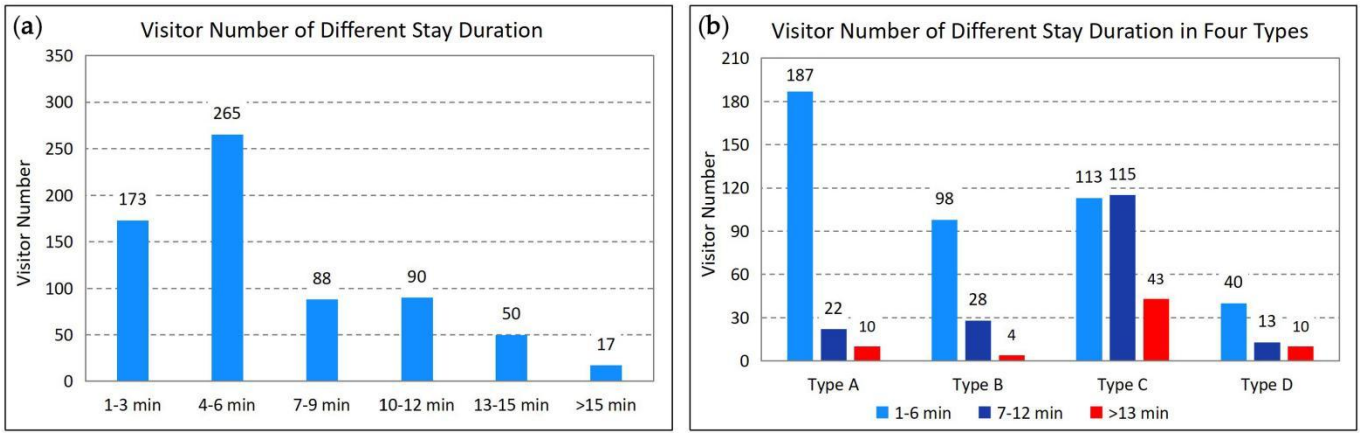

Figure 6-4-5. Visitor number comparison of different stay duration and four spatial types: (a) Visitor number of different stay duration; (b) Visitor number of different stay duration in four spatial types.

6.4.2 Correlations between stay density and predictor variables

The visitor stay density in Table 6-4-1 was chosen as the dependent variable, and four predictor variables in Appendix A were chosen as the influencing factors of visitor stay density. Outliers were examined before the correlation analysis. For the dependent variable visitor stay density, the maximum value lies in C5, a special unit in the previous research on visitor short-stay. Many other factors jointly contributed to the attractiveness of unit C5. The units D1 and D2 in rockery space are also unique, because the difference in the altitude and accessibility with other units will influence the attractiveness of the two units. Therefore, units C5, D1 and D2 were excluded from the test.

Table 6-4-2 shows the Pearson correlation test results of the dependent variable and four predictor variables of 18 units. The visitor stay density is significantly positively related to seating density, $r = 0.553$, $p < 0.05$, isovist area, $r = 0.537$, $p < 0.05$, and choice R5, $r = 0.498$, $p < 0.05$. It is also weakly positively related to width, $r=0.441$.

Table 6-4-2. Pearson correlation test on visitor stay density and predictor variables (n=18).

Correlation (r)	Stay density	Seating density	Isovist area	Choice [Norm] R5	Width
Stay density	1	0.553*	0.537*	0.498*	0.441
Seating density	0.553*	1	0.041	0.024	0.070
Isovist area	0.537*	0.041	1	0.215	0.148
Choice [Norm] R5	0.498*	0.024	0.215	1	0.679**
Width	0.441	0.070	0.148	0.679**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The stepwise regression analysis was employed to analyze the visitor stay density and three influencing factors. It can be seen from Table 6-4-3 that three models were finally tested, and three influencing factors were all included in the final model 3. The stepwise regression model shows that seating density, isovist area and choice R5 all had a significant impact on the visitor stay density, and they

could effectively explain 71.8% difference in visitor stay density. The seating density had the greatest positive influence on visitor stay density with a β value of 0.526, followed by the isovist area with a β value of 0.431, and choice R5 with a β value of 0.393.

Table 6-4-3. Stepwise regression analysis on visitor stay density and three influencing factors.

	Model	R	R^2	Adjusted R^2	SEE	R^2 Change	F value	Sig.
	1	0.553	0.306	0.263	1.094	0.306	7.053	.017*
	2	0.756	0.571	0.514	0.888	0.265	9.996	.002**
	3	0.848	0.718	0.658	0.745	0.147	11.904	.000***
	Model	**Coef. (B)**	**St. Error**	**St.Coef. (β)**	**t value**	**Sig.**	**Tolerance**	**VIF**
1	(Constant)	0.296	0.467		0.634	0.535		
	Seating density	1.586	0.597	0.553	2.656	0.017*	1.000	1.000
2	(Constant)	-0.992	0.568		-1.747	0.101		
	Seating density	1.526	0.485	0.532	3.145	0.007**	0.998	1.002
	Isovist area	0.002	0.001	0.516	3.047	0.008**	0.998	1.002
3	(Constant)	-2.007	0.606		-3.310	0.005**		
	Seating density	1.509	0.407	0.526	3.706	0.002**	0.998	1.002
	Isovist area	0.002	0.001	0.431	2.968	0.010**	0.952	1.050
	Choice [Norm] R5	6.365	2.354	0.393	2.704	0.017*	0.954	1.049

*. Significant at the 0.05 level.

**. Significant at the 0.01 level.

***. Significant at the 0.001 level.

6.4.3 Correlations between stay duration and predictor variables

The average stay duration in Table 6-4-1 was chosen as the dependent variable, and six predictor variables in Appendix B were chosen as the influencing factors of visitor stay duration. Firstly, 10 maximum values of more than 30 minutes visitor stay duration were excluded from unit C1, C4, C6 to make sure the data reliability. Secondly, for the dependent variable visitor stay duration, the maximum value lies in C4-S, an outlier from other twenty units in box plot (Figure 6-4-6). The different altitude and accessibility of units D1 and D2 had no direct influence on the place pleasantness and attachment. Therefore, only unit C4-S was excluded from the test.

Table 6-4-4 shows the Pearson correlation test results of the dependent variable and six predictor variables of 20 units. The visitor stay duration is significantly negatively related to choice R5, $r = -0.572$, $p < 0.01$. The width, D/H, enclosure ratio, short-stay density, and isovist area revealed no correlation with visitor stay duration.

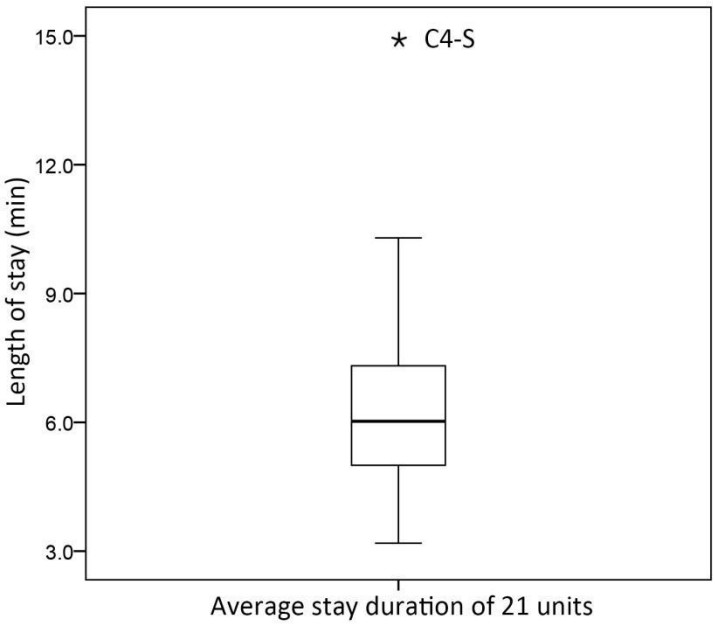

Figure 6-4-6. Box plot of average stay duration of twenty-one garden units.

Table 6-4-4. Pearson correlation test with visitor stay duration and predictor variables (n=20).

Correlation (r)	Visitor stay duration	Width	D/H	Enclosure ratio	Short-stay density	Isovist area	Choice [Norm] R5
Visitor stay duration	1	-0.031	-0.121	0.079	0.205	-0.095	-0.572**
Width	-0.031	1	0.415	-0.325	0.016	-0.015	0.546*
D/H	-0.121	0.415	1	-0.828**	0.243	0.318	0.465*
Enclosure ratio	0.079	-0.325	-0.828**	1	-0.314	-0.652**	-0.547*
Short-stay density	0.205	0.016	0.243	-0.314	1	0.145	0.096
Isovist area	-0.095	-0.015	0.318	-0.652**	0.145	1	0.286
Choice [Norm] R5	-0.572**	0.546*	0.465*	-0.547*	0.096	0.286	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

6.5 Discussion

6.5.1 Visitor stay characteristics

Previous studies on group activities of about 9,000 citizens have found that 74% were two people group, 21% were three people group, and very few groups consisted of four people or more [31]. In line with previous research, this chapter suggests that long-stay cases containing less than four people reached 85% in Chinese gardens. This also indicates that the garden space and seating facilities are more suitable for activities less than four people, and there are not so spacious place for outdoor activities of large groups in Chinese gardens.

The present study suggests that the attractiveness of water space is higher than architecture space in visitor stay number and density, and the place pleasantness and attachment of both water and architecture space is lower than veranda and rockery space in the average stay duration. The results are consistent with previous studies on the stationary points in the Master of Nest Garden and the Lingering Garden [37–38], both delicate traditional private gardens in Suzhou,

which indicate that the diversity in enjoyable landscape is a necessary condition for visitor stay, and most visitor stays occur in the waterside space.

The present study indicates that the veranda space is the first choice for long-stay visitors, and it offers the most pleasant place for long-stay in the garden. Previous studies also indicate the importance of veranda space to visitor stay. One previous study indicates that nearly 70% visitors choose to stay and rest in the veranda or pavilion, and nearly 50% visitors choose to stay and rest near the water [18]. Another previous study indicates that 95% visitors were satisfied with the veranda and pavilion space, and 74% visitors were satisfied with the seating facilities in the veranda and pavilion space [13]. Apart from the half shade and sufficient seating facilities, the edge effect also contribute to the attractiveness of veranda space. The veranda in Tianyige garden is built at the edge of the garden and close to the garden wall, so the veranda space has the advantages as a place to stay.

The present study indicates that the rockery space, more specifically, the pavilion space in the rockery, has the lower accessibility than other garden space, but the place pleasantness and attachment is higher than water and architecture space.

6.5.2 Factors influencing visitor stay density

Previous studies [37–38] indicate that five factors are the basis for the formation of popular short-stay points, namely, high accessibility, diverse landscape, resting facilities, large area, and spatial conversion. Another previous study [39] indicates that the highly used places are widely characterized by waterfront, resting facilities, wide view of landscape, large crowds of people, high accessibility, and recreational functions. In line with previous research, this chapter suggests that the resting facilities, scenery and accessibility have a significant influence on the visitor stay density.

From the stepwise regression analysis, the seating density had the greatest influence on visitor stay density (β=0.526). This finding on seating density factor corroborates the previous study [40] which indicates that enough facilities are important factors that influence user behavior in large-scale public open spaces. It also suggests that various seating facilities must be established in public spaces with a recommended total length of 40 m per 1000 m^2 to meet different demands, equal to the seating density of 1.265 in this chapter. In Tianyige garden, the water and architecture space with secondary seating and the veranda space with bilateral seating had a seating density about 1. The seating density of unit C1 with bilateral seating reached nearly 1.5 and was the maximum value in all the units. The veranda space with unilateral seating had a seating density range of 0.5-1.

The isovist area had the secondary influence on visitor stay density (β=0.431). The isovist area of water space is largest and can provide the most diverse scenery. The isovist area of architecture space is in secondary position due to the blocking views by the large-scale buildings. The isovist area of veranda space varies widely, with some open view veranda space such as units C1, C4, C5, C7, and some veranda space heavily blocked by vegetation such as units C3, C6, and C8. The pavilions in rockery space have a good overview on the whole garden, increasing the attractiveness of rockery space.

The influence of choice is less than seating density and isovist area on visitor stay density (β=0.393). Choice represents the passing through probability of visitors, and it can predict the accessibility and popularity of a place to some extent. Previous studies all mentioned the influencing factor of accessibility or crowd flow of people to the visitor stay and activities [37–39].

6.5.3 Factors influencing visitor stay duration

The Pearson correlation test shows a significant negative correlation between visitor stay duration and choice, r=-0.572, p<0.01. From the perspective of place pleasantness in physical, psychological and social aspects, large crowds of passing through visitors may make noise in the physical environment, and many coming-and-going activities may also do harm to the sense of stability and security of the place psychologically.

Furthermore, the descriptive statistics indicate that physical attributes of a space such as the shades and material of seating may also play a role in influencing the visitor stay duration. In Tianyige garden, seating facilities can be generally divided into two categories: the outdoor stone seating in water and architecture space and the half shade wooden seating in veranda space, and the average stay duration of veranda space (8.786 minutes) is much longer than water space (5.196 minutes) and architecture space (5.115 minutes). However, support for this conclusion is less robust: There is no controlling for other factors such as scenery and crowds. Nonetheless, this is similar to the findings of the previous study [40] which suggests that the seats under the crown have a higher occupation rate than the others, and necessary shading facilities such as roofs or tree sheds must be provided depending on the climate in the area.

6.5.4 Special units and outliers

The veranda unit C5 is quite distinctive in three following aspects. Firstly, it is the only veranda located in the central area of the garden with both sides open, higher accessibility, and better view. Secondly, when comparing C5 and C1 with both bilateral seating in Figure 6-3-7 (b, e), the width of C5 (1.5m) is smaller than

C1 (1.9m), which provides C5 with a better opportunity for face-to-face activities by visitor groups. Thirdly, most long-stay cases of senior groups—usually containing more than four people—were observed in unit C5, and repeated access by senior groups happened at times through observation.

Previous study [27] suggests that place attachment is more likely to develop with optional activities and social activities than with necessity activities, and group activities are easier to inspire the place identity because of the strong social interaction attributes. Generally, it indicates that the senior groups had a place attachment and place identity to the veranda unit C5 for its attractions of physical environment, face-to-face opportunities, and opportunities for optional and social activities.

The findings are consistent with previous studies on the preference of seniors to the park and garden, especially the architecture and veranda space. Previous studies indicate that the place attachment of the park by seniors is higher than other age groups [39], and seniors have much higher requirements towards park facilities and the environment [41]. Most seniors preferred to stay in the traditional architecture and veranda space, with abundant seating facilities and social opportunities [21]. The users' age, the frequency of activities, and the number of participants have a positive correlation with place attachment of urban parks [27].

The rockery space is quite special with high visibility and low accessibility. Although the rockery is visible from most parts of East Garden, the several entrances into the rockery space are off the main garden path and hidden into the environment. However, the attractiveness of the pavilions in units D1 and D2 is still high in the following aspects. Firstly, the 5-piece stone table & chair sets in the pavilions offer a face-to-face opportunity under four people and are quite scarce in the garden. Secondly, the pavilion in unit D1 is located at the highest altitude of the middle parts of East Garden, offering a best view over the whole garden. Thirdly, the visitor flow is quite small in the rockery space, so the pavilion space offers a high-quality undisturbed environment.

The outlier value in unit C4-S in visitor stay duration is due to the small sample size—only two stay cases containing five visitor. The first case with three visitors stayed 15 minutes, and the second case with two visitors stayed 30 minutes, both far exceeding the average stay duration. However, it is still in line with the negative correlation between visitor stay duration and choice.

6.6 Conclusions

By continuing the previous research on visitor short-stay distribution in the Chinese garden, this chapter examined the visitor long-stay distribution and duration and its influencing factors in the Ningbo Tianyige Museum gardens. Results show that the highest percentage of visitor stay cases were in groups of 2 people. The median long-stay duration per person in the whole garden was around 5 minutes. Results reveal that the water space has the highest attractiveness, and veranda space had highest pleasantness and most long-stay visitors. Our findings suggest seating density in particular, but also isovist area and choice (passing through probability), play the greatest roles in driving visitor stay density in the garden space. The choice is the key factor affecting visitor stay duration. Some evidence also suggested senior groups had a higher degree of place attachment to garden space especially veranda space. Based on the findings, suggestions have been provided for the planning, management and local improvement of Chinese gardens corresponding with users' needs. This chapter fills the gap of a special field on visitor stay behavior and influencing factors in the small scale of Chinese garden space. This chapter is also of great value to the mission of constructing of people-oriented urban green space and high-quality human settlements.

Based on the findings, we make the following suggestions to garden officials and staff for the planning, management and local improvement of Chinese gardens corresponding with users' needs. First, combine the veranda space with water and architecture or with paved grounds. Veranda space provides the better opportunities for long-stays, while the water and architecture space or paved grounds provide more open space for activities. Second, improve the field of vision and scenery of veranda space by trimming the surrounding trees and shrubs that blocking the view, and improve the accessibility of veranda space by increasing the network of garden path. Third, design diverse seating facilities to increase face-to-face communication opportunities for seniors and group of visitors. Considering the social demands of seniors, it is recommended that these seating facilities be located near large crowds of visitors and with high accessibility.

More study of the factors influencing visitor stay distribution and duration and the visitor demands for diverse activities in the garden space are needed. We would suggest future research combining the environmental behavior studies with POE methods to improve the understanding of user's demands. The spatial characteristics of Chinese gardens should also be examined to further develop the garden culture while accommodating to visitor interests and demands.

One limitation of this research is that some nominal and non-quantitative factors were difficult to measure or be considered, such as the seating material,

seating orientation and placement, and spatial shape, but these potential factors could also influence the visitor stay behaviors. Another limitation is that visitor composition was not considered in this research. Research based on visitor classification by different age groups and relations may reveal more diverse interests and demands towards the garden space.

However, an important strength of this research is that the previous research on visitor short-stay in Tianyige garden is conductive to the basic understanding of spatial characteristics and visitor behaviors, which is essential to predict the influencing factors of long-stay and interpret the findings. Another important strength is the garden unit classification and influencing factor measurement in a small scale in Chinese gardens, filling the gap of a special field on visitor stay behavior in urban green space.

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CHAPTER 7
CONCLUSIONS

7.1 Research Achievements

This study introduced the past and prospect of Chinese landscape architecture as the research background, analyzed the history and spatial characteristics of traditional Chinese gardens, and took the imitation of Tianyige library group by seven libraries of *Siku quanshu* as a study case. This study then took Tianyige garden as the research object, quantitatively analyzed the spatial composition of garden space and the distribution characteristics of visitor stay, and analyzed the correlations between spatial attributes and visitor stay distribution. The research achievements of each chapter are as follows.

Chapter 1 Introduction

Through the background analysis on the past and prospect of Chinese landscape architecture, it can be concluded that Chinese landscape architecture has the opportunity and potential to become one of the leading disciplines in the construction of ecological civilization, and the Chinese gardens play an important role in Chinese landscape architecture. The overall aim of this study is to explore the contemporary value of space and tourism of Chinese gardens. The significance of this study is revealing the openness value of contemporary gardens as sightseeing and public space, and make gardens more valuable urban green open space. This chapter also proposed the literature review, structure and methodology of the dissertation, and the definition of terms.

Chapter 2 History and Spatial Characteristics of Traditional Chinese Gardens

Traditional Chinese gardens are the concentration and refining of natural landscapes, presenting an intertwined and rich scenery per unit area. Traditional Chinese garden can be divided into several types according to their ownership, and the main types include imperial garden, private garden, temple garden, scenic area. In terms of regional division, traditional Chinese gardens can be divided as Northern Gardens, Jiangnan Gardens and Lingnan Gardens. Although traditional Chinese gardens can be divided into multiple categories, traditional Chinese gardens are still one unity in its style and core, with different categories and styles influencing and integrating with each other.

In general, the development of traditional Chinese gardens experienced four stages: generation stage, transformation stage, bloom stage and mature stage. The generation stage is from the Shang Dynasty to the Qin and Han Dynasties. The transformation stage is Wei, Jin and the Southern and Northern dynasties. The bloom stage is Tang and Song dynasties. The mature stage is Ming and Qing dynasties.

Based on the resources and hard work throughout the whole country, the imperial gardens were far more splendid and magnificent than the private gardens and temple gardens in China. It usually included a grand mountain, a huge lake, a central axis, symmetrical buildings with a decorative imperial style. The existing imperial gardens are mainly located in Beijing and its surrounding areas, which are the Three Mountains and Five Gardens in Beijing and the Chengde Mountain Resort.

Private gardens initially appeared in Han Dynasty, and it was developed in Wei and Jin dynasties and widely popularized in Tang and Song dynasties. Landscape painting originated in the Wei and Jin dynasties and reached its peak in the Song Dynasty, which profoundly influenced the gardening ideas and overall style of private gardens. Most existing gardens were built in the Ming and Qing dynasties and distributed in Suzhou, Yangzhou and other Jiangnan regions.

Unlike imperial gardens and private gardens, there is no definite style and feature for temple gardens and scenic areas. Compared with temples gardens which have clear garden walls, the scenic areas have more uncertainly in the boundaries. The biggest difference between imperial gardens, private gardens, temple gardens and scenic areas is that the former two have the most important function of residence, while the latter two are mainly built for worship or sightseeing. Although the living function have changed, the temple gardens and scenic areas are still built with the style of traditional Chinese gardens.

Gardens were determined by economic, political, and cultural factors in each dynasty, and it reflected the functional requirements of people at that time. Therefore, the functions and utilization of traditional Chinese gardens varied in different times. The functions and utilization of traditional Chinese gardens can be roughly divided into the following three aspects: productive and ecological functions, recreational functions and aesthetic and spiritual pursuit, and social activities and public places.

To sum up, the style and spatial characteristics of traditional Chinese gardens had been changing throughout history, but the central theme was carried forward and remained unchanged, which can be summarized as the Shan-shui thought, namely living in the environment with mountains and forests. Throughout garden history, imperial and private garden shared a parallel growth and mutual

influence, and jointly influenced the temple gardens and scenic areas. They also gave rise to a wide range of traditional Chinese garden types, extending the breadth and depth of Chinese gardens.

Chapter 3 Research Object and Field Investigation: Tianyige Museum

Tianyige Museum is located in Zhejiang, Ningbo, China. Featuring the renowned Tianyige, Tianyige Museum is dedicated to the art of book collecting and occupies an area of 34,000 m^2. Built between 1561 and 1566, Tianyige is now the oldest existing private library in China, and one of the three oldest existing private libraries in the world. During the compilation of *Siku quanshu* from 1773 in Qing Dynasty, the Fan's family contributed 641 species of books to the court. The long history and rich collection of Tianyige impressed Emperor Qianlong, and it was finally designated as the prototype of the seven libraries of *Siku quanshu*, making the Tianyige quite famous at home and abroad. In 1994, the Ningbo Museum was merged with Tianyige, and the new institution became the Ningbo Tianyige Museum. The East Garden and South Garden were built in 1986 and 1997, and some ancestral halls were incorporated into the Tianyige Museum, forming the current scale of Tianyige Museum. In 2018, the Tianyige Museum & Moon Lake Scenic Area was approved as the 5A-Class Scenic Area in China.

The research object of this study is the Tianyige group, East Garden and South Garden in the Ningbo Tianyige Museum. A total of four times of field investigation were conducted on Tianyige Museum and its gardens during this study, containing preliminary investigation, mapping survey, questionnaire survey on visitors, interviews with managers, and the visitor stay distribution observation and records. Furthermore, as a horizontal comparison with Tianyige Museum gardens, a rough investigation on the spatial characteristics and visitor behavior in other traditional Chinese gardens were conducted during this study.

Chapter 4 Spatial Composition of Tianyige Library

This chapter fully articulates the imitation of Tianyige among the seven libraries of *Siku quanshu*. By putting together Tianyige and the seven libraries as overall research objects and integrating the distributed previous research of these eight objects, this chapter has built a systematic structure from the perspective of imitation of imperial gardens in Qing Dynasty.

As the prototype of the seven libraries, the construction ideas, architectural configurations and overall layout of Tianyige were adopted by the seven libraries to various degrees. The book culture of Tianyige has had profound influences on the seven libraries and other ancient Chinese libraries.

In terms of architectural configuration, the seven libraries adopted the main

features of Tianyige like six-bay structure and two-floor appearance and had some initiative advances corresponding with the imperial ranks and atmosphere, such as a bigger size, a smaller end bay and three-floor inner space. The overall configuration of the seven libraries not only imitated the Tianyige but also distinguished the seven libraries with different values with the characteristics of adapting to local conditions. The garden spaces of the seven libraries were also deeply influenced by Tianyige Garden with southern private garden features.

The restoration of the destroyed three libraries is mainly based on the traditional literature and field investigation. Some rarely known features of the destroyed three libraries were revealed throughout the restoration, such as many close parallels between the Wenyuarnge and Wenjinge, the unique site location and the precipitous landscape of Wenzongge and the main feature of fitting the environment of Wenhuige and so on.

The compilation of *Siku quanshu* and the construction of seven imperial libraries was a big event in the ancient Chinese library history, marking the peak of ancient China library course. The four existing libraries of *Siku quanshu* are the best-known imperial libraries that have survived to this day. Tianyige is the oldest existing private library in China as well as one of the three oldest family libraries in the world. Overall speaking, the seven libraries' imitation of Tianyige is a successful case in imitation of imperial gardens in Qing Dynasty and has become one of the highest peaks in the construction of imperial gardens in Qing Dynasty.

Chapter 5 Visitor Short-stay in Tianyige Garden

Through examining the correlations between spatial attributes and visitor stay distribution in the gardens of Ningbo Tianyige Museum, this study revealed the openness of this garden space and its attractiveness to visitors.

Visitor flow on weekends was almost twice that on weekdays; peak hours are 10:00–11:30 a.m. and 2:00–4:00 p.m., while off-peak hours are 12:00–13:30 p.m. On weekends, architecture and water spaces enjoyed high visitor flow, while veranda space occasionally experiences high visitor flow from particular student groups. On weekdays, visitors were relatively evenly distributed in the architecture, water, and veranda spaces.

In respect of visitor groups, individual guests and tour groups preferred water space, followed by architecture space and then veranda space. Primary school student groups preferred architecture spaces, followed by veranda space. Essentially, most visitors were more interested in the beautiful scenery of the garden, resulting in the water space being more popular among general visitors. As primary school students usually played in groups, they tended to prefer spacious open spaces with shelter and adequate seating facilities.

There is a correlation between visitor stay density and six spatial attributes: integration, choice, width, length, enclosure ratio, and seating. The visitor stay density of all types is significantly positively related to integration and choice and negatively associated with length. The visitor stay density of veranda and rockery types is significantly positively related to width and seating and negatively associated with length. Visitor stay dispersion is significantly negatively related to visitor stay density. A partial correlation test controlling for visitor stay density revealed no correlation between visitor stay dispersion and length and width.

The four types of garden space have distinctive attributes and can be divided into two groups: centralized, spacious, and highly accessible open space, like water and architecture types; and narrow, longitudinal paths with low accessibility and abundant seating facilities like veranda and rockery types. The two groups reflect different patterns of visitor stay distribution.

The results of this study indicate that Tianyige garden is a classical-style garden with innovations in terms of its spatial composition. The distinctive attributes of the four types of garden space reflect different patterns of visitor stay distribution. Tianyige garden can cater to diverse visitor groups and provide a space for a wide range of activities, demonstrating the openness of Chinese gardens as urban public spaces. This study could contribute to the visitor studies as well as environmental behavior studies in Chinese gardens and other urban green spaces. The findings of this study could also provide useful insights for the planning and management of Chinese garden tourism. Furthermore, this study is of great value with respect to the utilization of green public open spaces in cities. With the proposal of constructing a high-quality "Park City" in China, Chinese gardens will play a critical role in creating a natural atmosphere, humanized environment, a pleasant and picturesque urban life, and a healthy and ecological city.

Chapter 6 Visitor Long-stay in Tianyige Garden

By continuing the previous research on visitor short-stay distribution in the Chinese garden, this study examined the visitor long-stay distribution and duration and its influencing factors in the Ningbo Tianyige Museum gardens.

Through field observations, short-stay and long-stay were classified according to different visitor stay behaviors. Most short-stay visitors just stood and stopped for a moment, enjoying the scenery, taking photos, or taking a short break, and the short-stay activities would not last long usually. Accordingly, short-stay activities showed how attractive different spaces were to visitors. Long-stay visitors tended to stand for a while or sit in a good place, and their activities included resting, chatting, picnicking, staring at smartphones and other entertainment, and the

longest stay lasted more than one hour through observation. Most long-stays gathered around the primary and secondary seating facilities and were close to the edge of water and architecture or in verandas.

48 percent of long-stay cases were consisted of two visitors, followed by three visitors reaching 21 percent and one visitor reaching 16 percent. The proportion of more than four visitors in a case decreased significantly.

The median long-stay duration per person in the whole garden was around 5 minutes. The visitor stay number and visitor stay density of water space is larger than architecture space, and the average stay duration of both water and architecture space is near 5 minutes, less than that in veranda and rockery space. The veranda space has the largest visitor stay number, the longest average stay duration, and most long-stays for more than 6 minutes. The visitor stay number is least in rockery space, but the average stay duration is longer than both water and architecture space.

Our findings suggest seating density in particular, but also isovist area and choice (passing through probability), play the greatest roles in driving visitor stay density in the garden space. The choice is the key factor affecting visitor stay duration. Some evidence also suggested senior groups had a higher degree of place attachment to garden space especially veranda space.

Based on the findings, suggestions have been provided for the planning, management and local improvement of Chinese gardens corresponding with users' needs. The study fills the gap of a special field on visitor stay behavior and influencing factors in the small scale of Chinese garden space. This study is also of great value to the mission of constructing of people-oriented urban green space and high-quality human settlements.

7.2 Proposals on Garden Planning and Management

Based on the research results and conclusions in Chapter 5 and 6, the following suggestions are provided for the tourism planning, management and operation of the garden, and the local transformation of garden functions.

Suggestions on scale of garden space. A larger space width can increase the attraction of the space, but it should match the garden style and overall scale. For some garden space with small scale, the passenger flow can be reduced through tour route design and guidance to provide a better tour experience. According to the high visitors' preference for the water and architecture space, the spatial scale can be slightly increased to reduce the visitor density.

Suggestions on garden facilities. Sufficient auxiliary seating should be prepared in the water and architecture space to meet the needs of short-stay and

rest for the big passenger flow. Verandas can be set at the edge of the water and architecture space, and some primary seating can be added to attract the long-stay visitors to increase the popularity of the place. For the veranda space, bilateral seating should be set in places with good accessibility and landscapes to increase the seating density and meet the needs of long-stay visitors, and seating density should be reduced in areas with poor accessibility and landscapes to reduce the amount of vacant seating. For the edge effect, paved grounds can be added around the veranda space to stimulate the edge effect together with the veranda space. The seating facilities in rockery space are relatively balanced.

Suggestions on view and isovist factors. From the isovist area map of the garden, the isovist area of the water is the largest with the best scenery. The scenery in the middle of East Garden and South Garden is also good. However, the view of the veranda space near the garden wall is heavily blocked by vegetation, which reduces the utilization of the veranda space. It is recommended to properly trim the vegetation near the veranda so as to increase the isovist area and scenery of the veranda area and increase the stay possibility of visitors.

Suggestions on accessibility and passenger flow. According to the conclusions, accessibility and passenger flow not only affect the attraction of space, but also affect the stability of the place. For high accessibility space, it is suggested to increase the richness of space scenery and the number of primary seating, and increase the number of long-stay visitors. For spaces with low accessibility but a potential scenery, it is recommended to improve the accessibility and quality of the place, and attract visitors with high-quality scenery and facilities. It is suggested to increase the accessibility of some verandas by increasing the network density, such as adding some paths to break the long continuous lawn.

Suggestions on specific groups of visitors and users. Considering the frequent access of local primary school students and elderly groups, it is suggested to increase the number of places with high accessibility and face-to-face communication facilities, and meet the activity needs of group visitors through appropriate seating orientation and arrangement. Based on the high communication demands of the elderly, it is suggested that the places for the elderly should be located in areas with higher passenger flow.

7.3 Future Works

Firstly, this study has a relatively small sample size, with only twenty garden units extracted from the garden as samples due to the overall garden scale. The impact of the landscape on the visitor stay was also not analyzed due to the complexity and interaction of the landscape in the small garden. So more gardens should be analyzed in the future to verify the conclusions and more hypotheses.

Secondly, this study did not control for other unknown factors that may influence the visitor stay behaviors. Some nominal and non-quantitative factors were difficult to measure or be considered, such as the seating material, seating orientation and placement, and spatial shape, but these potential factors could also influence the visitor stay behaviors. Different seasons and climatic conditions were also not considered. Future works should focus on including more related factors to obtain a better results of the spatial influencing factors on the visitor behavior.

Thirdly, visitor composition was not considered in this study. Research based on visitor classification by different age groups and relations may reveal more diverse interests and demands towards the garden space. Furthermore, this study only conducted qualitative observation and analysis of visitor activities. A more detailed behavioral study may better explain the communal nature and utilization of garden space, which will be conducted in the future works.

To sum up, more study of the visitor demands for diverse activities in the garden space and the factors influencing visitor behavior are needed. We would suggest future research combining the environmental behavior studies with POE methods to improve the understanding of users' demands. The spatial characteristics and the the unique attributes and advantages of Chinese gardens should also be examined to further develop the garden culture while accommodating to visitor interests and demands.

PUBLICATIONS

1. Jia, Yu; Tongtong, Liu; Jing, Yang. Imitation of Imperial Gardens in Qing Dynasty——Research on Tianyige and the Imitation and Restoration of the Seven Libraries of *Siku quanshu*. *Journal of Asian Architecture and Building Engineering*. 2021. DOI: 10.1080/13467581.2020.1870119.

2. Jia, Yu; Takashi, Yokota; Emiko, Itami; Jing, Yang. Correlations between Spatial Attributes and Visitor Stay in Chinese Gardens: A Case Study of the Ningbo Tianyige Museum Gardens. *Urban Science*. 2021, 5(4): 74. DOI: 10.3390/urbansci5040074.

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